

E OLA KA'AINA (SO THAT THE LAND MAY LIVE)

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E OLA KA'AINA, a functional model of a 'future' agro-ecosystem, will demonstrate the validity of small-scale food production and the essential merger of agriculture and aquaculture. In its final form, E OLA KA'AINA will be a fully integrated agricultural/aquacultural landscape; a demonstration site and education center revealing small-scale ecological food production in the wet and dry tropics. E OLA KA'AINA will demonstrate that Hawaii's uneasy dependence on imported foods and energy is unnecessary.

In this regard, the conceptual design of E OLA KA'AINA goes beyond a mere reduction of adverse environmental impacts into positive ecological enrichment and reclamation. A leading edge demonstration site such as this has far-reaching economic and ecological potential, providing residents with what they now import or do without: a wide variety of native and exotic food fish species, fruit and nut trees, shrubs, herbs, spices, vegetables, edible flowers, and other useful cultivars including bamboo and calabashes. E OLA KA'AINA will be the most innovative nursery/landscape on Oahu, going where other nurseries are unwilling or unable to tread, into edibles, community dynamics and participation, the challenge of careful, integrated pest management, and innovative marketing techniques.

The goal of E OLA KA'AINA is simple: the reintegration of abundance and beauty, and their magnetic attraction. In the marriage of aquaculture and agriculture, concrete solutions to challenges currently being addressed by limited technological and chemical advances will be actualized.

The demonstration site and its numerous components are detailed in Figure 1. This brief description will delineate the form and function of the landscape elements and their interrelationships. The educational benefits of this model of innovative, diversified agriculture are not emphasized here, significant on every level of education from primary to graduate school and beyond.

1. AQUACULTURE, WATER REUSE AND RECYCLING

The site is oriented NE/SW in order to fully utilize the prevailing trade winds for pond aeration, wind power for electricity, and water pumping for irrigation on a slope (mauka to makai) of not less than 1% nor greater than

5%. Toward the mauka end are three large pie-shaped aquaculture ponds for the rearing of prawns, *Macrobrachium rosenbergii*, and a polyculture of Chinese carps and hybrid tilapias. These organisms will be purchased originally as brood-stock, and then reproduced in aquaria and solar algae ponds. The 0.25-acre ponds have a large proportion of shallow area, a littoral zone, with about $\frac{3}{4}$ of the total surface area of each pond 1 m or less in depth.

In this area, a variety of emergent aquatic vegetation such as Tahitian taro, Japanese millet and others will be tested. These plantings will offer abundant habitat and an expanded niche, thereby allowing the prawns to be stocked intensively. Harvesting methodologies will rely on trapping rather than the frequent conventional seining applied in commercial Hawaiian prawn rearing (Wag, 1980). The other $\frac{1}{4}$ of this rosette of pie-shaped ponds will be deeper (2-3m) and stocked with various Chinese carps and hybrid tilapia for food and biological control of phytoplankton "crashes".

2. AGRICULTURE

Within the overall landscape dynamics, the diversified agriculture will consist of nine basic components: food forest, nursery beds, shade house, backyard garden, sunny lanai/rooftop container garden, shady lanai/patio garden, aquatic plant production, small livestock, composting/recycling systems.

(a) THE FOOD FORES'

In this, the central food forest acre will be the 'ecological edge', the most dynamic and productive part of E OLA KA'AINA; that place where a forest meets the agricultural land. It will be a model PERMACULTURE consisting of dozens (and in its mature years, hundreds) of different tropical and subtropical trees in a 'naturalized' eco-system (one based on any full mature forest in nature): a polyculture of mixed, perennial trees bearing primarily edible fruits, flowers, pods, leaves, and nuts; but also offering medicinal products, natural dyes, teas, and useful crops such as gourds, calabashes, bamboo, various fibers for weaving, and so on.

With the exception of careful observation and initial balancing, nursing and pruning, this will be a self-sustaining, high-yielding, low energy input agriculture. Chickens, ducks, and geese will fertilize the trees, provide a valuable means of pest control, keep the forest floor free of mature fruits, provide biodiversity and interest. Other means of Integrated Pest Management will be established as needed and may include specific cover crops (such as *Tagetes* marigolds for nematode control, a legume for nitrogen fixation, or other green manure for specific nutrient uptake/recycling), pheromone traps, bug lights, physical traps, companion planting, and cautious predator introduction (including but not limited to, insects, birds, and toads) until the ecosystem reaches a steady state of density, diversity, and maturity. All trees will be labeled and described. Most will (in a mature stage) be for sale in the nursery. Plant selection for superior strains will be of the highest priority.

(b) THE NURSERY BEDS

There will be 58 5'x20' (100 sq. ft.) beds, sized to facilitate research comparisons with such agriculturists as John Jeavons (1979). Each will be bordered with flowers and herbs to encourage beneficial insects and wildlife, and provide ever-greater diversity, beauty and scent. Shrubs and trees will be propagated and set out in these beds (or in containers in bed areas). Paths (3') will be heavily mulched for water and weeding conservation, beauty, and to provide a non-slip walkway and soft work area.

(c) THE SHADE HOUSE

A structure of pipes and black polypropylene (30%) shade cloth will protect tender seedlings from intense sun, wind, and harsh rains. It will be an elegant, octagonal, dome-topped building constructed of new and largely recycled materials. Inside will be ten 750-gallon solar algae ponds for fish propagation, bed irrigation, fertilization, and hydroponics. The center circle will be fully landscaped with many food crops, both perennial and annual, and serve as a small and quiet rest and bird nesting site.

In the Propagation Workshop and Tool Shop a turf roof, well-known for its insulating properties, will provide a cool workplace. Different

wall treatments for these wings will be considered. Tools will be housed for display after cleaning and oiling (one operation). New and imported, durable, fixable, high quality tools will be used and displayed. Examples are the U-Bar Digger (Stanford Research Institute, J. Jeavons) for loosening a 24" or so deep bed very quickly, causing no soil "turnover" and creating much aeration; and the *Grelinette*, a tool from France that acts on the soil by a body rotating it rather than use of leverage. One of the workshops will be a hands-on building of the U-Bar digger and *Grelinette*. All propagation tools and supplies will be stored in cabinets under the counters in the workshop. Interns will be encouraged to come and work with us on a regular, contracted basis.

(d) THE BACKYARD GARDEN

In a Japanese style landscape to inspire the suburbanite and the rural dweller alike, the model for relative food self-reliance for a family (two adults, two children) will be developed, making maximum use of the yard for food production and outdoor living space in privacy. The goals will be the same as for our temperate model. The Solar Shield Garden at Goddard College in Plainfield, Vermont (see *Better Homes and Gardens Gardening Guide*, 1981; *House and Garden*, February, 1981; *Gardens for All Newsletter*, Spring, 1980; and various Vermont Vanguard Press articles, 1980): lots of delicious food in a very small, beautifully landscaped, stable backyard homestead. Production of fish, chickens, eggs, rabbits, honey and cut and dried flowers will be included. A composting area, windbreak, provisions for a retractable clothesline, solar hot water heater (owner built) and an outdoor shower (which also waters the surrounding crops) will be factors in energy conservation demonstration. A one-page handout will be available and will include a complete layout. For those so inclined and financially able, design and implementation services will be available.

(e) THE SUNNY LANAI/ROOFTOP CONTAINER GARDEN

This will be a model for urban farmers, complete with a small, enclosed barrel-composting system. It has been said that 50% of

our vegetables can be grown on rooftops; and for every rooftop, there are one hundred existing balconies that can grow some food. We will show those with access only to such a small, urban space what to do with fruiting plants, espaliered trees, window gardens, shrubs and flowers for food, cooling, pollution and sound reduction. Many kinds of containers will be shown, including window boxes, for those without even a lanai.

(f) THE SHADY LANAI/PATIO GARDEN

This will be as above, but geared toward spaces without much sun. Leafy greens and other shade tolerant edibles will be grown in a fine landscape design.

(g) AQUATIC FOOD PRODUCTION

Aundant opportunity exists here for getting food from water. All of the waters (tiny stream, ponds, solar algae ponds) will be used for hydroponic plant production.

(h) SMALL LIVESTOCK

The presence of animals is absolutely essential for food and fertilizer production, for hygiene, and for pest control. In the case of bees, not only do we reap the honey, but also our crops will be easily pollinated. Ducks, geese, rabbits, chickens and other birds will be the E OLA KA'AINA animals. Much later, as the center expands, pigs will be considered.

(i) COMPOSTING/RECYCLING SYSTEMS

These are the most essential foundational aspects of E OLA KA'AINA. They will be for use and demonstration on the lanai level (barrel system), the backyard level (larger barrel system), and the nursery level (piles and windrows). At first we will use a shredder with the organic materials for fast accumulation of a lot of compost; later we may comfortably use longer methods of composting. Community members will be invited to bring their leaves and fronds, branches, and garden residues to the site. We will, however, always encourage and instruct in home methods of composting. All materials will be recycled whenever possible. Later, this can be a depot for other recyclables. Containers will be made of recycled

materials; such a large glass jars with the necks cut off. We consider this reduce, reuse, return, recycle mentality the most important of all the aspects thus far noted.
