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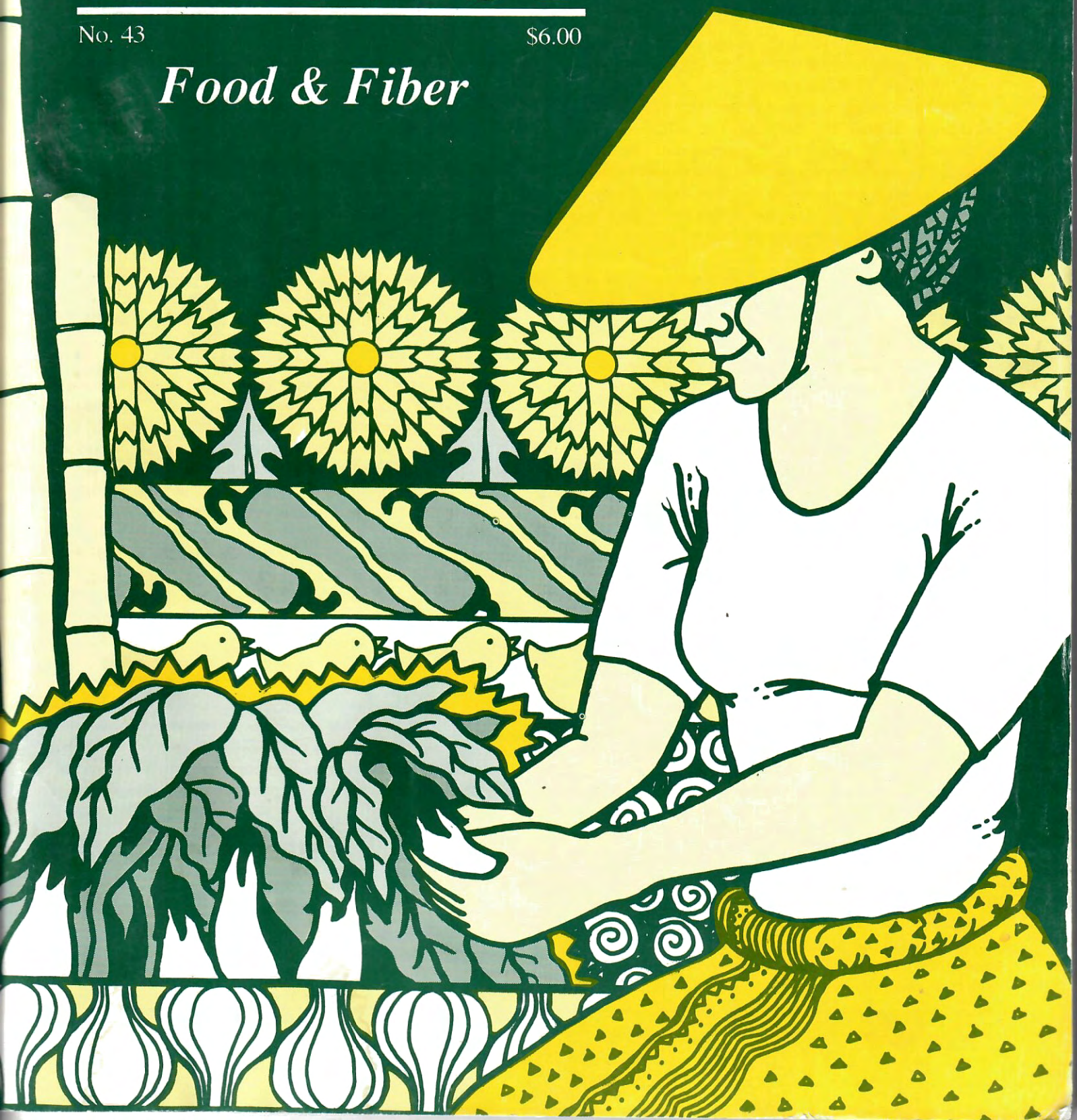
Food & Fiber



To Feed and Clothe the Body

Peter Bane

Growing food and fiber has become a global political issue: who does it, what seeds are planted, where the harvest goes, who pays whom, and how much. The most common of human pursuits has become the most controversial. Genetic engineering of food and fiber crops threatens the very fabric of life itself as no phenomenon since the advent of the atomic age. This threat comes at at a time when the world has never been more exposed: the ozone layer, climate buffers, tropical forest lands, distant cultures, our private lives, and DNA itself are all under devastating assault by a wasteful and death-worshipping industrial civilization.

When Life is under assault, it is necessary to reassert fundamental ethical truths. All people everywhere have the right to life and that right includes at a minimum the right to eat and the right therefore to grow, raise, and gather food of their own choosing which is appropriate to their climate, landscape, and cultural practices. And that implies further that all people everywhere have the right to use the land where they live to grow, gather, and raise food.

It is time to consider stripping from corporations the privilege of growing, owning, and trading in food and food products: to reclaim for human persons the fundamental sacrament of eating and feeding. Such a proposition—unthinkable in much of the industrialized world—would have have little, and that mostly beneficial, effect on the half of the world still living within a village economy.

To speak of these things with integrity we have to take responsibilty for our own food (and also fiber). This is possible—as Jerry Heath shows us—even in northern climates, and, like the urgently needed conversion from a fossil-fuel to a solar economy, need not even be painful. Indeed, the gains in health and wealth alone should make the case persuasive.

This means we must not only provide ourselves with adequate nutritious food throughout the year and provide a surplus against cyclic swings in climate and to assist neighbors, but we must take responsiblity for conserving and reproducing our genetic inheritance. The wealth of human invention and care embodied in our domesticated plants and animals is incalculable. Along with the wisdom of how these came to be, how to care for them, and why they are important, there can be no greater treasure on this earth. More valuable than gold, agrobiodiversity is the common heritage of humanity; we must resist all attempts by the "world pirates" to prise this wealth from the hands of communities which have created and conserved it faithfully in the service of life for over 10,000 years.

There are more stories in this issue than that of the demand for ethical responsiblity. We have tried to highlight the essential and often invisible aspects of food and fiber: the reality of hunger and the possiblity of anyone, anywhere providing food for themselves and their families; the importance of protein in addressing the real hunger crisis; the vitality of traditional food, ferment, and cooking; the need for seasonally and regionally appropriate foods; the possibility of small farmers increasing food production beyond present known limits using organic methods that pay careful attention to plant physiology and soil biology; the availability of high-quality food and fiber that is overlooked; the essential diversity of the world's crops and cuisines; the possibility of achieving sustainability through integrative system design (Permaculture)—indeed the virtual impossibility of achieving it without...; the multifunctionality of fiber plants; and not least—though it deserves a fuller treatment than we have given it—the necessity (for human and landscape health) of including animals in our domestic economies, our diets, and our crop rotations. The presence on our cover of a woman farmer, drawn by a woman artist and farmer, Ruth Gonzalez Uffelman, reminds us of the truth that women still grow (and prepare) most of the food eaten by humans the world over.

In compiling this issue—originally focused not only on Food and Fiber, but including Medicine—we received an abundance of excellent material. Like the subject, our authors represent a planetary wealth of experience; they and our stories come from all the inhabited continents as well as most parts of North America. However, despite an expanded page count, space limitations have forced us to hold back the section on Medicine for a future issue. We plan to take the material received on Medicine, add to it, and publish on Medicine and Health in the winter, issue #45.

Associate Editor Toby Hemenway will take the editorial helm of the magazine for the summer issue, #44, on the theme of Earthworks and Energy. After Medicine and Health, we will turn our attention to Right Livelihood in the spring of 2001, issue #46.

This magazine is a product of its reader's interests and contributions. The editorial team are here to provide organization and stimulus to that desire for greater knowledge and empowerment. We welcome your letters on any subject, and invite submissions of relevant material in any form.

The demise of *Permaculture International Journal* after 21 years of publishing, reported on page 74, marks a watershed for the Permaculture community worldwide. It also places a greater responsiblity on the shoulders of those remaining organs of communication for the Permaculture movement: this magazine, *Permaculture Magazine*, U.K., and the lesser known regional journals.

On a personal note, this issue is the first to be produced from *PCA's* new home, Earthaven Village in the Blue Ridge Mts. While still making adjustments (like putting a floor in our house), we appear to have survived a momentous transition, and hope to consolidate the gains toward lower overhead, more appropriate facilities, the availability of support staff, and a better quality of life.

Above all, we appreciate your continued support and encourage you to share *Permaculture Activist* with friends and colleagues who might also value it. Δ

— Future Issues —

#44 *Earthworks & Energy*	**Deadline June 20**
#45 *Medicine and Health*	**Deadline October 10**
#46 *Right Livelihood*	**Deadline February 15**

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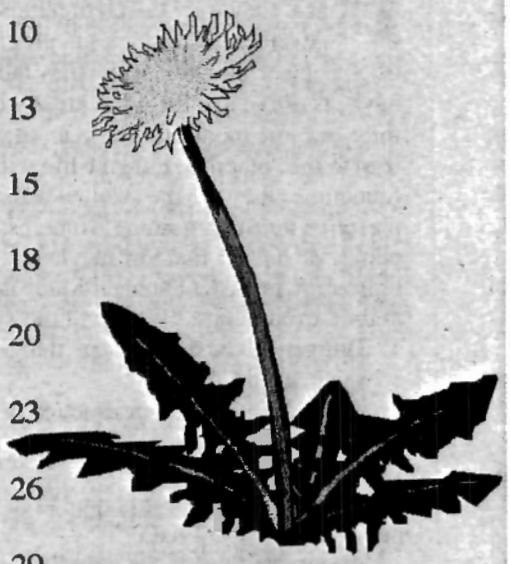


DEPARTMENTS

Lessons from Southeast Asia

Food and Plants for Hunger

Rosemary Morrow

Food is nutrition. Today people discuss food and nutrition as if they were different things. In my experience development agencies in programs to assist poor people often neglect "hunger" while they talk about nutrition. When advisers arrive to assist rural areas where hunger is normal for three or more months of the year, they cannot or do not make that leap to the "other" to imagine life with chronic persistent hunger. Sometimes they see the swollen bellies, or lethargy. They then prescribe nutrition training, vitamins, or worm tablets. Many people do not see that low height and weight for age is caused by long-term, persistent hunger. Many do not even ask, as they look at the surroundings: "What will this family eat tonight?"

Hunger can be due to many things such as:

- war, as in Cambodia,
- cash cropping and destruction of natural farming systems, as in the Philippines, and
- environmental destruction, as in much of Africa and Asia.

About one-third of the world's people are hungry. They live and work on food intake below the average daily calorie and protein needs for their age. Chronic persistent hunger is easy to ignore, and, on low daily food intakes, children are either stunted or wasted. People succumb easily to illness, are slower to recover, find concentration difficult, and are often lethargic. There are also many malnutrition illnesses such as goiter, vitamin A blindness, and scurvy.

It is misleading to see families eating because although there is some food, usually a meal has just not enough for everyone, every day. Another paradox is that often their environment is green. For example, in Asia, the hunger time is just before the harvest when the fields are full of heavy rice heads, thick and green-yellow. But there will be nothing in the rice store and so people chew sweet potato, or cassava, neither of which can give enough calories for daily body needs.

Certain groups are more at risk from malnutrition, and to some extent this depends on the culture. Often it is the women, who feed children and men first. Then amongst the children, it is the newly weaned to two years old who move into malnutrition, then young teenagers. There is really no one to advocate for any of these three groups since their hunger is not visible. People in these places often think these low intakes are normal.

Often governments put hungry people in the "too hard" basket since they have little or no education, no resources, and are marginalized. Frequently, officials have no idea where to start, or they calculate that the resource input must be enormous to move people to a reasonable quality of life. Eventually, the whole family, or some members of it will drift to the big cities in search of a better life. There they form the landless poor of developing countries.

The Case of Cambodia

Although I work in Viet Nam, and sometimes Indonesia and India, I concentrate in this paper on Cambodia. It is one of the world's poorest countries. The government spends more than half the budget on armaments, and is concerned primarily for its own power—not distributing resources outside the capital, Phnom Penh. The wars have been physically and psychologically catastrophic. There have been seven or eight different regimes in about ten years. The climate is particularly difficult with a wet season which is torrid and torrential, and a dry season which is very long and parched. The infrastructure is poor. There was one public phone in 1992 in the capital of one province where I worked, Pursat, and usually it did not work. The roads are dustbowls.

Before the brutal Khmer Rouge dispersal people had lived in villages for thousands of years, in palm leaf huts in the forest clearings, with their rice fields, fishing along the rivers, and leading very leisurely lives in a forest environment. They didn't have a history of gardening; they had a history of gathering. The forest was so rich villagers could wander out and kill a monkey or a wild pig, they could fish, they could pick leaves, they had everything they needed. Cambodia had always grown some food, i.e. rice but

the Khmer have never been gardeners. They tended to fish and to gather forest products for the rest of their diet. Basically, fish, rice, and some fruits and vegetables is a reasonable diet.

Now after the war and the bombings so much has gone: people, resources, knowledge. And much of the land is drying out as the forests are sold to neighbouring countries for cash. With population pressure, land mines, and deforestation the fish supplies are smaller and the access to forest products is severely reduced. The old life cannot be reinstated. About half the people are hungry and many suffer from malnutrition. Literacy is about 60%. Many household heads are women. Domestic violence is almost at epidemic proportions. People often live in fear of casual marauders with guns who have replaced the Khmer Rouge soldiers.

I began work with Quaker Service Australia, in 1992, to introduce systematic sustainable small-scale food gardens (Permaculture) with women in two provinces, Pursat and Kampong Chhnang, as well as exploratory work with primary school teachers in Takeo province and intensive work among the Khmer agricultural development NGO staff in Phnom Penh.

When a project starts in a new country there are always uneasy feelings and self-questionings along the following lines:

- People asked for this project but do they really want it?
- Do I know enough about the culture and language to be effective?
- Are we working with the right people?

I am aware of a moral issue involved: not to promise people results unless you know they will be achieved. If the project fails they will not trust again and will be further demoralised and perhaps blame themselves for the failure, or worse, may be hungrier than before the project.

The progress was slow because of the depression of the people and their lack of confidence. Their knowledge and skills of gardening were vestigial. However, permaculture is malleable. It lends itself to any environment, any culture, and any size land holding. In this situation we started with two resources: the people—in this case, a group of dedicated women from the Department of Women's Affairs in a remote province, and the knowledge—a body of permaculture principles and ethics. We married them in a Cambodian context to grow food for hungry families. This is the story of that experiment.

Finding out what is possible

When I first come to any project, I start by posing some questions. I go to visit, talk, and do a feasibility study, finding out about:

- the agriculture,
- whether people grow food,
- what sort of food—plants and animals,
- who does it,
- what are the seasons,
- has anyone tried to work with people to grow more food differently,
- how do people learn?

And then I try to find the right people, because if you find the wrong people who want a project only for kudos or money, the project can fail. When you find the right people who really want to do it, then the results will always be amazingly greater than you can foresee. Seeking these people, finding them, and working closely with them is probably the most important thing you do in a project.

Working with women

We worked with women because women do most of the work in growing and harvesting food. The Department of Womens' Affairs in Pursat province was selected because the women there wanted this project, were locally recognized as capable, and could see how useful it would be and how to implement it. Women are often not allowed to leave the home. Often they are not allowed even to offer an opinion, and sometimes to speak. Gardening is one activity which is neutral and which raises a woman's self-esteem and respect in her family and in the village. It will not cause further violence and domestic troubles. They can also talk about gardening, so beginning the process of "letting women speak."

Beginning with plants

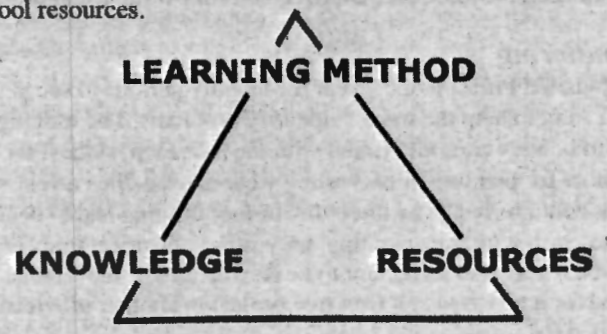
We decided not to tackle the problems of improving rice yields because: this would exclude women who had no rice field, rice is such hard work, and other NGOs are working in this field. So we worked with vegetables because plants as food, rather than commodities, can:

- ameliorate some diseases,
- prevent others,
- bulk up diets in both protein and carbohydrates,
- soften a harsh environment,
- provide people with the ability to feed themselves,
- assist in regaining self respect, and
- help in cleaning unhygienic or contaminated land.

Research entailed collecting lists of all possible plants grown in Cambodia—native and introduced. There was not much.

The approach

We decided to work closely on a three-pronged approach, i.e. triangulation—one apex being the permaculture knowledge, the second apex being a training method, and the third was biological and tool resources.



Training a core group

Firstly, training was given to women from the provincial and district level to enlist their co-operation and to get a standard quality of knowledge. They made the first gardens in the project so they had first-hand experience to speak from, and from which to report successes and problems. We had to carry out courses for these women because they were later to train women in the neighboring province of Kampong Chhnang. We started with a Permaculture Design Course followed by a course in Adult

Learning Methods and Materials. A special part of this was for illiterate people.

A core group of 20 women was selected, as trainers, by the project manager, Ms. Em Ponna. They decided to try a new learner-centered teaching method for village women. They also experimented with a training method to introduce new plants and ideas. They discussed and evolved techniques to grow an essential palette of plants which were nutritionally important. The women realized that gardening could be difficult and require much skill.

The core group then selected women from districts and communes with potential as local trainers. These also had to make gardens as part of their training. Training and information sessions always preceded a change in seasons. We did Dry Season Gardening, Wet Season Gardening, and Hot Dry Season Gardening. New information was presented in bite-sized pieces, offered for discussion, and could be implemented immediately.

The local trainers were asked to identify poor women farmers—the poor hungry, not the poor sick or the poor landless. The trainers then developed criteria for acceptance into the project, e.g. women with many children, women with no children (labor), and women alone. The very poorest villagers were given a big machete, a bucket for watering, and bamboo to build a fence to start their gardens. Some farmers were selected to develop model farms and they received special training.

Demonstration Centers - Resources

Then demonstration centers were established to supply the biological stocks so badly needed after such long years of war. The Centers were provided with a reasonable variety of plants, good quality seed, fruit trees, and animal stock. The first one was set up on the grounds of the handicraft workshops in Pursat.

There were some initial problems because although the women wanted these Centers they had no idea how to set them up, nor how to run them. We sent one woman to Viet Nam to see how they are managed. The standards were gradually lifted because good plant care practices had to be implemented so visitors and project beneficiaries could follow the techniques.

Monitoring

I visited Pursat twice a year for lengthy periods to see the work, and to help the trainers identify problems. The trainings had to be very carefully timed with the monsoon, since if the window for planting or harvesting were missed, then a year's work could be lost. The three-day farmer training had to be timed not to clash with transplanting, harvesting, the driest time, or the floods. It was also important to be flexible. So, if the women asked for a trip to visit a fruit tree project in another province, we could assist.

I waited until the first stage had been carried out and then returned to ask about problems and successes. Gradually the power shifted from me, a foreigner with a project, to them, the practitioners with their local knowledge setting the agenda and the pace of the project. I became a resource instead of an expert.

Choosing Nutrition Vegetable Gardens

Given the choice of a variety of activities such as vegetable gardens, orchards, chicken raising, medium-term crops, fuelwood plantings, and raising large animals, the nutrition garden was given priority.

They had decided to work with home gardens and firstly, vegetables because:

- Work is close to home and it is easy to care for children.
- Vegetables can quickly help to remedy malnutrition illnesses such as vitamin A blindness.
- Skills learned here can be transferred to other crops.
- Resources for making gardens are close to the home.
- Men do not like their women to leave the house.
- Costs are very, very little.
- Returns can be quite fast.
- It does not add too heavily to women's burden of work.
- Home garden environment is improved in sanitation and control of parasites and mosquitos.

The permaculture principles they used were:

- Work where it counts.
- Use local resources.
- Start small and get bigger when successful.
- Make the problem the solution.

The women trainers worked out the basic tasks and the order in which they would have to be implemented to ensure the vegetable garden would be successful. They responded to the idea of the most limiting factor, i.e. likely cause of failure. At the same time, they started thinking about integrating fruit trees and animals into the garden design.

It was important to consolidate their knowledge, compare notes with them, and provide more documents after classes. So we carried out visits to various parts of Cambodia to learn from other gardens, and did some more short five-day courses.

Training Aids

Then they wanted materials. It would have been possible to have the mainstream texts translated from English, however the principal printed permaculture works are not easily transferred to the Khmer situation. The women trainers decided to make their own. They wanted the work of gardening divided into bite-sized pieces in several formats suitable for themselves as reference materials, for district and commune trainers, and for village women gardeners. They decided on:

- Posters. These were sets of large posters having several themes. Accompanying these were small posters to explain one of the themes in the large posters. Posters were plasticised and easy to carry. Sets of non-permanent pens were used to color themes.
- Trainer's book. This was meant to give trainers more knowledge, and techniques. Some women asked to learn seed saving and fruit tree grafting so they could write the book well.
- Leaflets. These were primarily pictures with a few words. They could be left behind in the village. If the gardener was not literate, then the children or another could read them. These also served as literacy materials.

Most importantly, this work produced the teachers of integrated sustainable food gardening. The knowledge and techniques were localized. The knowledge base became sustainable because they now owned it.

Garden placement

It was also a new idea to site a garden appropriately, and so they developed site analysis skills based on water, nutrients,

shade, proximity to the house, surveillance, and natural disaster occurrence such as hot winds, and floods. Gardens came to be placed with regard to:

- Water - near or enclosing the bathroom, or the well where greywater runoff from washing clothes and bathing is a problem mosquito breeding area.
- Size - because womens' work is hard and long. About 5m² was the average.
- Shade and sun and strong winds.

Commune women in Vietnam— self-learning

Eight essentials

The eight basic tasks—which would ensure success unless there was another cataclysmic disaster, like wars or floods—are given below. They also gave the trainers some indicators against which to monitor the gardens and the degree of success; and these were new ideas.

1. There had to be a fence, or pigs, buffalo, and chickens would quickly destroy the garden. This was made of renewable and local materials. People used bamboo, wood, or whatever they had in a variety of creative designs. The poorest farmers had to be given machetes to cut bamboo or sticks to make the fence. The fence was needed to keep animals out and to extend the growing area as a vertical space. Here are planted the vine *slacba*, which grows almost like a weed, has edible leaves, and survives almost all conditions. Its green leaves supply vitamins and minerals, while the plant offers shade and wind protection to its neighbors. It is interplanted with lemon grass, a perennial used in soup which most Cambodians eat every day. Amongst this chili is planted. This is claimed to have anti-thyroid properties, and to be cooling. Parts of the fence are used for beans in the dry season, and for cucumber, another nutrition vegetable.

2. They had to make compost because of the worn-out soils. If they had animals they also used pig or buffalo manure. Tropical soils are typically saline and acidic. After we learned how terrible the soils were, the making of compost became mandatory, and at that time the women appeared with a remarkably easy recipe for making compost in 15 days. So we used their information and their demonstrations. We asked women to make several 1m³ bamboo compost bins and to place them in the garden where they would be used. This was very successful and popular. Previously they had made composts in pits which required a wooden shelter against hot sun or torrential rain, and from which it was laborious to remove the compost.

3. The first planting had to be the ten hardiest Cambodian plants for that area with nutritional value, and as permanent as possible. This meant a structure of nutrition plants which would endure harsh conditions. Some of these were: Banana, papaya, and pumpkin for energy, and vitamin A vegetables: *Sauropus androgynus*, amaranth (3 kinds), and leaf chrysanthemum *(C. coronarium)*. Onions and chives, which are natural antibiotics, completed the list. They had wanted cabbage and purple broccoli because these have high market value. However they also do not set seed, and are particularly pest prone. We finally decided that natural Khmer plants were best for Cambodia. Everyone knew them and knew how to cook them.

4. They had to interplant and intercrop to supply nutrients and also to assist in controlling pests and diseases. The idea was that in the 5m² plots vegetables would be packed.

5. They had to plant windbreaks, both big and small, to protect the small garden. There could be nitrogen-fixing trees, later to be cut for fuelwood, or a dense planting of lemongrass, or even, a greater distance away, larger fruit trees such as mango.

6. They had to practice water-saving methods. There was a battery of techniques for water saving from roofs, in jars, in soil, in ponds, through reduction of evapotranspiration, by building up, or making saucer beds. This was very difficult. Water was a big problem. For centuries the Khmer have saved rice from one harvest to the next. However there was a great negativity about saving water. We had long discussions about the reluctance to do this. It took about a year of probing the mindset from many directions to find out why. Finally the question, "What does Buddha say about this? What did people do in the past?" eventuated in a response: "Water comes from the Gods and people cannot do anything about it." This corresponds to a gardener's attitude that garden and farm wealth does not come from the soil, but comes from the sky. It is tantamount to Australian farmers saying, "I've got bad soil and so I get poor yields." It took two years of discussion to decide to create Water Education Model Farms showing many things a farmer could do.

7. They had to develop the practice of organic mulching and soil cover. When we talked about evaporation, the trainers didn't understand, and when I explained that mulch keeps water in the soil they did not believe because they know water goes down not up! They have watched pond and well water levels drop. So they didn't want to mulch.

8. They had to practice elementary pest and disease control without chemicals. The use of chemicals is frightening. People can't read the labels, and do not believe the quantities. Some women were painting their dried fish with pure DDT to keep the flies off. Apparently some people have drunk pesticides to get rid of intestinal parasites. Also, purchase of pesticides takes people into debt.

So a small amount of time was devoted particularly to the planting. More time and effort was given to protecting the plants from the many disasters that could befall them in Cambodia, and from the harsh natural conditions.

Each task was designed to work with the others to ensure the garden would be successful. Learners were told that if they did all tasks, then their gardens would provide food. If they only did five then perhaps it would fail, and if only one or two things then it certainly would fail.

This sounds prescriptive, however, trainers insisted that farmers needed a structure, and most of all they needed to succeed—to have food to eat or to sell, all year round. Once they were successful growers then they could and would deviate from this to achieve better results. They would have the confidence to experiment.

Results

In Pursat, the women built gardens in all five districts of the province. Seventy women per district and their trainers all made gardens. Each woman had to pass on the techniques to five other neighboring women who helped each other to construct gardens. They were pleased with their results and wanted more information about continuity of planting, and more discussion about soil improvement. In Kampong Chhnang province, the women built a model garden around the Women's Association headquarters. Here too, 350 women made gardens, most of them for the first time. They showed considerable ingenuity. Some made round gardens which are particularly efficient in resource use. Others managed to get extra seed such as carrots, and one even had pea seed sent to her from Australia.

In the very dry districts of Kampong Chhnang by the end of the dry season women were reducing their gardens to circles of one meter across and high. Nutrition plants were sown down the sides and around the edges as well as on the top. This small mountain produced enough food to put greens in the soup every day. Some made door gardens—the size of a door. Small amounts of water from occasional clothes washing or cooking was used to water these gardens.

About 7% of women failed to make a garden or reap a harvest. About 10-15% were very good. Some earned an income up to $100 per month. The rest were mediocre to good.

Considering that this was the first time that they had gardened, it was a remarkable result. Later some dropped out of the project because they found other work. However, most of the model farms which had agreed to carry out all the tasks became local nursery centers for fruit trees and were soon grafting, layering, and putting in cuttings of fruit trees to be loaned or distributed as the next phase of the project. The fruit tree distribution is proceeding faster than the first phase.

Nutritional Impact

The objectives of the project were to see whether the trainers could pass on and teach nutritional gardening with new methods to very poor illiterate farm women. The objectives were never, at this stage, to change nutritional status. We knew that 85% of the women and children had been hungry for three or more months of the year. After the project women had gardens with some plants in them all year. We asked them what they ate. All families with gardens were eating raw, cooking, or selling plants from their gardens. In fact they were often indignant when asked what they did with the garden produce. By observation, children appeared to have fewer infected noses, chests, and eyes. In another year, a health check will be carried out on a stratified random sample of project participants compared with non-participants.

The copycat effect of the gardens is evident in small lanes of farm families where perhaps there were ten participants, but 20 or more gardens showing adoption of the new techniques. The need is such, that without a lobby group, the project is being copied.

Constraints and Failures

The size and success of the garden depended on the most limiting factor. This was almost always water in the dry season. No effort was made to ensure water all year around, instead the first objective was to extend the wet season. This was done by compost, mulch, windbreaks, and water storage in jars and ponds. Ponds are highly recommended because they are so multipurpose. Wells are difficult

- because the ground water may be contaminated.
- Usually one person owned it among several families.
- Greywater lying beside it was putrid.
- Well water was wasted while plants died in the dry season.

Later, water education farms were started, which depended not on wells, but on a battery of techniques to catch and retain water in ways that were environmentally sound. Some volunteer farmers offered to implement a list of 20 simple and very cheap things one could do to save or conserve water. These became the water education model farms. Later other farmers would visit and see what the effect was on the garden.

At first all the trainers and farmers simply wanted lots of seed, and if possible, different foreign seed. Usually this would not set seed, or was demolished by insects, or failed. After this phase, the trainers reported back that the problems were really the need for water, and for soil improvement. This had been easily

foreseeable, however, not in the early stages by the farmers and trainers.

In Takeo, the school food gardens were disappointing, yet the school teacher-farmer home gardens were excellent. The school gardens failed because the teachers do not have the time to care for the gardens. As it is they rise at 4:00 a.m. to do their own farm work before coming to teach school. In the village, the animals eat the school gardens and it is very difficult to maintain good fencing. Even the gates fall off their hinges! The teachers were still very enthusiastic and suggested that next time each child plant and care for a tree—thus creating a viable, productive, mixed forest around the bleak school grounds. We tried this and it worked better.

Spread of Nutrition Gardens

I was approached by a person who told me that these Permaculture gardens are now spreading like measles. We started with 300 women farmers and after two years 1500 women had gardens. Some are quite gifted gardeners yet others are still struggling with the harshness of the natural environment.

The project has not been operating long and and to foreign eyes looks messy, and not very productive. The progress is often slow because of failure of rains, or heavy flooding, and many Khmer lack:

- confidence that they can succeed,
- networks of gardening associations,
- education, literacy,
- and many biological concepts. When discussing earthworms farmers say "Kill them, because they get in your stomach like hookworm and roundworm."

However this project illustrates that it is possible to work with a group of people from a non-gardening culture, offer them resources, training, and support, and they will be able to take the first tentative steps towards control of their lives and circumstances in ways that are nonconfrontational.

Psychologically, people change from being fairly passive and inert to becoming friendly people who want to show how they have succeeded and want to talk about their results. They say, "Dont give us money, give us more knowledge." Women say, "I don't lie awake worrying about what to feed the children tomorrow." Village neighbors copy the ideas they see in the project area.

So, when hungry people can overcome their hunger by gardening in a diverse and complex way, there are not only nutritional benefits but also very great psychological and social ones.

I feel very grateful to work in a project which people really want and start straight away to implement. Δ

Rosemary Morrow is the author of The Earth User's Guide to Permaculture *and* Teachers Notes for The Earth User's Guide. *Text and photos ©Rosemary Morrow, 1998. Write her at Lot 23, Explorers Rd., Katoomba 2780 NSW Australia.*

Health and Ferment—
Sourdough as Permaculture

Andrew Goodheart Brown

For permaculture to have much personal meaning, our zone zero must rest on a solid foundation. We need to apply our many principles and practices to our own health and well being, and that of our loved ones. Any philosophy or set of practices that ignores the body itself is doomed. The serious permaculture practitioner must take the necessary steps to create a healthy, productive, inner landscape.

...Nothing much, whats new with you?...

Many of us are products of a culture that looks entirely to health professionals to mend our hurts, take away our pains, and prescribe medications to bring us back to some form of center. Good health has been thought of as the lack of ill health, and we have been raised as passive recipients. In general, there have been few connections between nutrition and health, other than some lip service about food pyramids that are rumored to be funded by the industries whose products make the list. As a people, we neither equate food with energy nor with health. Food has become simply something to fill our stomachs. How many of us live on processed foods: out of cans, packages, wrappers, and freezers? How many of us truly equate quality in with quality out?

Have you read many packaged food labels lately? Ever asked what is put into foods to prolong their shelf life? Ever wondered if it's just coincidental that cancer affects one in three Americans? Do you really trust the makers of processed foods to carry your best interests, or might profit be their motive?

...Food is Energy...

Food is is meant to be more than a stomach stuffer. Food is a vital part of both culture and nutrition, and nutrition is the basis for health, vitality, and well being. A proactive relationship towards good health begins with diet. By adopting a sound and well-balanced diet of many nutritious foods, paying attention to how we eat and what we put into our bodies, we can provide ourselves with true health insurance.

Building personal health, like building healthy soil, is thus a long-term process, supported by good habits maintained over years. With health as with gardening, fads and amendments come and go: the best strategy is good management. Many dubious and otherwise downright carcinogenic materials bombard us from the outside world every day. While we have little control over many of these influences, we do have absolute control over what goes into our bodies as food and drink. This is a leverage point (in permaculture, a place where we can achieve the most benefit with the least effort). Exercise it!

All food is not created equal. Supermarket eggs are not even on the same planet as organic eggs from free-ranging hens, though they may have the same shape. In another universe altogether are organic eggs from your own bioregion, and even more so, those from your own hens! With permaculture, we work to create healthy soil ecosystems, which in turn produce healthy, nutrient-packed plants. By consuming these fresh, unprocessed, nutritious plants, along with purchased fresh foods produced in the same manner, our bodies take in what is needed as a basis for optimal health.

...we won't be fooled again...

Don't continue to be fooled. Pesticides, herbicides, fungicides, and other poisons are used to sterilize the very soil life that is necessary to all plant vitality, and the nutritive yield of natural, healthy, soil activity is replaced with a chemical supply of the minimal nutrients necessary for plants to function. Not only is the food thus produced lacking in nutritional vitality, but traces of the various poisons are contained within the food itself. And if this wasn't enough risk, many chemicals are used to retard spoilage and keep food long past its natural shelf life. How can there really be an acceptable limit to poisons that inflict genetic damage, that bioaccumulate, that cause cancer, unless that limit be zero? Who makes those decisions, and who funds the studies?

My household consumes very few processed foods, and when at a grocery store (or even our natural food co-op), with a package of something in hand, I almost always look at the listed ingredients. My most common reaction is to wonder why in the world "they" put this or that collection of chemicals into the processing—in effect, ruining the food. When faced with food containing things I would never heap upon my plate, I put it back and walk away. Am I extreme? I cook almost everything fresh, and from scratch. Often I grind grains in a hand mill to make breads, so I know what goes into good bread; it is not the many, scary, chemical ingredients listed on supermarket breads. Am I extreme? It's my health, and I take it seriously.

...out of confusion, into the Mystery...

Even with a more natural, whole foods diet, what we don't know—and are not

taught—can hurt us over the long run. Industrial production has stripped not only the nutrition and wholesomeness from much of our food, it has stripped the culture from it as well. And culture is synonymous with ferment, the soil, and unseen processes of growth that take place in the dark. Science, which drives industry, has been slow to replace the wisdom embedded in traditional knowledge.

But traditional knowledge is reemerging, and merging with scientific discovery. And this new synthesis is very much the business of permaculture. A fine example of this kind of work is the book *Nourishing Traditions*, by Sally Fallon (1). When I first saw this large and pricey book newly arrived in our household, my skepticism went up, "Another cookbook, and for what?" I thought. But I've learned, and more importantly applied a great deal from reading this collection of gems. For information in books only becomes knowledge when we put it to use. And knowledge in turn only becomes wisdom when we understand how it came to be, and become responsible ourselves for its creation and transmission.

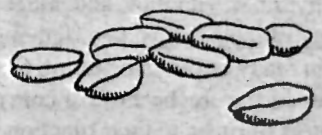
The wisdom of seeds is the heartsong of every true gardener. And the kitchen, as every permaculturist knows, is very close to the garden.

Grains, nuts, and other seeds are energy and nutrient packets designed over several hundred million years of biological evolution to provide the best opportunity for seedling survival. As gardeners, we know that a seed in its soil bed needs water to germinate. Evolutionary co-incidence? Recent studies show that grains (in fact, seeds in general) contain natural chemical inhibitors that keep the seed from sprouting prematurely. These inhibitors are water soluble. When the seed is exposed to water, the inhibitors are released and enzymatic activity swells to a frenzy: *Voila!* Germination!

If we eat seeds dry (e.g. nuts, grains, seeds) most of their energetic and nutritive value is unavailable, and passes through our system. We get food that fills our stomach yet little of the enzymatic, nutritive punch. These inhibitors are known to neutralize the enzymes in the human digestive tract. In addition, contained within the bran of grains is a substance called phytic acid. In its unaltered state, phytic acid combines in the intestines with macronutrients (most notably: calcium, phosphorus, iron, and zinc), blocking their absorption: in effect, mining our inner landscape of vital nutrients.

...the Key to nutrition...

All is not lost! There are a number of simple, age-old techniques we can use to neutralize phytic acid and thereby improve the nutritive value of grains and seeds. Broadly speaking these involve two basic strategies—sprouting and fermentation—which are often combined in a variety of ways to make a host of nutritious and tasty products.



Sprouting begins with *prolonged soaking* and leads to malting and the use of sprouts as products in themselves. It is the seed's own process of releasing its stored solar energy and engendering vitality. Beans are often sprouted and then eaten as a vegetable. Maltose, or malt sugar, is produced when the sprouted seed converts stored starches into sugars in preparation for the growth of the plant. This gives us such products as rice and barley malt syrups, and forms the basis for beer, ale, stout, porter (with all the variants thereof), and whiskey, made from malted, fermented grain. Which brings us to *fermentation.*

Ferments are all controlled forms of decay, the twin sister of growth, and they are of two basic types, fungal and bacterial. The former are what give us bread, wine, beer, blue cheeses, and tempeh, a traditional Asian food prepared from beans, grains, or seed to which a fungal culture has been introduced. Examples of bacterial ferments include vinegars, yogurt, miso, and most cheeses. The simplest fungal ferments of grain are *sourdoughs*, which involve the cultivation of wild airborne or cultured yeasts in a mixture of flour and water to produce breads or pancakes. A special form of bacterial ferment is called *lacto-fermentation*, where cultured or raw, unpasteurized milk or whey is introduced to grain and allowed to stand for a number of hours.

A very old story....

And why is all of this important? Because these processing techniques improve the nutritive value of seed foods, such as grains and pulses, which became a subject of vital importance to humans some ten thousand years ago with the shift from hunting and gathering to an agricultural way of life. Meat from wild

Nutrition 101...

The body's main energy fuel is glucose, which is derived most easily from carbohydrates as well as from some proteins. Our brain and its many systems run on glucose; nothing else will suffice. Proteins are the actual building blocks for our bodies, used to make muscle and organ tissue, synthesize hormones, and more; but in the event that not enough glucose is available for the brain, protein can—with the assistance of some glucose—be broken down into glucose and so meet the body's energy needs.

Fat is stored energy. Anything we consume in excess is either eliminated or stored as fat. Excess protein is stored as fat. Excess carbohydrate is stored as fat. Excess fat is stored as fat. However, the energy cost to liberate the stored energy in fat is high, and comes from available glucose. As an energy source, our fat reserves alone are useless to our body without a supply of carbohydrates. In a situation where your body does not have enough energy to fuel its vital needs, protein in the muscles gets broken down into glucose. Thus, if you fast from all foods, your weight loss will happen mainly through muscle loss; your fat will stay where it hangs. If, however, you fast with some intake of carbohydrate and protein, your body's energy cost to break down stored fat is met, and your muscles will stay intact as your fat reserves shrink.

game, insects, fruits and berries consumed fresh and raw, roots, leaves, nuts and other vegetable elements are all high in natural enzymes as well as proteins, fats, carbohydrates, vitamins, and minerals, in highly available forms. Seeds, though they contain many of the same nutritive constituents, were, because of enzyme inhibitors intrinsic to their function of reproducing the plant, much less digestible. Traditional diets, developed over thousands of years, incorporated the knowledge of animal and plant nutrition and of fermentation that unlocked the nutrients in cultivated foods. And so, as Fallon reports, Dr. Weston Price, a dentist and anthropologist (3) discovered from his studies of indigenous peoples in the 1930s that teeth and bone structures had begun deteriorating in cultures all over the world as and wherever industrially processed food came to supplant wild food and traditionally cultured food as the basis of diet.

Now things come back round to the kitchen!

We've seen that *prolonged soaking* (overnight in warm water) neutralizes enzyme inhibitors present in all seeds, thereby releasing numerous beneficial enzymes, nutrients, and vitamins. With the addition of some live yogurt or raw milk, *lacto-fermentation* occurs, in which lactobacilli and other useful organisms break down phytic acid.

Proteins present in grains, most notably gluten, are difficult to digest. Soaking and lacto-fermentation as well as other forms of ferment break down gluten and other proteins, in effect pre-digesting them, saving us energy and making the nutrients more readily available. Talk about stacking functions!

...the bread of dreams...

My experience with lacto-fermentation is that I can't get enough of it. For instance, my household is very fond of steel-cut oats (Irish or Scots oatmeal), which we like to eat with sunflower seeds, sesame seeds, and raisins. Following permaculture principles and creating a needs/yields analysis for my household and lactobacilli, I matched up the yields of the lactobacillis with the needs of my household, and put the little critters to work, doing what they do so well: neutralizing enzyme inhibitors and phytic acid, as well as initiating the pre-digestion process. They conveniently do it while I am sleeping. Upon awakening, not only am I entirely tickled by all that free labor performed on my behalf, but the product of that work is so absolutely delicious and satisfying that I have a hard time not hurting myself by overeating. As a gourmet, natural foods cook, two signs indicate a successful meal to me: when the last bite compels you to have another bite, and licking the plate. With lacto-fermented grains and seeds, I demonstrate success on both counts.

Soaking seeds prior to cooking or consuming them takes some forethought. Granted, we are so engulfed by labor saving devices that forethought may seem a luxury, yet living a full, healthy, and vital life would encourage some disengagement from an out-of-control human world. After all, forethought was what made agriculture possible to begin with! We need to start somewhere, and the most effective place is with our own nourishment—in its myriad forms. So please take the time to soak your grains, nuts, and seeds. Flour can be soaked overnight to form a sourdough which can be used in breads, waffles, pancakes, and pastries. Experiment. Give it a try. These and other types of food can begin to be seen as vital fuel for our daily energy needs. From my own experience as a wholistic gourmand, I can guarantee that you will be pleased with the tastes and textures of soaked and lacto-fermented seeds, nuts, and grains. Not only do they taste better, your body will feel the difference in available energy and vitality.

Some foods for soaking: Almonds, sesame and sunflower seeds, pecans, walnuts, all other nuts except cashews; also all beans and all grains such as wheat, rye, oats, kamut, spelt, and rice. If you soak in quantity, you can dry the seeds in a food dehydrator or at very low heat in an oven (below 115°F).

Some foods for lacto-fermenting: All grains, whether whole, cut, rolled, or ground into flour. For vegans, and others not consuming animal products (even though the amount of milk used is minimal) it is still very worthwhile to soak your grains in water before cooking.

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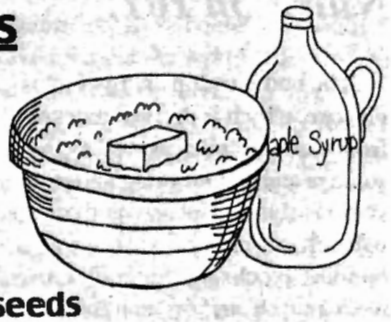
Goodheart's Irish Oats



1/2 c. organic steel cut oats
2 T. live yogurt or raw milk
1/8 c. of organic raisins
2 c. of good water*
a pinch of Celtic sea salt
1/4 c. organic sunflower seeds
1/8 c. unhulled organic sesame seeds

In a bowl, add water, yogurt (or raw milk), oats, sunflower and sesame seeds, sea salt.

***With steel cut oats, the water/oat ratio is always 4:1. With the other seeds in the mix, it's wise to add a little more water to the whole, perhaps 1/4 cup. Cover (not airtight), and set in a warm place overnight. In the morning, add raisins, and set over low heat, stirring frequently. Cooking time is fairly short (another benefit of lacto-fermentation), between 5–10 minutes. Serve with a dollop of ghee or organic butter, and some good maple syrup. Yum!**

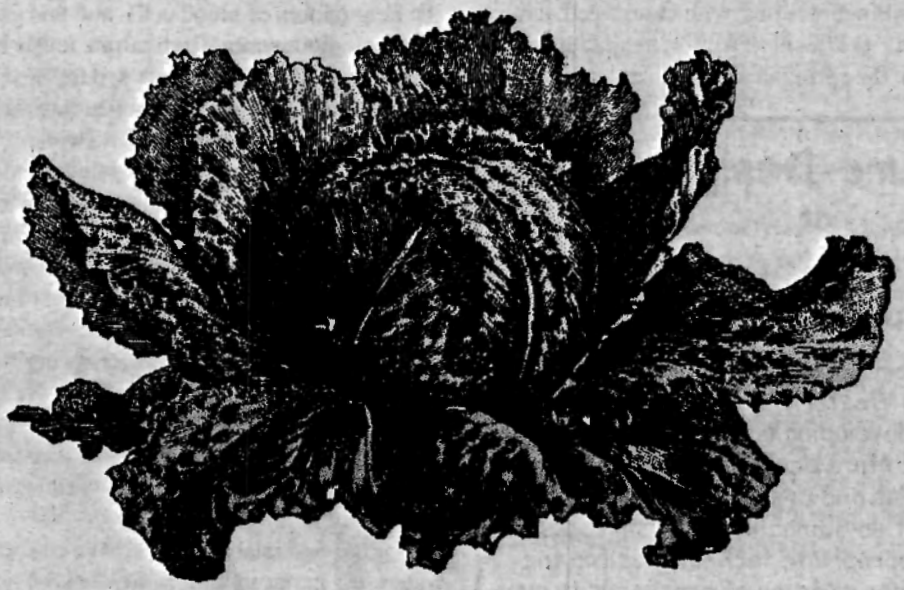
Maximum Nutrition All Year

Salad of The Season

Darrell Frey

As we began to develop our farm we sought a crop that would be both healthful and profitable. We also wanted a distinctive product that could provide a weekly harvest through most of the year. Growing a mix of fresh salad greens fit the menu.

The name "Salad of the Season" describes our solution. We choose different varieties of lettuce, other greens, and herbs to suit the growing conditions. Wild and self-seeding edibles in the gardens and greenhouses choose their own timing. The mix changes with the seasons.



The salad is based on six to ten types of young lettuce. Any edible leaf, bud, or flower can be added to this. We start by adding young pea shoots; cut baby greens such as mustards, kales, mizuna, tat soi, cress, arugula; and add other herbs such as nasturtium leaves and fennel tops.

The spring salad may include violet greens and flowers, watercress, chickweed, ox-eye daisy greens, dandelion, spinach, broccoli raab, kale florets, mache, and good king henry.

The summer mix combines lambsquarters, amaranth, sheep sorrel, wood sorrel purslane, anise hyssop, dock, orach, mallow, plantain, and pennycress.

Fall salad is based on kales, ornamental cabbage, chervil, miners lettuce, mizuna, and tat soi, while spinach, chickweed, and mache appear again.

As winter sets in we are still harvesting miners lettuce, chervil, and chickweed, but are adding endive, beet greens, young chard leaves, shungiku, salad burnet, sorrels, and fennel greens.

We are always on the lookout for new salad greens. Many make their appearance for only a few weeks of the year.

Maximum Nutrition

The salad mix fits well with our wish to provide our customers and ourselves with maximum nutrition. Most wild greens are rich in calcium, iron, and other minerals. Many are rich in vitamins A and C. Young sprouts of brassicas such as kale and mustard also contain a wealth of antioxidants and other phytochemicals. Purslane contains healthful omega-3 fatty acids. Watercress is rich in minerals and contains vitamins A, B_2, C, D, and E. Wood sorrel is rich in vitamins A and C and is a source of potassium and phosphorus. Chickweed contains potassium, phosphorus, and manganese. In addition to being rich in Vitamin A and C, dandelion leaves and flowers contain calcium and substantial amounts of B_1, sodium, potassium, and trace elements.

Many wild plants are traditionally known as tonics—foods that rejuvenate and revitalize the body after a long winter. Most common vegetables, and particularly modern varieties have been selected for mild flavor and the absence of bitter qualities. However, these bitter elements are closely associated with good mineral nutrition. Spring tonic plants like dandelion greens, violet leaves, chickweed, and watercress have been relatively little selected, nor bred for specific charac-teristics. Given the recent emergence (70-100 years, with many new discoveries) of scientific nutrition, it seems logical to assume that many healthful compounds in our food remain undiscovered. Wild foods, being in their more natural state, may contain a broader range of these unidentified but healthful elements.

Our own theory of a sustainable diet takes the concept of tonic foods and combines it with the concept of macrobiotics. Macrobiotic philosophy stresses eating fresh local foods in their proper season. It is reasonable to believe that eating a variety of fresh, live foods, in season, provides us with the most direct access to nutrients at the time we need them most. A salad mix with many fresh and raw ingredients provides a broad range of potential nutrients while introducing tonic foods into the diet.

Economic Benefits

The use of wild edibles in the salad helps increase the profitability of the farm. Seed costs are non-existent. Young weeds between other crops are harvested for the salad, doubling

and tripling yields per area. Later they are tilled in as green manure or left as a ground cover. Many wild plants act as accumulators, gathering mineral nutrients from deep in the soil. These are good for the topsoil as well as the salad bowl. Some herbs self-seed, like kale, chervil, and mache. Some, like bronze fennel, salad burnet, anise hyssop, and good king henry, are perennial.

Many salad plants naturalize and adapt to the site. We have four distinct strains of lambsquarters (magenta, white, bronze, and lemon) and several crosses. This year we had an oakleaf lambsquarters appear in several garden beds. Sheep sorrel leaves range from four-inch long narrow arrows to two-inch round hearts. Brassicas cross easily. Last spring we found a red mustard/Russian kale cross. These variations make salad growing more interesting and help keep the product in demand with top chefs and local customers.

From the bioshelter and the unheated coldframes and polytunnel we reap a good harvest of wild edibles and self-seeded greens and herbs fall through spring. The solar-heated greenhouse beds have their own seasons, with chickweed, lambsquarters, and miners lettuce prevalent in winter; amaranth and purslane emerging later in the spring as soil temperature increase.

Precautions

The use of wild edibles requires proper identification. Please consult an experienced forager before eating any wild plant.

Some salad plants such as sorrels, beet greens, and even spinach contain oxalic acid, which limits calcium absorption. Kidney failure has also been associated with the excessive consumption of foods containing oxalic acid or potassium oxalate. Oxalic acid will not likely be a problem unless consume at high levels in a diet low in calcium and B vitamins. Younger plants probably have lower levels of oxalic acid, and cooking may help to nullify its effects. Mixing small amounts of these plants into a salad mix is a good way to enjoy and benefit from them in moderation.

Under conditions of low light and high nitrate levels in the soil, leafy greens can absorb more nitrates than they can process into plant tissue. After digestion, nitrates are converted to nitrite which can be more toxic than nitrates. Nitrites replace oxygen in the hemoglobin of blood cells, and this can cause a disease calle methemoglobinemia. High nitrate levels in well water have been linked to sudden infant death syndrome. Nitrates are also a potential source of the carcinogen nitrosamine and can cause gastroenteritis and anemia after a while.

Studies have shown that nitrate accumulation can be reduced or avoided by keeping soil nitrogen low in winter gardens and harvesting near the end of a sunny day. In Pennsylvania, we hav found that nitrate levels peak during cloudy weather from December through late January. At our farm we have chosen thi period as our down time, when we rest, celebrate the midwinter holidays, and plan for the winter-spring garden. The small amount of salad we mix during this time is harvested only after periods of sunny weather. We also keeping soil temperatures lower (under 50°F) during the solstice season to inhibit plant activity. When the sun shines the soil warms and plants accumulate less nitrate.

Sanitation is also a concern. We use only greenhouse-grown watercress in our mix to avoid potential health risks from waterborne contaminants, diseases, or parasites such as sheep liver flukes. Manure must be fully composted before being applied to raw food crops such as salad greens.

The Salad of the Season has evolved to be a perfect crop for our farm. With a diversity of potential ingredients we always have a good mix, even if part of the crop fails. The seasonal variation in the salad keeps customers interested in the product. Our determination to maintain high quality limits production to about 60 pounds per week May through November and an average of 25 lbs/wk from January through April. At the premium price we receive, our salad annually generates more than $15,000 in sales. Most importantly, using what most consider a problem—weeds—as a prime ingredient in our product, demonstrates a major principle of permaculture: turnin a problem into a resource.

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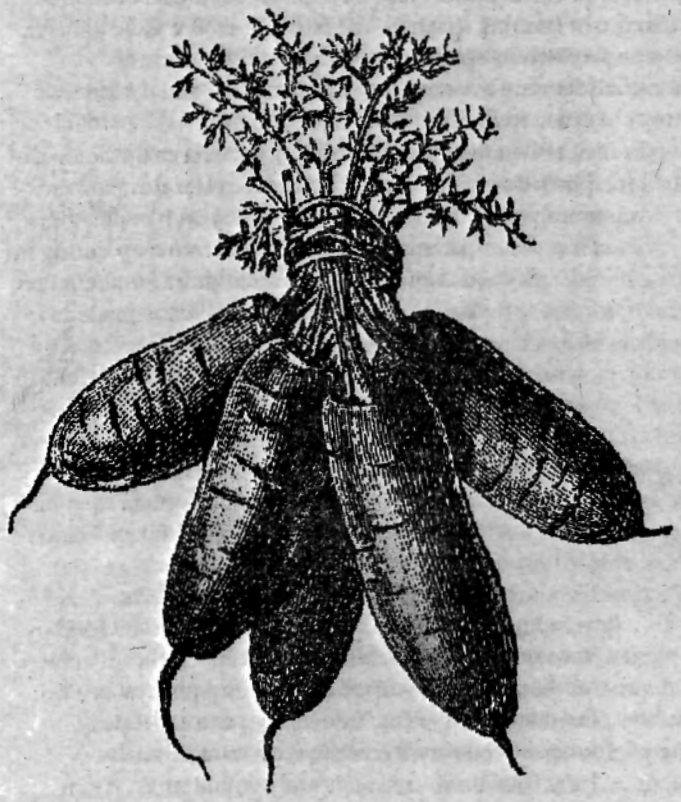
A Community Heritage

Heirloom Fruits and Vegetables

Suzanne P. DeMuth

Like any heirlooms passed from generation to generation, the vintage varieties of garden plants that we still grow today have lasting value. Some old types of vegetables have been kept alive within families or communities by succeeding generations of seed savers. Others with a long history in the seed trade can be traced back to the 19th C., when commerce in seeds expanded, or even to the Colonial period. Both types are threatened with commercial extinction. According to the 1994 Garden Seed Inventory, for instance, two-thirds of the 5000 non-hybrid varieties available in 1984 seed catalogs from North America were dropped during the next decade.



How old is "old"? Most people agree that heirloom vegetables and fruits are those types known through historical documentation or folk history for at least 50 years. Dating to the early 20th C. and before, many originated during a very different agricultural age—when localized and subsistence-based food economies flourished, when waves of immigrant farmers and gardeners brought cherished seeds and plants to this country, and before seed saving had dwindled to a "lost art" among most North American farmers and gardeners. For instance, antique apple grower and historian Lee Calhoun uses 1928 as the cut-off date marking heirloom apples that were once grown in the U.S. South. By this time, subsistence farming in the region had nearly disappeared and commercial apple breeding was severely diminished. (He found that only 300 of the 1600 apple varieties that originated or were once grown in the South still exist.)

In addition to their long history of use, the heirloom vegetables that are routinely grown from seed are open-pollinated, meaning they set seed "naturally," often aided by wind, rain, or pollinating insects, and can thus be renewed by sowing the seeds harvested from each generation of plants. Known also as standard or non-hybrid, open-pollinated varieties tend to be stable and true-breeding. They differ from F1 hybrids, which in usual practice result from deliberate crossing of two distinct, highly inbred parent lines. (The term "F1" to describe the hybrid offspring indicates the "first filial" generation, with respect to the parent lines.)

Since their genetic makeup has been simplified in this way, F1 hybrids tend to be highly uniform, and may (in corn and brassicas particularly) display "hybrid vigor," as shown by improved yields or more robust garden or field performance. Hybrids are used increasingly in large-scale, intensive agriculture because they provide production advantages for farmers and commercial incentives for seed sellers. The benefits of hybrids tend to be less cut-and-dried for home gardeners, however, and saving seeds from hybrids is problematic. Although seed collected from F1 hybrids may be viable, the resulting plants tend to be highly variable, hence undesirable for many growers and especially uneconomical for commercial producers. Thus, gardeners and farmers who grow hybrids must return to the seed company each year to obtain the same varietal "package."

Growing interest in heirlooms

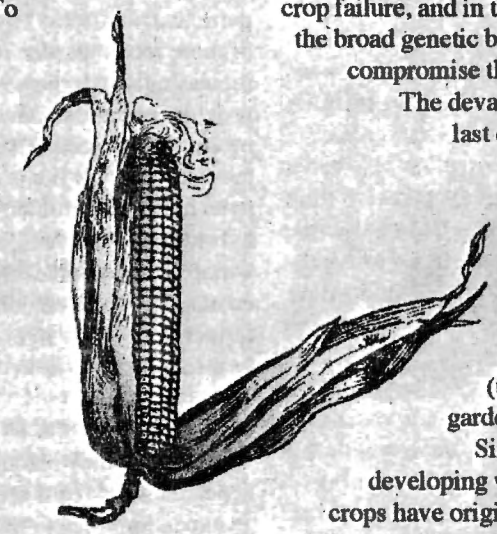
Although they belong to the past, heirloom varieties of vegetables and fruits are by no means obsolete. Since the 1970s, an expanding popular movement dedicated to perpetuating and distributing these garden classics has emerged among home gardeners and small-scale growers, with interest and endorsement from scientists, historians, environmentalists, and consumers. Although active seed savers tend to be a minority among the millions of Americans who plant a garden, broad-based support has expanded for grassroots plant conservation networks such as Seed Savers Exchange in Iowa, and Seeds of Diversity Canada. A variety of other groups with local or regional membership, or with ethnic or crop-oriented focus, are also active.

With support from these networks, vintage varieties are being introduced—or reintroduced—to the garden seed trade, and are appearing at local farmers' and specialty markets. New, independent seed companies offering unique collections of regionally adapted varieties have emerged (filling the void created by the decline in long-established, regional seed companies, which have been displaced or absorbed in recent decades by transnational seed and agrichemical firms). Fruit

hobbyist groups—whose members include antique and rare fruit enthusiasts—are thriving, and old fruit varieties are increasingly available from specialized and mainstream nurseries. Traditional crop varieties are being restored to native farmers and gardeners, and associated farming traditions revived. In addition, a number of living historical farms and open-air museums are growing and disseminating authentic old varieties, often supported by historical research to discover their past uses and growing methods. Interest in heirlooms relates strongly to the perceived limitations of modern hybrids, which can be said to lack "pride of ancestry or hope of posterity."

Novelty, nostalgia, and general merit

Heirloom enthusiasts have discovered the endless variety and novelty still existing among the old types of vegetables and fruits. Their unusual shapes, distinctive colors, and uncommon flavors are especially appealing. Even the old names exercise the imagination, recalling the "sounds and tastes and tales of gardeners past." (To name only a few...consider the Cherokee Trail of Tears bean...or Moon and Stars watermelon...or Bloody Butcher and Howling Moon corns...or Sops of Wine, Esopus Spitzenburg, and Rambo apples...) According to ethnobotanist Gary Nabhan, curiosity and kindness by crop stewards have helped to foster and perpetuate diversity. To explain the enormous variation in the shapes and colors of beans found among different cultures around the world, one scientist has suggested that, in addition to yield, hardiness, and flavor, beans have been selected for their beauty, "to feed not only the body but the spirit."



Beyond their novelty, sentimental, or aesthetic appeal, heirlooms are considered by many who grow them to be top performers in home gardens and wherever toughness and dependability are desirable. Or, they offer superior flavor or cooking properties, or unique harvest or storage characteristics. Many traditional varieties display combinations of traits that make them especially responsive to local or regional conditions, or well-suited to organic, low-external-input, or permaculture systems, or tolerant of local pests and diseases. The corn and bean varieties developed by native Southwestern farmers, for instance, are highly adapted to the local soils, climate, and growing methods that shaped them, allowing survival of the plants, along with their caretakers, under harsh, dryland conditions.

Sustaining connections

Those who grow and disseminate old varieties tangibly engage the past, and cultivate community relationships based on participation, equity, and sustainability. Some seed savers perpetuate a family legacy, or share favorite plants with neighbors or friends. Others express community or tribal kinships by growing varieties central to traditional, local foods and cuisines, or to religious practices, or that embody other cultural meanings. Some who delve into the histories of local or ethnic varieties discover connections to fading agricultural traditions and rhythms, and to the social customs of past generations. Some heirloom advocates have taken to heart Wendell Berry's urgings to "learn the life histories of the food species," to reduce the growing gap between food producers and consumers.

Preserving alternatives

There is growing awareness that crop surpluses, supermarket abundance, and product and brand name proliferation mask a general decline in agricultural diversity. Of particular concern to garden stewards, and a primary reason to preserve heirloom varieties is the serious decline in our food plants' genetic base. According to the United Nations Food and Agriculture Organization, crop genetic resources are being lost, globally, at the rate of 1-2% per year.

In North America and similar agricultural settings, many forces work to reduce genetic richness in the crop and livestock base, and in consequence, to lessen the ecologic and economic resilience of farming systems. Despite impressive yield gains in modern production agriculture, widespread adoption of simplified farming systems with low genetic diversity carries a variety of risks. In the short term, such systems risk potential crop failure, and in the longer term, they encourage the demise of the broad genetic base that contributes to high yields, and thus compromise the future genetic health of crop populations. The devastating ruin of the Irish potato crop during the last century, and more recently the Southern corn leaf blight in the U.S. in 1970, signaled clearly the dangers of genetic uniformity in our staple food crops. Economic and social forces have stimulated decline in seed companies serving local and regional markets, and heightened losses in seed-saving traditions among farmers (themselves a disappearing breed) and gardeners.

Similar influences shape events in the developing world, where many of our important food crops have originated and evolved. In some of these "centers of diversity," homogenizing forces imperil the survival of vast numbers of existing "landraces," the heterogeneous, locally adapted, farmer-bred crop varieties that have traditionally supported local food producers and rural communities. Along with their wild relatives, these "gene treasures" deliver the genetic infusions that are needed to improve crops the world over. Here also, the results are farming systems with diminished ecological and genetic complexity, fewer farmers with reduced seed-saving skills, and impoverished natural habitats. It is widely agreed that wise management of our biological resources is central to ensuring food abundance.

Concerns over "genetic erosion" (the continuing, absolute losses in crop species and varieties) are intensified by questions surrounding ownership and equitable access to plant genetic materials. Various stakeholders—from North American seed savers to Third World farmers—are apprehensive over potentially widespread use of bioengineered varieties, including

the specter of "terminator" seeds that fail to reproduce. Of concern also are expanded uses of legal mechanisms (such as patents and plant breeders rights, or restrictive commercial seed lists) that remove plant germplasm from public use.

Fostering participation and choice

Many who perpetuate heirlooms aim to preserve a measure of personal or community independence. Seed saving is inherently self-reliant, allowing people to bypass the seed trade and to maintain choice varieties found commercially wanting, or to breed desired types themselves. (Organic growers, for instance, who seek to grow "full-cycle," are working to ensure the continued availability of organically grown seeds.) Alongside farmers' markets, community-supported agriculture, urban and community gardens, and similar initiatives, grassroots efforts to preserve heirlooms may help return food production and consumption from "the global everywhere" to serve more locally responsive and regionally reliant food economies.

Community-based stewardship

National governments and international organizations are attempting to preserve plant germplasm (i.e., seeds and other plant materials) in "genebanks" (known also as *ex situ* or "offsite" storage). These measures fall short as fail-safe approaches, however, since they "protect the products of evolution, but not the process," and they rely heavily on continued political stability and support, including sustained governmental funding. Although their stored plant materials are held for public use, the U.S. collections, in particular, fail to serve the direct needs of many gardeners and other small-scale growers, since the stored materials are largely those favored by professional plant breeders to improve commercial crops. Thus, the national collections consist overwhelmingly of breeding lines and other specialized types of germplasm, as well as farmers' landraces and wild relatives of crop species. The old commercial varieties and family heirlooms of various garden crops (many of them lacking the "deep diversity" typically sought by breeders), and crops with low commercial appeal, have received lower priority.

Within their original and natural environments, crop plants are subjected to changing conditions and stresses, and thus are continually shaped by natural selection. *In situ* conservation, or preservation by growers, replicates these conditions. In addition such measures put vital plant germplasm into as many "hands" as possible. People thus have continued access to plant materials valued for their horticultural, cultural, and historical relevance, and with their qualities—for better and worse—clearly visible.

Variety's merits

As their commercial demise suggests, the old vegetable and fruit varieties are not uniformly appreciated. Many gardeners choose freely among the growing array of old and new varieties available, acknowledging the gains (such as improved disease and pest resistance) conferred by plant breeders, and advances in seed purity and quality provided by professional seed producers. Heirloom promoter Carolyn Jabs has acknowledged, for instance, that in light of modern breeding work, as well as changing tastes and environments over time, "some heirlooms do resemble museum pieces." Likewise, Seed Savers Exchange co-founder, Kent Whealy, has asserted that the network is not "anti-hybrid," but he points out that the ascendency of modern hybrids has loomed large in the "wholesale destruction of traditional varieties."

Narrowing discussion of the values of old and new varieties to their respective horticultural merits ignores their broader appeal as cultural, historical, and genetic resources.

In the end, the question of whether old or new varieties are "better" remains elusive, since the answer implies values and priorities: Better for whom, and for what purposes? As seed activists Cary Fowler and Pat Mooney have written, "Someone else's seeds imply someone else's needs." Growing old varieties allows people to express their individual tastes and preferences, and their personal or commonly-held beliefs about what is worth sustaining. As Carolyn Jabs has put it: "In a world...changing so rapidly, one of the most meaningful things we can preserve...is a full range of possibilities." More than 75 years ago, Liberty Hyde Bailey asked readers of *The Apple Tree*, "Why do we need so many kinds of apples?" His answer—"Because there are so many folks." In the same book, the eminent American horticulturalist lauded the part played by the "amateur" in creating, appreciating, and preserving variety in our domestic fruits, declaring that "when we lose the amateur, we lose the ideals." Professor Bailey anticipated the views of modern heirloom stewards when he said that "...there is merit in variety itself. It provides more contact with life, and leads away from uniformity and monotony."

A note on terminology: The terms used to describe old varieties are varied and often used loosely. I have here used "heirloom" broadly and synonymously with such terms as traditional, vintage, antique, heritage, or classic, since each of these terms conveys the age and perceived value of heirlooms, but says little about who grows them, or where, or how. This usage follows that of plant breeder, Carolyn Deppe, who describes the seed-propagated vegetable heirlooms as "any old open-pollinated variet[ies] that [have] been around for a while."Δ

Suzanne P. DeMuth wrote this essay for the Alternative Farming Systems Information Center, Information Centers Branch, National Agricultural Library, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland 20705-2351. It is reprinted here with the author's permission and has been edited for length.

The Synergistic Vegetable Garden

Emilia Hazelip

We have inherited an agriculture which has always disturbed the soil in order to prepare the next crop. The ancient agricultures of the Inca, the Maya, and the Orient also prepared fields in such a way. Culturally, that gesture has been honored and sung by poets. Ecologically, pedologically, it is a catastrophe.

A natural, non-traumatized soil presents a subtle balance of thousands of diverse organisms. From friendly bacteria to fungi, the presence of all these invisible subtle lives allows interactions according the "Synergetic Effect." Among the dynamic processes in the soil, I think that the Ethylene-Oxygen cycle is a good example of this wonderous world. The entire availability of mineral nutrients from the soil depends upon the alternation of aerobic and anaerobic conditions at microsites throughout the soil mass, yet the act of plowing destroys the very anaerobic conditions that allow ethylene gas to be produced and which make mineral uptake by plants possible. Our conventional agriculture remains ignorant of this fundamental science.

What could we give back to the soil that would bring back its wildness? We cannot recreate that quality if we keep on destabilizing the rhizosphere. The only way is to learn an agriculture that will reconcile the maintenance of soil wilderness and the production of crops.

This I have endeavored to do for over 20 years, and as the system evolved, using the self-fertility of the wild soil as fertilizer, I have given it the name Synergistic Agriculture. This can be practiced at any scale. The machinery used in the U.S. and Canada for no-till agriculture can be used for Synergistic Agriculture.

Evolution of the Method

The foundation of my research is the system described by Masanobu Fukuoka, whose book, *The One Straw Revolution*, changed my life in 1977 when it was published in English and I read it. He described a way of cultivating cereals, vegetables, and fruits which was free of the plow and of chemicals. Nothing was added to the soil except the straw from the crops which had grown in it, seed for the next crop, and the manure of ducks allowed to glean and graze following each harvest. Instead, he used a leguminous crop such as clover to suppress weeds and fix nitrogen. The animals hastened the breakdown of organic material which fed a lively community of soil organisms: this was the basis of fertility. Fukuoka harvested two crops per year from his land in southern Japan and achieved yields equivalent to the best returns of chemical agriculture in the district. At the time he wrote he had already done this for 30 years with no loss of fertility in the soil.

In Fukuoka's Natural Agriculture, no machines are used, nor greenhouses, nor all these things we have to do when working in difficult climates. To me, what seemed the most important was to be able to obtain crops without "exploiting," or exhausting the soil, even if a compromise were needed regarding machines.

Before finding Fukuoka's work, I had been working around Alan Chadwick in Santa Cruz, California in the late 60s, learning his methods of biodynamic and French Intensive gardening (double-dug beds).

From reading Ruth Stout's books (also in the 60s) (5, 6), I learned to cover the garden beds with diverse materials. She used deep mulch, renewed it frequently and fed the soil under the mulch with everything from her kitchen and all the weeds of her yard. Try to get her books if you are interested in soil self-fertility—she is truly a pioneer in this field.

photos by the author

Garden layout showing mulched paths, raised beds, and trellis

Since then, in all my gardens I have made raised beds, though the difference in volume comes only from the soil taken off the paths and put onto the beds—no double-digging stuff for me.

In 1985 during the first Permaculture Design Course in the Pyrenees with Sego Jackson, Marc Bonfils gave a presentation on cereal production in a self-fertile way. His method is based on the use of traditional varieties suited to winter dormancy and a long cycle of growth, surface sowing of the seed at wide intervals (to eliminate competition between plants for water and nutrient) into a living mulch of perennial clover, timing of the sowing to coincide with summer availability of nutrients in order to establish for the plant a strong root system capable of carrying it through the winter, encouragement of tillering and side shoots, and the return of all straw and organic wastes to the field. The soil is never plowed after establishment of the system. And all fertility is generated by the activity of microorganisms in the soil.

Today, microbiologists like Alan Smith and Elaine Ingham are presenting much needed evidence of the reasons to stop altering soil's structure and stressing it to exhaustion by plowing.

A Succession of Cultures

I could not call any of this "do-nothing" agriculture since on the contrary there is much to do to establish a succession of cultures where what you are harvesting is as important as what

you are leaving behind. A detailed plan indicating the plants, mixtures, and successions is a must. The cultivator must also pay attention to the kind of root residue the soil is receiving, and be ever mindful of combining the crop with nitrogen-fixing plants of the legume family.

Although to begin, a big upside-down job could be done, once we start the garden, we pay dear attention not to disturb the soil deeper than the sowing depth and only where it is sown.

Organic matter in the soil is consumed by the chemical reaction that follows when atmospheric gasses are mixed with the soil by plowing. Although by mineralizing humus, a quick, instant fertilizer may be produced, the price to pay for this is much too high. Plant growth and health depend on other substances like ethylene gas which enhances the assimilation of iron and other essential nutrients; and ethylene is only generated and conserved in soil which is not disturbed. Plants will be healthy if all the digestive flora of the soil are present.

Transforming Carbon to Humus

Soil and plants are a single organism. Plants are the "antennae" of the soil, capturing light and creating solid, organic, vegetable matter in the space above the ground. Fully 95% of needed nutrients come from a synthesis of gas and light. In other words, the plant is only taking from the soil 2.5% of its needs in the form of minerals and trace elements. The remaining 2.5% of nutrients is the nitrogen which can be obtained in a symbiotic way by interplanting with nitrogen-fixing plants, mainly from the legume family, like beans, chickpeas, fava beans, lentils, and peas.

Harvesting is as important as the rest. The soil is a living mass of interacting beings and they all eat just like everything alive on this planet. Their food chains are wonders of intricate relationships covering the mineral, the vegetable, and the animal/insect/ bacteria worlds.

Uneven aged plants together

Even in agricultural conditions, from the moment we stop creating stress in the soil with our "well-intentioned" plowing disturbances, we can organize our garden in such a way that the soil functions as if "in the wild." The great bulk of what has grown in the soil must be left in it, either by its roots (if it is an above-ground crop), or by following a root crop with another crop which will leave a generous amount of root matter in the soil, like Swiss chard.

Those residues, together with a biodegradable mulch, amount to surface composting, leaving more organic matter in the soil than the crop has removed. From the moment we stop mineralizing humus (by eliminating the plow), litter accumulates on the soil; and at a myriad of microsites within it, happy bacteria, cycling back and forth between ethylene and oxygen, release biological gas essential to the wellbeing of all types of roots, and continuously access the mineral fertility of the soil in the rhizosphere precisely where the plant roots can best assimilate it.

The Model of Nature

The less we disturb the soil, the more diversity and intensity of interactions will take place in its mass, the healthier the plants and the fewer problems for us. It is time for us to acknowledge that the soil needs to be itself while we produce our crops; to respect this organism enough to let it function in its natural way although "domesticated" by our technical care.

The organisms in the soil are like the bloodstream of the human body, carrying nutrients and participating in the assimilation of the minerals present.

Above the ground, leaves act like photovoltaic cells, capturing light and producing energy. The only bridge between the inorganic chemistry of the atmosphere and the organic world is this fantastic alchemy performed by plants. And all life depends upon it.

It always struck me as funny, that in the wild, plants are the first link of food chains and are seen as responsible for the creation of "soil," but in agriculture, they are accused of exhausting the soil. Very typical of Homo occidentalis, a scapegoat has been made responsible for the negative effect of plowing: the crops!

The soil should never be opened up and force-fed, not even with the best made compost, ever. Leave to the soil only what has grown in it, and the rest put above the soil, as mulch. And let the whole of the soil occupants bring this inside its mass.

I truly believe that as long as we have not made peace with the soil, we won't find peace above it either. As long as we justify the exploitation of this organism, other exploitations will follow. And we will remain parasites, consuming more than participating in the miracle of life.

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Learning from Nature—
A Revolution in Rice Cultivation

Justin Rabenandrasana

A very productive System of Rice Intensification (SRI) is being developed in Madagascar. Over the past four years, some hundreds of farmers around Ranomafana have increased their irrigated rice yields from 2 tons/ha to up to 8 tons/ha and more. Instead of relying on the "Green Revolution" recipe (of hybrid high-yielding seed varieties, chemical fertilizer, and irrigation), which they could scarcely afford, they have followed innovative soil, plant, water, and nutrient management practices. They continued to use their own seeds and compost, and while these intensified management practices cost them 40-65% more labor, the result was a very high return.

The system was developed in 1983 by the late Fr. Henri de Laulanie, who observed a strong increase in tillers (multiple stalks sprouting from a single plant) and yield after an accidental early transplanting of rice. He went on to combine early transplanting with other practices that provided an optimal rice plant environment. In 1990, Fr. de Laulanie helped to establish Association Tefy Saina (ATS), an NGO to promote and improve SRI in Madagascar.

Basic principle: strong plants

The success of SRI is based on the synergetic development of both the tillers and roots. With a more vigorous root growth, plants can become fuller and taller, and get better access to the nutrients and water they need to produce tillers and seeds. With more growth above ground to carry out photosynthesis, more energy is available for root growth and the stronger the plants, the more resistant they are to attacks by pests and diseases. In Madagascar, where soils are deficient in nutrients, a dense and extended root system gives plants many advantages.

Capture full potential for tillering

One of the "tricks" in SRI is that it capitalizes on an in-built pattern of development in rice that had been identified many years ago by the Japanese researcher T. Katayama. He studied the patterns of growth and development in rice, wheat, and barley and found that these plants put out tillers in a regular sequential pattern. In rice, each tiller produces another tiller two phyllochrons later (a phyllochron is an interval of plant growth, usually about five days but it can be longer or shorter depending on temperature and soil conditions). When soil and other conditions are favorable, the rice plant can go through as many as 12 phyllochrons (or more) before it moves from the vegetative growth phase to the reproductive phase (marked by panicle formation and flowering). The number of tillers can increase exponentially with as many as 84 or more forming on a single plant.

photos Association Tefy Saina

The full potential for tillering can be captured by the synergetic effects of the following techniques:

Early Transplanting

Transplanting after the fourth phyllochron begins (after 12-18 days) sets back the growth momentum of rice plants so that their full potential for producing tillers, roots, and grains is not achieved. If the 10th through the 12th phyllochrons of growth do not materialize because of late transplanting, 75% of a rice plant's tillering potential is lost. If transplantation is done poorly and the first two tillers get damaged, one cannot expect more than 16 tillers to grow.

Transplantation should be carried out carefully and early, about 8 to 12 days after sowing, when the seedlings have only two leaves. It should be done very soon after removing the seedlings from the seedbed and within 15 to 30 minutes after the tiny plants have been gently uprooted. The tiny roots should be placed horizontally in the soil so that the tip of the root can easily resume its downward growth. In this way the leaves of the seedlings will not become yellow and the plant will start to grow again within a few hours. The plants have time to adjust to their new environment before the first tiller starts to grow.

Planting one by one

If two, three, or more plants are transplanted together in a clump, competition among their roots limits tillering to five per plant at the most. The close planting common in traditional rice cultivation is antagonistic to tillering. To enhance the development of roots and tillers and minimise competition between plants, seedlings are planted one by one in SRI.

Wide spacing

Farmers often believe they can boost their yields by planting rice more densely with 50-100 or more plants per square meter. However, wider spacing encourages more rooting, more tillering, and more grain filling. In SRI, spacing follows a square pattern of

between 25x25cm (10"x10") and 50x50cm (20"x20"). In this way a considerable amount of seed can be saved. In SRI, 5-8 kg of seed is sufficient for one hectare of transplanted rice (4.5-7 lbs/ac), whereas in Madagascar it is quite normal to use 100 to 200kg/ha (90-180 lbs/ac). Rice plants grown under SRI management have between 50 and 80 tillers and routinely produce 150 to 200 grains or more per fertile tiller.

Capturing full root growth potential

For centuries rice farmers have kept their paddy fields inundated when their rice is growing. In this way they suppress weeds and reduce the amount of labor needed. This led farmers and scientists to believe that rice plants benefit from being continuously flooded. However, rice is not an aquatic plant, and although it can survive with its roots submerged it does not really thrive. During its reproductive phase, when plants go through flowering, panicle initiation, grain filling, and maturation, maintaining 1-2 cm of water on rice fields has a beneficial effect. But during the preceding growth phase, rice plants grow better in unsaturated soil. The reasons are simple. When there is no standing water and there is air in the soil, the roots can acquire oxygen much more easily through the *aerenchyma* (air pockets) in the root cells. Lack of oxygen in the root zone leads to soil acidification that causes the destruction of *aerenchyma* and hampers nutrient uptake, assimilation, and plant growth. The nitrogen cycle in the soil is disturbed as well, and all kinds of toxicity will develop. Scientists from IRRI (Intl. Rice Research Institute) have identified the problems caused by anaerobic decomposition in continuously irrigated rice systems as one of the main causes of yield decline (Pingali et al, 1997).

The full potential for root growth can be captured by:

Alternative wetting and drying of the field modifies the growing environment of rice. This improves soil structure, gets more oxygen into the root zone, and enhances active soil life. As the soil dries, air replaces water, and when it rains or irrigation is applied, this air is pushed downwards. Periodic water stress and the availability of oxygen facilitate root growth, and the volume of soil penetrated by the roots increases. In rice production, an effective drainage system to evacuate excessive rainfall and irrigation water from the field is as important as the irrigation system itself.

Minimum irrigation

At the beginning of tillering, there is still not much vegetative growth and the plant only requires a small amount of water. When the root system has been developed, three or four days of superficial dryness should not cause alarm even if some cracks develop in the field. During growth, irrigation will only be needed if rainfall is inadequate and then should be applied in moderate amounts and at favorable times—preferably at night. In this way, irrigation requirements can be reduced by up to half.

Early and frequent weeding

Whatever the crop, early weeding is always important for a good return. In rice paddies, where traditional methods are used, hand weeding is usually done six weeks after transplanting. This is far too late for two important reasons. Not only are weeds replacing half the expected harvest by this time, but farmers also lose the opportunity to bring oxygen into their soil. Aeration of soil by weeding may be even more important in rice cultivation than the removal of weeds. With SRI, simple mechanical push-weeders are used, and these churn up the soil. In Ambatovaky, the community near Ranomafana where SRI has been adopted most enthusiastically, 75 farmers experimented with weeding during the 1997-98 season. The two farmers who did not do any weeding got almost 6 tons/ha (2.4 tons/ac); the 35 who did the recommended minimum of one or two weedings averaged between 7 and 7.5 tons/ha (2.8-3.0 tons/ac); while the 24 who did three weedings averaged 9 tons (3.6t/ac) and the 15 who did four weedings averaged over 11 tons (4.4 tons). This showed how early and frequent weeding is very important in enhancing the development of the root system and the entire rice plant. The extra labor needed for additional weeding more than pays for itself at harvest time.

Application of compost

SRI was first developed in the 1980s using chemical fertilizer. But after the price of fertilizer skyrocketed in the early 1990s, Fr. de Laulanie began experimenting with compost. He used cattle manure where this was available, but mostly he used any sort of decomposed biomass, including rice straw. Cuttings from leguminous plants and shrubs proved particularly beneficial. He found that using organic sources of nutrients could help achieve levels of production that could not be obtained using conventional practices. In the north of Madagascar, a private

company conducted trials to determine the best levels of chemical fertilizer for rice. It reported achieving average yields of 6.2 tons with modern methods and seeds. At the same time 27 farmers using SRI in the same area averaged 10.2 tons/ha.

It is still uncertain how and why these high yields are possible on such poor soils. Around Ranomafana, pH values are between 4.2 and 4.6 with extremely low levels of exchangeable bases (Ca, Mg and K) and phosphorus levels that average between 3-4 ppm, which is considered very deficient. Possibly this can be attributed to the large volume of soil penetrated by roots and the high activity of soil-life brought about by aerobic soil conditions and organic fertilisers.

An approach not a package

In the past 10 years, SRI has been used with similar success in many places in Madagascar and under different production conditions (elevation, temperature, soil types). Currently, SRI is being promoted by several development programs. The University of Antananarivo's Ecole Superieure des Sciences Agronomiques (ESSA) has supported field studies to evaluate and analyze the method. The Cornell International Institute for Food, Agriculture, and Development (CIIFAD) has been working with ATS since 1994. Outside Madagascar interest in SRI is growing, and SRI as a methodology is still being evaluated. ATS insists that it be treated as an approach, a strategy, even a philosophy, rather than a "package." It is the combination of practices that is important, more than any specific single method. These practices need to be tested and, if need be, adapted when introduced to new environments.

Even if such high increases in yields cannot be obtained everywhere because of constraints such as water control, substantial gains in rice production should be possible by applying SRI insights and practices. By mobilizing the experimental capacity of thousands of farmers to adapt the technology to different conditions, SRI could become one of the most beneficial innovations in agricultural practice this century.

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A fully developed rice plant

Cold Climate Food Strategies

"It is the middle of January on the coast of Maine, and I'm harvesting crops for dinner. Despite the typically frigid New England weather, I can choose from 18 garden-fresh vegetables. I begin by harvesting a salad of mache, curly endive, and claytonia. I will serve the salad with a mustard vinaigrette and raw carrot and kohlrabi slices on the side. Then I gather spinach for a duck-egg souffle, dig some leeks to prepare sauteed with butter and pick some parsley to garnish the potatoes from the cellar. Not bad for fresh garden harvesting in Zone 5." —Eliot Coleman

Jerry Heath

If you're a northern gardener, permaculture offers good news and bad news.

A great deal of permaculture teaching has emphasised the use of perennial vegetables and fruits. While this may provide the bulk of diet in tropical and sub-tropical climates, depending on this approach would quickly lead to starvation in a cold temperate region. For the colder areas of the U.S. and almost all of Canada (USDA Zones 5 and lower) there are only a handful of hardy perennial vegetables. They include asparagus and rhubarb, but even these have very short seasons, producing a crop for only four to eight weeks of the year. So the bad news is that perennial plants in our climate are mostly called trees and flowers, and not many of them produce food. Our small number of food-bearing trees and shrubs are all dormant during the winter so that traditional agriculture only actively produces food for about five months of the year. This means that we must find ways to extend the growing season and to store and preserve food if we are to approach year-round self-sufficiency. The main sources of food therefore will have to be from annual vegetables, grains, and legumes, augmented by nuts, fruits, and meat and dairy products.

Before we feel too sorry for ourselves for living in such a hard climate there are a few advantages to consider. While our winters bring a halt to plant growth they also provide an important protection from insect and disease pests which can plague warmer climes throughout the year. One good hard frost and we can sit back for a few months, enjoy our harvest, look at our seed catalogues and dream of spring. Outside the chickadees and woodpeckers are eating insect egg clusters on their and our behalf. Freezing and thawing cycles loosen the soil over winter, making it more permeable and easier to work. Another real advantage of the northern latitudes is long daylight hours during the growing season, which can make our northern gardens extraordinarily productive. The stories about 90 lb. cabbages in Alaska are true!

There is no single right way of achieving self-reliance; the good news is that there are dozens of right ways depending on your land, your skills, your preferences, your time and your income. It is a matter of using permaculture design principles and of making the compromises that suit your needs.

I offer two examples: the first is our approach at Wild Apple Farm in southern Ontario, which I describe as middle class permaculture. The second is a different and innovative system developed by Eliot Coleman for coastal Maine. Both he and we garden organically in climate Zone 5, although I'm convinced that it gets colder in Ontario. To date, we don't have livestock, having limited ourselves to vegetables, herbs, and wild and cultivated fruits. Coleman concentrates on fresh vegetables, and uses ducks in a classic permaculture way to weed and fertilize the gardens and to control slugs. He has developed techniques which allow him to harvest fresh produce 12 months of the year, and he stores seasonal surpluses; he doesn't freeze or can. Other approaches may be more or less complex, capital or labour intensive, larger or smaller, they may include livestock or poultry; they can all work, and they can all be called permaculture.

Despite a frost-free period of as few as 100 days in northern parts of the U.S. and much of Canada, the growing season can be doubled by the use of hardy plant varieties, succession planting, solar devices, and the creation of microclimates.

Succession planting

The traditional habit of planting all your garden after the last spring frost and pulling it out before the first frost in the fall wastes a lot of opportunities. Succession planting can double or triple (with protection) the length of season for cool weather and fast growing crops. Many varieties planted in April (peas, salad greens, carrots, onions) can be planted again in early August following the harvesting of garlic, beans, early cabbage and broccoli, in time for a fall crop.

Varieties and Crops

Vegetables - Choose varieties that are suited to your climate and your needs. For long season, frost-sensitive crops such as winter squash, the days to maturity can vary from 65 to 115. If your frost-free season only averages 100 days you should select an early variety. Crops like tomatoes and peppers require the same approach. Another means of extending your season is to plant heat-resistant lettuces to make summer crops more feasible. For storage crops such as carrots, potatoes, and winter squash choose varieties that store well. Other varieties are especially suited for freezing. Most seed catalogues note these special properties so that you can select the varieties that fit your needs.

Field Crops - If you are operating on a garden scale I don't recommend growing grains and legumes. I have hand harvested

and threshed soybeans and kidney beans and it quickly cured me of the habit. Buy organic grains and legumes from an organic farmer and you will be doing yourself and the farmer a favour.

Fruit and Nuts - As you go toward colder climates the number of fruit and nut species that will flourish declines, therefore you must first select for hardiness. Forget about citrus, peaches, apricots, and pecans. This is apple, pear, plum, cherry and berry country. Even within a species there is a wide range of hardiness. For example, apples will grow from northern Canada to the West Indies depending on the variety: hardiness ranges from Zone 2 to zone 9. Any reputable nursery will specify the hardiness of their plants. You can further lower your risk by buying from suppliers in your own area or a colder one. Having dealt with hardiness you can then select for good quality and disease resistance.

Microclimates

These can be created by garden design (using slope, proper orientation to the sun, and windbreaks) and with physical devices (cold frames, cloches, row covers) to make heat traps that extend the season in both spring and fall for frost-tender or heat-loving crops such as tomatoes and peppers. Mulching is also effective in moderating soil temperatures. In a cold climate it is best not to mulch heat-loving crops until later in the season when the soil has warmed up. You can also shade cool weather varieties such as salad greens to get extra crops during the heat of mid-summer. Row covers and shade frames can be constructed in modular sections to fit on wide row raised beds, then changed as the seasons progress and in conjunction with crop rotations.

Eliot Coleman describes methods for harvesting cold frame crops from September to December and again from March to May with some hardy types like kale, leeks, green onions, spinach, and sorrel right through the winter. With tunnel-covered cold frames he adds arugula, chard, chicory, endive, mache, and parsley to his year-round list. Coleman says, "As a rough estimate, each layer of covering is the equivalent of moving your plants a zone and a half to the south. Thus for me in Zone 5, a cold frame moderates the temperature to that of Zone 6 plus, and a frame inside a tunnel has its climate moderated to that of Zone 8." This is like moving your garden from Maine to Georgia or parts of California—not a bad feat!

Coleman has constructed his mobile tunnel greenhouse on rails and alternates it between two sites in his garden as part of his crop rotation. It is used year-round; open at the ends in July to September over heat-loving crops like tomatoes, peppers, and melons, and closed over the rest of the year to grow and harvest cool weather crops, especially greens.

In addition to this outside work, you can dramatically lengthen your growing season by using more expensive devices such as greenhouses. The best "solar" designs, such as the Brace version, are quite energy efficient because of insulated walls and good geometry, and can produce a higher light intensity than in outside growing areas. The greenhouse can be attached to the south face of your house for a symbiotic energy exchange.

Year-round Harvesting

Eliot Coleman has harvested crops throughout the entire year from his gardens in Vermont and Maine which have a similar climate to ours (1). He says "The four-season harvest is based on a simple premise. Whereas the growing season may be limited to the warmer months, the harvest season has no such limits. I enjoy a year-round harvest by following two practices: succession planting and crop protection." I recommend his *Four-Season Harvest* as the best single source of information on this subject. One of the book's many strengths is that Coleman doesn't suggest any technique or practice he hasn't thoroughly evaluated himself.

photo Peter Bane

Polytunnel in Gloucestershire, England

After stretching the growing season and the amount of food produced as much as possible, the second strategy is to store (simply keep) or preserve (process in some manner) the surplus for the rest of the year. A combination of traditional and modern technologies can be used.

Storage

Where feasible this is the most desirable method of keeping food because it is cheap, easy, and doesn't require energy. Many crops can be stored for 3 to 9 months in a cold room or root cellar. The temperature has to be kept near freezing with high humidity for crops such as carrots, parsnips, turnips, rutabaga, cabbage, beets, and potatoes. Apples like the same conditions but should be separated from the others because they give off ethylene gas which causes the vegetables to ripen and rot. Garlic, onions, and winter squash prefer cool and dry conditions. The beauty of this system is that it uses no energy and doesn't break down. Even simpler, some crops such as carrots, parsnips, and leeks can be left in the garden through much of the winter if they are heavily mulched to keep them from freezing and thawing. When we renovated our 100 year-old farm house we used selective insulation and heat supply design to reduce energy use and to create a number of temperature zones within the building. They include the heated living area (sweet potatoes), partially-heated workshop/loft (onions, garlic, and winter squash) and unheated cellar (root crops, potatoes, apples, beer, and wine).

Preservation

Freezing - Our freezers are an important part of our food storage strategy because of the high quality and closeness to fresh

food they provide. They are like having our own supermarket at home. While they do use a significant amount of electricity, we justify them by the amount of other forms of energy they save. They save a lot of trips to town because we can buy items in season and in bulk that we don't produce ourselves. Other forms of preservation require energy at the preparation stage. We have several ways of minimizing energy consumption. To reduce energy usage and spread the work out over the year we freeze crops such as rhubarb and berries when harvested and then process them into jams and preserves in the fall on our Amish wood cook stove when the heat is welcome in warming the house rather than doing it in the sweltering summer and using the electric stove. This approach also facilitates making jams and chutneys from combinations of fruits and vegetables that are not available fresh at the same time. Following the same logic you can bake extra bread in the winter and spring to stock in the freezer as the previous summer's produce is emptied out.

Freezer energy consumption can be greatly reduced by keeping the freezer in an unheated location where it can be turned off in the winter months. Our 22 and 16 cubic foot freezers live in the unheated garage and are unplugged for about six to eight weeks in the winter. Even when running they use less energy because of their cool environment. A freezer is more efficient when it is kept full and so we have an annual cycle which optimizes this aspect. In the spring we empty out the smaller freezer and clean it, and at the summer low point of the storage year we transfer the food from the large freezer to the small one. Besides saving energy, this process helps us to find and use up older items.

Another important function of our freezers is to keep the many soups which are a central feature of our diet. Starting in late spring with fresh wild mustard and chive and potatoes from the root cellar, there is a steady procession of soups through the year. Because crops often come in abundance and because it is an efficient use of our time and energy, we make large batches—usually enough for six meals for the two of us. We freeze them in two- to four-serving batches, so we have lunches and light suppers readily available at all times—great for surprise guests! Often there are as many as 50 packages of soup of a dozen varieties, along with many stews, chilies, and pasta sauces in the freezer. Other vegetables are blanched and frozen as they are harvested. These include tomatoes, beans, peas, and broccoli. We also use the freezers to keep the whole lamb and some dozen chickens we buy from a local organic farmer. Most of the 50 gallons of cider we press each year goes into the freezer.

Drying - Herbs, fruits and vegetables can be preserved by drying. You can use air, the sun, a wood stove, or an electric dryer depending on the crop, your climate, and your preference. Besides enjoying teas made from fresh garden herbs from May until October, we dry enough to last us the winter and for gifts. Frequent clipping of the herbs controls diseases and prevents them from going to seed too early, so it increases the yield and improves the quality. Dried pears are quite sensational and apples work well. We dry some herbs by hanging them in bunches in a well-ventilated area; others we do in our electric food dryer. If you prefer, you can sun dry some produce such as tomatoes, although in our climate this is difficult. We had great success drying tomatoes in the cab of our truck properly aimed south.

Canning, pickling and preserving – Abundant wild apple trees give our farm its name and form the backbone of our fruit crop, but we have many other wild fruits which are ideal for preserving. Our harvest includes wild blackcap and red raspberries, blackberries, elderberries, chokecherries, nanny berries, and grapes, and we make a large variety of cooked jams, jellies, syrups, and drink concentrates from them. Besides satisfying our own needs they are very popular gifts with city friends and relatives, and we sell a few as well. We also make fruit-flavoured vinegars, notably elderberry, which we use in salad dressings. Some of our sweet apple cider ends up in jellies and syrups. Chutneys, pickles, and relishes are also worth making. Fermentation can produce items such as sauerkraut, vinegar, pickles, cider, or wine.

A Word on Livestock

A rural permaculture design doesn't have to include livestock. If you are a vegetarian, don't want to be tied down, or simply don't feel like looking after animals, then don't have them. Do one of your farm neighbours a favour and buy their eggs, meat, or whatever interests you. It will become a link in your community's economic system. On the other hand, animals work very well in a mixed farm design. In a cold climate they provide a valuable source of protein and are an effective way of storing food in the winter. I would recommend keeping traditional, multi-purpose breeds such as Hampshire chickens (eggs and meat), Horned Dorset sheep (meat, wool, and milk) and Red Poll cattle (meat and milk) rather than the modern in-bred specialized breeds typified by Holstein dairy cattle. The older breeds are hardier and were developed for free range instead of factory farming. By using them you will also be helping to maintain greater genetic diversity in farm livestock.

Conclusion

The prime directive of Permaculture, according to Bill Mollison, is to "take responsibility for meeting our own needs and those of future generations." It all begins with food. In a climate colder than those enjoyed by most North Americans, we estimate that 90% of our food is organically grown in our bioregion. We do treat ourselves to oranges and grapefruit, some of which is organic, and a few processed organic foods. Very little comes from a supermarket.

Growing and storing food at home connects us with the earth. It is the essence of beneficial relative location: what we need is near at hand. Employing a variety of methods incorporates the permaculture principles of redundancy and diversity. By combining season extension strategies with food preservation techniques you too can create a sustainable local alternative to refrigerated trucks and planes hauling food across the continent.

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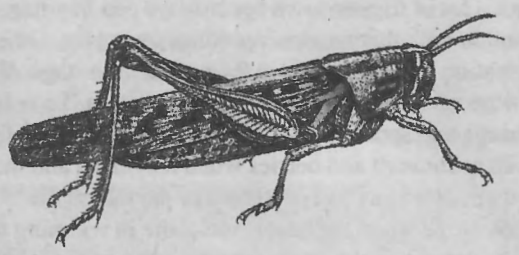
The Wonders of Insect Cuisine

Marci Robbin Tarre



Cooking with insects appears to be a dead art in the United States. As a population, we not only fail to acknowledge that insects serve as an important, cherished food source around the world, but we wholeheartedly deny or disregard their recent historical use in this country. In fact, our aversion to insects as human food is an exception to the global rule.

Well over 500 insect species are known to be used as food around the world (5). Various life stages of dragon-flies, walking sticks, grasshoppers, cockroaches, termites, lice, water bugs, stink-bugs, aphids, cicadas, marsh flies, crane flies, scarab beetles, weevils, silk moths, tent moths, hornworms, inch worms, sulfur butterflies, bees, wasps, and ants, to name a few, grace the plates of people in over 40 countries. While insects are often thought of as "famine food," they are not eaten simply for their high protein and energy content. They offer spiritual, medic-inal, nutritional, and flavor benefits to many who indulge in them.

Indigenous people of this land often relied upon and celebrated the culinary use of these abundant, tasty critters. Mormon crickets (actually migratory grasshoppers) landed in great swarms in the Great Salt Lake of Utah where they were soaked in salt brine and then washed upon the shore to cure in the sun. Local Ute and Paiute harvested them by the thousands by simply strolling along the shoreline with a basket (7). Tohono O'Odham of the Sonoran Desert hand-picked large white-lined sphinx moth caterpillars that they called *makkum* (Nabhan). After removing the head and viscera, the larvae were either roasted over hot coals and eaten immediately or were placed on heated stones to dry. They were relished as a food source, which is not difficult to believe: this was a seasonally abundant, protein- and energy-rich, delicious food for a people subsisting mainly on a wild desert plant diet.

Honeypot ants, which occur globally, were eaten by many Native American people until recently. These ants have a unique system of stockpiling their food for the winter months. Nectar and honeydew gathered by workers outside of the nest is brought inside and fed to a special caste of workers called "repleats." The abdomen of each repleat swells to several times its original size. These bloated ants remain inside the nest to regurgitate their stomach contents to their sisters on demand. People of Australia and both American continents have expended huge amounts of energy to excavate these ants' nests to eat the sweet living honeypots (1). Aztecs and Toltecs reportedly fermented the bodies of honeypot ants to make a sacred drink (10).

Potent Nutrition

Nutritionally speaking, insects are an efficient source of essential amino acids (meaning those which the body cannot synthesize or convert from other amino acids) as well as many other macro- and micro-nutrients. Some contain high levels of protein and fat as well as iron, zinc, thiamine, riboflavin, iodine, vitamin A, magnesium, calcium, as well as essential amino acids. A study of edible caterpillars from the Congo shows them to contain all the essential vitamins except B1 and B6 for proper growth of young rats (2). In Papua New Guinea and Irian Jaya, the sago grub (immature stage of a weevil) is found in the rotting pith of sago palm trees. The trees themselves are the source of palm oil sold on the international market. The grubs are an important source of fat, iron, and zinc for the indigenous Sepik people who eat them. The palm weevil larvae can compose up to 30% of the protein intake for the Sepik (3).

In South Africa, a saturniid (silk) caterpillar called the mopanie worm is a seasonally abundant, nutritionally rich source of food. The amino acid composition is reportedly nearly complete, including lysine and tryptophan which are limiting amino acids in maize foods as well as methionine which is limiting in legumes (4). Another example of a nutritionally significant insect food comes from Mexico. In the southern states, *gusanos del maguey*, larvae of giant skipper butterflies (known to us as the worm at the bottom of the tequila bottle), serve as an important food for the rural poor. These larvae hatch from eggs that are laid on the leaves of agave plants, and then bore into the leaves, eating their way down to the "heart" of the plant. For rural Mexicans harvesting wild agaves for food, fiber, or alcoholic beverage, a coincidental encounter with *gusanos del maguey* means only one thing: good food! The larvae are collected in the field and either strung as a necklace or wrapped with the outer "skin" of the agave leaf. They are then brought back to towns or villages along with the agave harvest to be cooked over hot coals and eaten. These "worms" are rich in tyrosine, an essential amino acid lacking in the typical southern Mexican rice, beans, and cassava diet (2).

Rice field grasshoppers are eaten in many Asian countries. These common crop feeders, *metdugi* in Korean, are high in iron, vitamin B2, and protein (9). For many Koreans, *metdugi* appeal to their sense of tradition and/or nostalgia. Rapid and widespread industrialization, urbanization, and pesticide use since the 1960's nearly brought the practice of eating grasshoppers to an end in Korea. Fortunately, however, public outcry forced the government to change policies. In 1981, a mandate requiring farmers to spray rice fields with pesticides at least three times per season was loosened, and *metdugi* populations began to rise. *Metdugi* are again a popular item at local markets and sell for a fairly high price on the international market (9).

Medicine, too

In addition to daily food use, there is extensive documentation

of insects being consumed medicinally. For example, besides being a popular food item in Korea, *metdugi* are highly prized for their medicinal value. In the province of Chahwang, *metdugi* are used as preventative medicine for both constipation and heart problems. Traditionally, these grasshoppers were prescribed for children with convulsions, coughs, tetanus, and weakness (Pemberton). The chemical composition of other insects have made them practical candidates for use in folk medicine. Goiter, a treatable disease caused by iodine deficiency, has been treated by rural people in the state of Guererro, Mexico, with pentatomids (better known as stink bugs) for centuries. These insects feed on plant juices and store concentrated amounts of iodine from the fluids (10). In southwest Nigeria, cockroach hemocoel (blood) is reportedly mixed with okra to be used as an antibacterial mouthwash and toothpaste for dental patients (6). Cockroaches are particularly high in defensive compounds, many of which are surely bioactive. Finally, immature wasps of several species were boiled, roasted, or eaten alive by ancient Mexicans. Women ate a particular species *(Polistes instabilis)* for their nutritional value, hormones, and steroid-type compounds at times of menopause. The larvae and pupae are still eaten by women in Pacific coast areas of Mexico, especially Oaxaca, to help during this time of physiological change. Brood of other species are eaten alive directly from the nest to treat urinary diseases. Honey from still other species are known to be used for eye problems such as cataracts or clouding of the cornea (10).

Bug breeder Dick McDonald enjoys fried scorpions in China.

A Legacy Unclaimed

While we don't often speak of edible insects in this country, the ghosts of our past still inhabit the earth. Today, Mormon crickets continue to land in haphazard swarms in the Great Salt Lake. We, on the other hand, deliberately choose to dismiss them as a possible food source. White-lined sphinx moth caterpillars still roam the desert floor. They are, however, no longer destined for the frying pan. If noticed at all, they are most likely mistakenly regarded as a potential garden pest. Few people nowadays could recognize a honeypot ant colony; far fewer would be interested in digging one up for the sake of the sweet living nectar reward. The unfortunate result of our ignorance in this realm is increased pesticide use, fear and misunderstanding of insects, loss of food diversity, and loss of culture and language associated with these foods.

Turning this trend around poses an interesting challenge. I believe we can start by learning about traditional wild insect foods from our own region and experimenting with them. In doing this, we not only seek and value the knowledge that living elders and oral traditions embody, but we learn about our history and the natural world around us. I have wild harvested the white-lined sphinx moth larvae that were once eaten by the Tohono O'Odham in and around present-day Tucson. They are a delicious, beautiful, and nutritious food, and my life has been enriched for having tried them. I am also privileged to have eaten live termites from a freshly split log. Their taste was somewhat nutty—like me!. And I am, perhaps, one step closer to my wild primate relatives for having indulged in one of their favored foods.

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Suppliers of Insects

• GrubCo, Box 15001, Hamilton, OH 45015. 800-222-3563

• Rainbow Mealworms, 126 East Spruce St., P.O. Box 4907, Compton, CA 90224. ph. 800-777-9676

• Waxworms, Inc., PO Box 333, Cameron, WI 54822. ph. 715-924-2777

Other Great Resources for Bug Eaters

• *The Food Insects Newsletter*. ($10/yr). Contact Florence Dunkel, editor, Dept. of Entomology, MSU, 324 Leon Johnson Hall, Bozeman, MT 59717-0302; ueyfd@montana.edu.

• The Society of Ethnobiology. An academic organization linking culture with natural history. Fantastic quarterly journal and annual conference. Annual membership (students $25) includes the journal and discounts on the conference. website: http://gullart.dac.uga.edu/ISE.

• The Sonoran Arthropod Studies Institute (SASI). A great local nonprofit organization dedicated insect natural history through research, outreach and an annual conference. Their gift shop offers books by mail order, T-shirts, and other insect-related items. Contact SASI at 520-883-3945; sasi@webtv.net; http://www.sasionline.org.

• *Man Eating Bugs*. Peter Menzel and Faith D'Aluisio. Ten Speed Press, Berkeley. 1998. A beautiful, inspirational photo essay on how, why, and where insects are eaten globally.

• *The Eat-A-Bug Cookbook*. In addition to containing creative gourmet recipes for cooking arthropods, this book has lots of cool tidbits about nutrients, history, events, and people involved with insect cuisine.

• *The Permaculture Book of Ferment and Human Nutrition*. Bill Mollison. Tagari Publications. Tyalgum, NSW. 1993. A wonderful book chock full of interesting foods from around the world, including some insects. Great discussion of nutritional value of these foods and the importance of traditional harvest and preparation techniques in ensuring the bio-availability of nutrients within a given food.

• *Cultures of Habitat*. Gary Nabhan. Counterpoint. Washington, DC. 1997. Ex-plores the connection between loss of bio-diversity and loss of cultural diversity.Δ

Words of Caution—
Tips for Eating Insects

If you are planning to harvest insects from the wild, please do some research and observation before consuming them. As every good Permaculturist knows, general strategies must be adapted to suit local conditions. The knowledge that a particular type of insect has been used as food in another place or time is a good starting point when identifying potentially edible insects. However, it is essential to learn about insect natural history and the history of the land on which you are harvesting. This can be done by talking with local elders, using resources in a public library, observing the land, insects and other animals over time, and experimenting on yourself.

Some general rules of thumb are as follows:

1. Start small—don't eat 500 ants if you haven't eaten those specific ants before.
2. After eating an insect, wait at least several hours before eating more—look for signs of allergy such as headache, rash, fever, swelling, throat irritation, nausea, dizziness, or difficulty breathing.
3. Hold and observe an insect before considering eating it—if you wouldn't hold it in your hand, you probably shouldn't let it loose in your digestive system.
4. Don't eat raw insects, especially those with particularly hard exoskeletons, because they may contain harmful intestinal parasites.
5. Avoid insects from highly polluted or contaminated areas (use your judgement).
6. Don't eat things that feed on toxic plants (if the insect is brightly colored, this is a warning signal that it contains plant toxins or a fierce sting/bite).
7. If other mammals or birds are feeding on an insect, chances are it is edible for humans.
8. Don't eat anything with obvious hairs or stingers that might be irritating or contain poisons.
9. If you're allergic to seafood, use caution when eating insects—they contain similar proteins.
10. Don't take more than your fair share of insects—ask yourself how your harvest will affect the ecosystem in which you are collecting.
11. Termites and wood-boring grubs tend to be highly edible, even uncooked.
12. Identify the bug before you put it in your mouth—get a field guide to the insects of your area.
13. Document what you have tried, where you got it, how it tasted, etc.
14. Enjoy your meal!

Some of these points may seem contradictory or overly cautious. Basically, you are the judge of how careful you will be with the foods you try. If you are worried about adverse effects from eating unfamiliar, wild insects, order some insects from a supplier (mealworms or wax moth larvae are good starters). These will arrive alive and packed in either sawdust or newspaper. Once you have separated the insects from their substrate, they can be put into a plastic container and frozen. The frozen insects will last until you have the urge or guts to use them. Just put them in an iron skillet with some herbs and spices and add this into a stirfry or into a nut mixture. The same can be done with wild harvested insects. Δ

Marci Tarre is writing her master's thesis at the Univ. of Arizona, Tucson on the nutritional role of Hyles lineata *(the white-lined sphinx moth) larvae in the traditional Tohono O'Odham diet, a subject that bridges disciplines, and addresses her many diffuse interests including harvesting wild desert foods, preparing traditional cuisine, and writing about human nutrition, international politics, and natural history. This pursuit also ensures that her taste buds remain stimulated, her friends fascinated if not disgusted, and that conversation is never dull around the water cooler.*

Economic Botany

The World of Chilies

Scott Wilson

Unbeknownst to most of the world, the greatest legacy of the conquest of the New World by Spain and other European powers was not the gold and silver robbed from Aztec and Inca empires, but rather the immense wealth of plant material that followed the conquistadors back to Europe. Indeed, many of the signature cuisines of the world today—Italian, Chinese, Thai, Indian—would not exist had this great redistribution of botanical treasure not occurred.

One of the most fascinating tales of the New World plants recalls the voyage of the Capsicum genus out of Mexico and around the world. Chile peppers traveled back to Spain on the ships of Christopher Columbus, but there they met with a cool reception, except in the medicinal gardens of physicians and botanists. Credit for a more successful dispersal of the capsicums belongs to the Portuguese, who encountered the chile on the east coast of Brazil. From there, it traveled to trading posts on the west coast of Africa, then journeyed to India's west coast via the Cape of Good Hope. It continued on to Malaya, China, Japan, and then the Philippines, before sailing across the South Pacific to the Spice Islands, a part of present-day Indonesia. Returning from there to North European ports, it finally reached North America on Dutch and English slave ships. Capsicum's circumnavigation of the globe took less than 50 years.

By the time the chile reached Europe again, in Germany in 1542, it was called the Calicut pepper and was believed to have originated in India in ancient times. George Eberhard Rumphius, an important botanical author of his time, insisted that chiles had been carried from India to the New World where Columbus found them. His claim is dubious since there is no mention of Capsicums in Sanskrit, Roman, Hebrew, Greek, or Arabic literature, and there is no conclusive evidence to suggest that Old World cultivators were in contact with the neotropics before 1492.

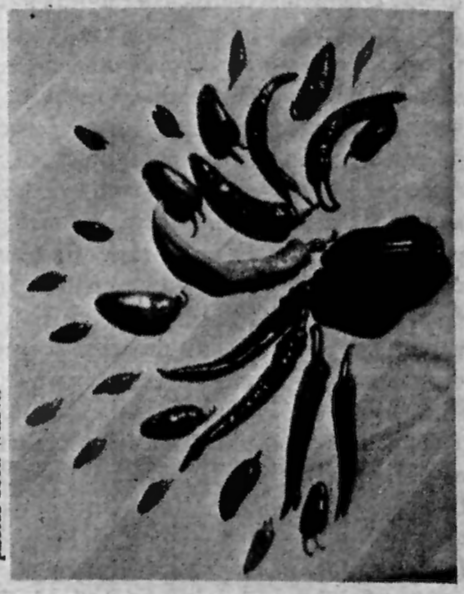
Origins

For thousands of years before they rounded the globe, however, chiles had migrated north, south, and east from their center of domestication in South America. Though the exact location of Capsicum's first cultivation is disputed by botanists, Hardy Eshbaugh, professor of botany at Miami University in Ohio believes chilies originated in southern Bolivia, near its border with Paraguay and Argentina. *Capsicum chacoense*, the most primitive of all chiles and perhaps the mother of all peppers, still grows in that region.

Comparing enzymes in *chacoense* to those in other capsicums, he found the former to exist in more "primitive states." Thus, he suggests that the Bolivian pepper must have come first.

A colleague and former classmate of Eshbaugh's, Barbara Pickersgill, believes that chiles may have originated in Brazil from species in related genera and that until these plants have been studied in living collections, the exact cradle of chiles can't be determined. In any event, it is fairly certain that the first varieties of chiles originated in an area bordered by southern Brazil to the east, by Bolivia to the west and by Paraguay and northern Argentina to the south. It is only there that all of the major domesticated species within the genus grow.

By 1993, 27 species of Capsicum had been described. Of those, five are domesticated: *baccatum*, *pubescens*, *annuum*, *chinense*, and *frutescens*. While cultivation of *Capsicum baccatum* and *C. pubescens* is confined primarily to South America, the three other closely related species spread far from their area of origin, *annuum* having been domesticated in Mexico, *chinense* in the Amazon watershed, and *frutescens* in Central America. These three—known to botanists as the annuum-chinense-frutescens complex—are the most commercially important.



photos Scott Wilson

Nutrition

Capsicums are bought and sold primarily for use as flavorings and as colorful vegetables, but they are noteworthy to the permaculture designer or gardener for their multifunctional contribution to balanced diet and curative medicine.

Nutritionally, capsicums are an outstanding source of vitamins C, A, and P. The scientist who discovered ascorbic acid, Albert Szent-Gyorgyi, determined that a Hungarian paprika contains five to six times more vitamin C by weight than oranges or lemons. Chiles also contain copious quantities of carotene—an orange-yellow or red hydrocarbon that the liver converts into vitamin A—even more

than carrots. Vitamin A is important for normal cell growth in the body and maintenance of the skin and mucous membranes. Also, chiles supply large amounts of vitamin P, known alternately as the bioflavonoids, substances which aid in maintaining the walls of small blood vessels. The vitamin content of chile preserves and of dried chiles can help our bodies maintain resistance to illness throughout the winter when fresh foods are in short supply.

Chilies as medicine

In addition to the preventive use of chiles in a healthful diet, many people apply them curatively. Capsicums were in use for medicine in the New World long before European contact. The Mayans of northern Guatemala made a potion called *ic*, ingested to cure cramps and diarrhea or rubbed on gums to cure toothaches. The Aztecs, from whose Nahuatl word *tzilli* our word chile stems, applied hot chile mashes to aching bones and muscles. Generally, in areas where folk medicine and herbalism are practiced, chiles are used as remedies in both their fresh and dried forms. Where western medicine prevails, however, the use of chiles for their curative properties is shunned even though those properties are well documented. I believe this is due to profit-driven motives of the pharmaceutical-medical complex which shuns using food as medicine.

Authors wife, Jane Larson, loading chilies onto tray for drying

Regardless of medical practice or prejudice, a look into any herbal reference reveals the beneficial properties of chiles. The actions of the chile's constituents are stimulant, carminative, tonic, sialogogue (increasing saliva flow), rubefacient, anti-catarrhal, anti-emetic, anti-microbial, and diaphoretic. Curiously, many of the books I've read and herbalists I've spoken with refer to cayenne as the chile to use. This is somewhat misleading because cayenne is indistinguishable from other pungent red chiles in its composition. In fact, most of what is sold as cayenne could be the powder of any hot red chile. Any high-quality, organically-grown hot chile will serve well to "regulate the blood flow, equalizing and strengthening the heart, arteries, capillaries, and nerves."

Cayenne is a general tonic and is specific for the circulatory and digestive system. It may be used in flatulent dyspepsia and colic. If there is insufficient peripheral circulation, leading to cold hands and feet and possibly chilblains, cayenne may be used. It is used for treating debility and for warding off colds. Externally, it is used as a rubefacient (literally, "red-facing," or increasing local blood flow) in problems like lumbago and rheumatic pains. As an ointment it helps unbroken chilblains (frostbite), "as long as it is used in moderation!"

From this brief description, we can see the vast utility of Capsicums to the permaculturist. But that's not all. Chile plants, with their myriad pod shapes and colors ripening through the summer and fall, are lovely denizens of the ornamental and edible landscape. Chile plants do quite well in pots, too. If you can't stand peppers, and I haven't yet convinced you to eat them, grow some and trade them or rub them on your aching bones after a long day working in the garden!

On the culinary plane, chiles occupy a beloved place in the cuisines of many countries such as Mexico, Thailand, China, India, and Hungary. While most cuisines utilize chiles primarily for their heat, Mexican cookery alone has achieved the mastery of blending chiles to create subtle savory sauces that in the estimation of many surpass those of France.

Interestingly, Mexican chefs never blend fresh chiles with dried ones. To do so would be heretical! The Hungarians are curious in that they fell in love with the chile's flavor but not the heat. Until 1945, when a mild paprika was developed, great energy was spent deveining the beloved pods to rid them of their spicy compounds.

Peppers for lawn and garden

If the number of uses of capsicums hasn't amazed you yet, read on. During my brief reign as owner of a chile pepper company, I received many calls from distressed lawn owners whose lovely turf was being destroyed by raccoons. They had heard that cayenne powder would deter the pests. It will, in fact, deter any creature that has taste buds, but the quantities needed to cover areas sufficiently and repeatedly are prohibitive in their cost. More effective uses in the garden include mixing the hot powder with bird feed to deter squirrels. It doesn't affect the birds, which have no taste buds.

For a spray to eliminate aphids, use fresh hot peppers and blend them with water. Then strain the water and add a little powdered real soap to spray on plants infested with aphids. I've made a similar concoction of peppers and garlic, which I steeped for 24 hours before straining. Spraying every day in the early morning, I had success in deterring cabbage moths. This spray can be used several times daily on roses, azaleas, chrysanthemums, or beans to hold down serious infestations. Ground red chiles may by sprinkled on tomato plants attacked by caterpillars. If you spot tomato hornworms, wait and see if parasitic wasps are present. They build noticeable white cocoons on the hornworms, and will do your pest control work for you. You can increase their presence by planting umbelliferous species in and around your garden. Repel eggplant pests by rubbing ground chiles on the leaves. Sprinkling it on corn silk helps deter raccoons from helping themselves.

In permaculture, beneficial groupings of plants are known as guilds. A point of departure for building guilds with capsicums would be researching garden literature from around the world, especially in countries where chiles are widely grown and eaten. An interesting relationship between *Capsicum annuum* and *Zantedeschia aethiopica* (common calla) was observed in our California garden by my wife. The chile plants were planted directly above the sparsely foliated callas. As Autumn arrived, we harvested the chiles. Then the callas grew up and enveloped

the chile plants, protecting them through the winter. All of our exposed plants were killed by frost.

Salsa and chutney

Value-added products based on chiles are as diverse as the people who grow them. Drying chiles is the simplest way to add value to them. It stabilizes the fruits, extends their life and saleability, while making storage, transportation, and distribution easier. Removing their water content intensifies also their qualities so that less becomes more. Prices for dried chiles are often ten or more times the price of fresh.

Humidity, light, and insects, particularly moths, are enemies to dried chiles and must be controlled. Home vacuum sealers work well to seal chiles in gallon and quart jars. Whole chiles retain their quality longer than ground chiles as they have less oxidizable surface. Store them in the dark as light reduces their nutritional value over time. Acidifying and brining chiles preserves them and can be the first stage in producing hot sauces; the fruits can also be used as condiments at this stage. Using chiles in other products such as salsas and chutneys is an option, though their commercial production requires more specialized equipment and knowledge, and is subject to greater regulatory control.

Having attempted (and failed) to enter the "fiery food" industry and the mail order industry, I have a few tips to would-be-entrepreneurs. Our (my wife and I) greatest error was in not having enough start up capital. We were making headway extremely slowly and probably would have succeeded had it not been for lack of funds. When you start your mail order chile business, over-estimate your start-up costs by about five years then add 15% to be safe.

We wanted to sell high quality organic chiles to other "hot heads," to establish mutually beneficial relations with small organic farmers, and guide production of exotic and hard-to-find chiles for the gourmet niche. But competing in an ever consolidating and modernizing industry meant doing things like shipping chiles from New Mexico, putting them in little bags in California, then shipping them around the country, sometimes to people in New Mexico! We had to adopt four-color labels with UPC codes to get into stores. We spent thousands of dollars on advertising. It was just not what we wanted. But if you want to get into the trade, be prepared for intense competition as the industry matures. Establishing a modest trade with local restaurants and independent grocery stores would be a good way to get your feet wet without risking too much.

Home economics

We are considering resurrecting our chile operation here in Oregon, though with a much different emphasis. Our goal will be to weave mutually beneficial connections with other local farmers and crafters. It's got to stay local and sustainable or it isn't worth it. I now envision having a small commercial kitchen on our farm to process chiles. We will age mashes and make hot sauces. We will concoct chunky salsas loaded with garden produce and chiles whose names you can't pronounce. We will market them to local restaurants and shops. We will use them as our currency in bartering with like-minded neighbors. This time we will do it because we love to do it and might get something—cash, services, or products—in exchange. If the venture doesn't fly, we'll eat the products ourselves because we only make what we like to eat. If we can't sell them to earn, we'll eat them to reduce our need to earn. Our product will precede its reputation, unlike many big money products that create a mystique through advertising, then offer average products.

If permaculture folks around the world made chile sauces or condiments, we could reopen ancient traditions along new trade routes into the twenty-first century. Whether or not that happens, everyone should, nay must, grow chiles in their garden. The benefits of Capsicums counted herein are so numerous that we all should be growing them.

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Biogeography for the Garden—

A Look at Food Origins

Peter Bane

A stroll down your garden path is in many ways like a bus ride through Manhattan. All about you is a polyglot community, its inhabitants transplanted, whether recently or generations back, from the far corners of the globe. And like the world city, the well-stocked garden is a university offering courses in a vast range of subjects: geography, botany, history, traditional agricultural science, plant breeding, medicine, the arts and literature. Lately, like the city of which it is a vegetable analog, the garden has become political.

The plants that sustain us come from elsewhere. This is particularly true for North Americans as it is for Europeans and Australians. For though these parts of the world are economic, political, and agricultural powerhouses, they are pipsqueaks in the realm of economic botany. It is important to remember this, especially now that hullabaloo over genetic engineering has brought crop diversity into the headlines. To understand the implications of this we need to look briefly at the story of agriculture and settlement, the core subjects of permaculture.

At the close of the Neolithic Era, some 10-15,000 years ago, human culture underwent a revolution. As the planet warmed and the great ice sheets receded, bands of hunters were able, in a fairly short span of centuries, to overwhelm and finally exterminate the huge herds of megafauna that had roamed the plains and tundra of Asia, Europe, and North America. Less well known, but contemporary with these exterminations, large mammals went extinct or became much more scarce across Africa and South America as well. An enormous source of high quality protein food was eliminated from the human diet with repercussions that we are still feeling today. Faced with diminishing food supplies, humans turned more to fishing and the gathering of plant foods for sustenance, and following this impetus, gardening and farming expanded.

Humans today derive most of their food from plants; indeed, over 90% of the vegetable food consumed in the modern world comes from about two dozen crops (see Table). Yet the range of plants known to and used by indigenous peoples is vast. At least 3,000 food species are in commercial cultivation, and this is the merest tip of the iceberg. Perhaps as many as 150,000 species of plants have been used by humans for food, fiber, and medicine.

Today's gardener, in whatever part of the world, stands on the shoulders of the ancestors. Identifying, testing, selecting, propagating, breeding, and conserving the agricultural heritage of humanity has been the work of countless millions of women and men for over ten millenia. And so the idea of granting scientists or the companies they work for patents because they shot this dandelion gene into that banana plant seems ludicrous. We might as well give over fares from the city bus to the vandals who sprayed it with grafitti and changed the route sign. Most of the crops we know today had already been domesticated more than 3,000 years ago. Of common vegetables, only the rutabaga originated in the modern era, and it is little more than a big, sweet turnip. Everything else, from avocados to zucchini, predates the founding of Rome.

Cultivated Ecologies and New Cuisines

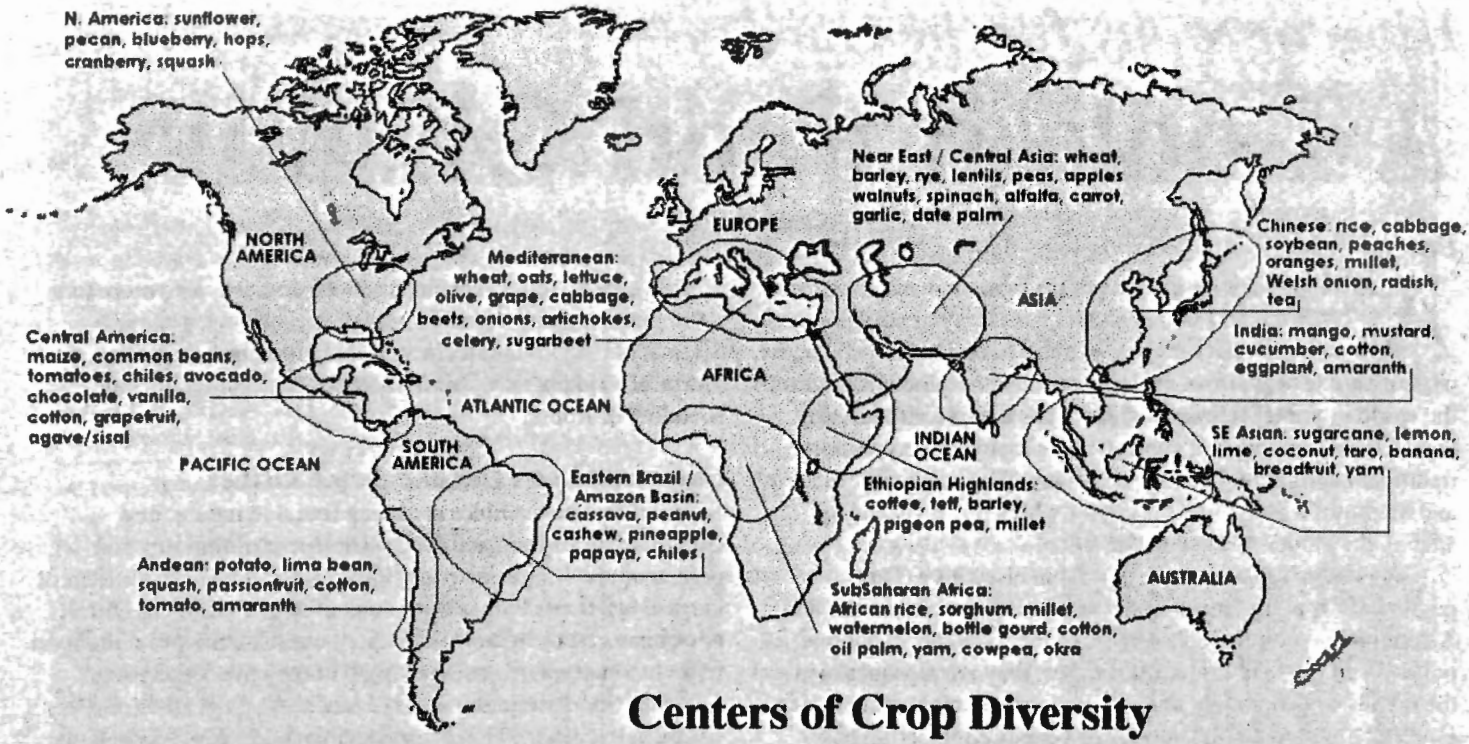
But if few new edibles are being found in nature, new combinations of food and food plants are proliferating, and permaculture designers are exploring at the edges of this field of knowledge. Some cuisines we think of as classic are but brash newcomers on the historical stage. We can't think of Italian food without tomatoes or Thai cooking without chilies and peanut sauce; the modern potato is the "French" fry. Yet all these American vegetables have travelled from the New World to the Old in less than 500 years. And the traffic hasn't been all one-way either. Apples have moved around the world from Central Asia, oranges from China. Modern cooks have mixed and interbred these cuisines even further. But at the root of all this culinary miscegenation is the same impulse: to garden more kinds of useful, beautiful, and interesting plants.

Learning to use plants was an urgent necessity for people in the late Neolithic. It remains a passion for permaculture designers and many gardeners today. But where we expect to have success based on how well we shop for plants or seeds and what we've done to amend our soils, our ancestors prospered according to the keeness of their observation skills, their intuition, and in large measure, the luck of where they happened to live. For the distribution of interesting and useful plants is not uniform around the world. And that dear friends, is a BIG truth.

Centers of Diversity

It turns out that most of the species of crop plants humans use today originated from wild plants that were (and are) found in seven or eight regions around the world. These centers of diversity were first analyzed in the 1920s by a Russian geneticist, Nikolai Vavilov, whose name has become synonymous with them.

The Vavilov centers, though widely separated geographically, are linked by similar ecological characteristics: they are mostly mountainous regions in the tropics or subtropics. Why this should be has everything to do with the principle of what permaculture calls "edge." Diversity in plants reflects diversity in the surrounding environment. Mountainous regions in the warm latitudes have a broad range of mild climates with many different solar aspects, rainfall regimes, and local soil conditions, all in close proximity. This diversity of microenvironments and microclimates reaches almost unbelievable extremes. Some steep Himalayan valleys support bananas on the south-aspected slopes



Centers of Crop Diversity

facing permanent snow fields on the opposite side. All mountain ranges offer a variety of niches to one degree or another, coupled with which, mountain soils are often richer in minerals than surrounding plains. This is because on a geologic scale mountains are always young, by definition: they are less eroded. Where these many varieties of plants come close together, whether in mountainous regions or along human trade routes, hybridization happens much more readily, and diversity flourishes.

Permaculture gardening aims to replicate in microcosm what nature created in the Vavilov centers: diverse microclimates providing niches for a large number of useful plants in a small space. Of course the wealth of these regions, though originally botanical, became, with the help of early farmer-scientists (!), horticultural. So we can hope our gardens too, become the basis for cultural work, for plant breeding, for the discovery of new and useful interactions between species, and for developing the multiple functions of familiar plants and animals.

Applied Biogeography

With this in mind, how can biogeography, which is the study of different plant/climate/soil communities and their distribution, be of use in the garden?

Firstly, it can help us sort the natives from the non-natives. In the U.S. and Canada only a handful of food plants of economic importance are native, though many more "wild" plants were used for food by aboriginal Americans. Among those native foods, the sunflower and its close cousin, the jerusalum artichoke, are familiar to most gardeners. Raspberries, blackberries, and berries in the heath family: blueberries and cranberries, are native, as are the black walnut and its relatives, butternut and pecan. There are native hazelnuts and persimmons, plus pawpaws, though these species have not become as important economically as the others. Squash, which originated in central America, had developed a secondary center of diversity in what is now the eastern U.S. The traditional Thanksgiving dinner, for all its questionable historical antecedents, is a ritual celebration of the continent's native bounty.

This is important, of course, for a variety of reasons, but largely because native plants have more interactions with microbes, insects, birds, and the inherently wild creatures of the larger landscape than do exotics. Whatever mix of plants we select for our gardens, it is essential to create a backbone of native plants to support beneficial insect and pest predator populations, to feed native pollinators, and to host native fungi and soil organisms.

Also, most of the native North American food crops have undergone much less selection than crops from the Old World and Latin America. There is room to develop better varieties of persimmon or pawpaw or to select for pest resistant butternuts.

Secondly, biogeography can help us sort out our gardens

The Bottom Line—Crops that Feed the World

Wheat	**Rice**	**Maize**	**Potatoes**	**Barley**	**Cassava**	**Oats**
Sorghum	**Soybean**	**Sugar Cane**	**Citrus**	**Sugar Beet**	**Beans & Peas**	**Rye**
Banana	**Tomato**	**Millets**	**Cottonseed**	**Sesame**	**Apples**	**Onions**
Mango	**Palm Oil**	**Peanut**	**Coconut**	**Olive**	**Sw. Potato & Yams**	**Grapes**

Vavilov Centers of Crop Diversity

Central American - maize, common beans, squash, tomatoes, chile peppers, avocado, chocolate, vanilla, cotton, agave/sisal, grapefruit.
Andean - potatoes, beans, lima beans, squash, passionfruit, cotton, tomato, amaranths.
Mediterranean - wheat, oats, lettuce, olive, grapes, cabbage, beets, onions, artichokes, celery, sugar beet.
Ethiopian highlands - coffee, teff, barley, pigeon pea, millets.
Central Asian/Near Eastern - wheat, barley, rye, lentils, peas, apples, walnuts, spinach, alfalfa, carrot, garlic, date palm, flax, plum, fig, pistachio, almond, apricot, cherry, pear, pomegranate, melon.
Chinese - rice, cabbage, soybean, peaches, oranges, millet, multiplier onions, radish, tea.
Southeast Asian - sugarcane, lemon/lime, coconut, taro, bananas, breadfruit, coconut, yams.

Other Centers of Plant Domestication:

India - mango, mustard, cucumber, cotton, eggplant, amaranth.
Sub-Saharan Africa - African rice, sorghum, millet, watermelon, bottle gourd, cotton, oil palm, yams, cowpeas, okra.
Eastern Brazil/Amazon Basin - cassava, peanut, cashew, pineapple, papaya, chile pepper.
North America - sunflowers, squash, blueberries, cranberries, pecans, hops.

seasonally.

Most cool weather crops have their origins in the Mediterranean, central Asia, or China: the cabbages, carrots, onions, lettuce, peas, radishes, leeks, beets, and spinach that make up our fall, winter, and spring harvests were first cultivated in cool, moist environments along the seacoast or in the mountain highlands of the Old World temperate zones. To improve our cold weather diet, we can look to these areas for a greater variety of hardy vegetables. Legumes for cool weather cover crop are mainly Old World plants, too: vetches, peas, broadbeans, and lupins.

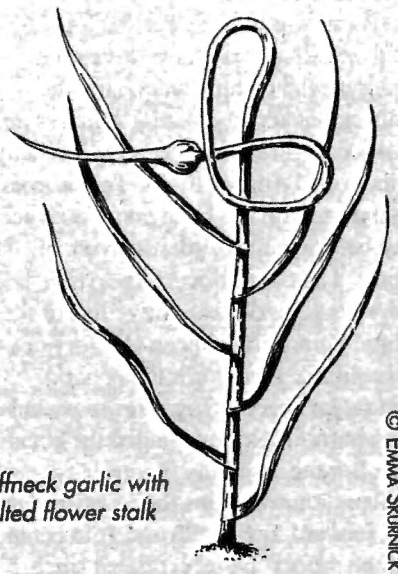
Our summer gardens, on the other hand, are a riot of African and American abundance. Sweet corn, beans, squash, tomatoes, peppers, watermelon, sweet potatoes, peanuts, and okra originated in the tropics and subtropics of the southern continents.

Thirdly, knowing the climatic patterns and environmental conditions of the region from which a crop originated (its ecology) can help us grow it more effectively. For instance, broccoli, which is an overwinter crop of the Mediterranean, is adapted to fall seeding and spring flowering. The root maggots that often attack spring broccoli transplants are there to help break down the mature stalks of a plant that has already gone to seed. When we insist on growing spring broccoli, we need to know we're working against the grain.

Though the mixing of plants from different regions has not always been beneficial, on the whole it has been a source of enormous wealth and productivity. The hunger of plant-impoverished Europe for the Indies, East and West, was in large part biological. Gold and silver may have driven the explorers and conquistadors, but the enduring legacy of colonial ventures and transoceanic trade has been the enrichment of the world's agricultures. The process of plant migration has been going on since long before humans got involved, of course. The ocean tides, winds, fish, birds, and other long-distance travellers of the animal kindom have been at it for eons and continue their work today. And humans had been doing it for thousands of years before Columbus sailed the ocean blue. But the assembly of new combinations of plants took a quantum leap forward in the 15th and 16th centuries and the process has accelerated since.

As gardeners we stand in a long tradition of horticultural science. As designers of cultivated ecologies, permaculturists are adapting the world's genetic heritage to millions of micro-environments, in villages, suburbs, and cities, which didn't exist a hundred years ago. This is a huge frontier of knowledge and the need for more thoughtful and creative observers is urgent. Δ

A Garlic Primer



Stiffneck garlic with bolted flower stalk

© Emma Skurnick

Orin Martin

The modern garlic, *Allium sativum*, is thought to have evolved from a wild species, *A. longicuspis*. It is native to south-central Asia in the steep ravines and mountains of the Tien Shan Plateau of northwestern China into southern Uzbekistan. But in fact, a broad area referred to as the "garlic crescent" runs from the Tien Shan Plateau across northern Afghanistan, Iran, the Southern Caucasus Mountains to the Turkish shores of the Black Sea, and is said to be the primary center of distribution for modern garlic. Garlic was spread across this region and beyond by both nomadic cultures and early trade routes in times before written history.

The Major Garlic Types

Human distribution coupled with climatic effects fostered the evolution of two groups or sub-species of garlic: *Allium sativum ophioscorodon* - the stiffneck garlic of northern continental Europe (harsh winters), and *Allium sativum sativum* - the softneck garlic of milder Mediterranean climates. Within the softneck group several distinctive garlics developed in the milder regions of China, Korea, and Japan. These are referred to as Turban and Asiatic types, and offer growers some of the earliest maturing of all garlics. They possess characteristics of both softneck and stiffneck and are highly recommended to kitchen gardeners and niche marketers alike.

Stiffneck or Ophio Garlic

This group or sub-species has a host of common names: stiffneck, topsetting, ophio, serpent, rocambole, etc. Stiffneck or ophio garlics are wilder than their softneck counterparts, and are probably quite similar to any number of the 150 species of wild garlic. While there are records of this type of garlic being in cultivation for 3,000-6,000 years, there is very little evidence that it has ever produced viable flowers and seed. Stiffneck garlics have a distinct set of characteristics that distinguish them from their more highly domesticated softneck relatives. They produce a solid stiff false flower stalk with a coiling seed stalk (see illustration) and tall, elongated symmetrical bulbs with a delicate paper tail at the top of each clove. Ophios have smaller bulbs, with a single layer of 6 -10 large, uniform cloves (sometimes as few as 3-5). Stiffnecks require more exacting cultural inputs, are less productive per area, have a shorter storage life (4-8 months), and most importantly, offer a wider range of distinctive, aromatic, highly flavored varieties.

Softneck Garlic

Sativum means domesticated or cultivated in Latin. Thus, this subspecies of garlic commonly referred to as softneck or artichoke garlic is highly domesticated (sativum sativum), thought to have evolved under cultivation from its wilder progenitors, the ophio or stiffneck garlics. As such the softnecks are more responsive to inputs of water and nutrients, and produce both bigger bulbs and greater yields per area than stiffnecks. Characteristics that differentiate soft- from stiffnecks include: larger leaves and a bigger plant with no false seed stalk, larger, heavier bulbs with a higher clove count (15-40), and a soft (braidable) neck. The bulbs are lumpy and not as highly colored or attractive as stiffnecks, the cloves more difficult to peel. Yields of softneck varieties are greater and their storage life longer—from 6-10 months, therefore, these are almost the only garlics used in commerce. They exhibit only minor varietal taste differences.

It is assumed that softnecks are superior for mild winter areas and stiffnecks for cold winter areas. But as a class, softneck garlics are better at adapting to cold weather than stiffnecks are at "crossing over" to mild winters.

Elephant Garlic

Elephant or great-headed garlic *Allium ampeloprasum* (formerly *porrum*), as it was once called, is botanically a leek. Big

Garlic Varieties

Stiffneck Garlics

There are several distinctive sub-groupings of stiffneck garlic based on the color, sheen, and shape of bulbs and cloves.

Rocamboles perform best at latitudes greater than 40°. In wet, mild winters they often bulb poorly if at all, or fail to form cloves. These are arguably the highest flavored of all garlics, peel most easily, and thus are preferred by cooks in the know. The plants are short and squat with broad, spreading leaves. The flower stalks make 1-3 tight coils (360°) and then resume vertical growth. Other varieties form coils that shoot off at random angles. The bulb wrappers are streaked light purple. The 6-11 plump, rounded cloves have high soluble solids, and are usually brown, often a rich mahogany with a purple splash. Rocamboles have the shortest storage life of all stiffnecks, 2-4 months, and mature midseason to late.

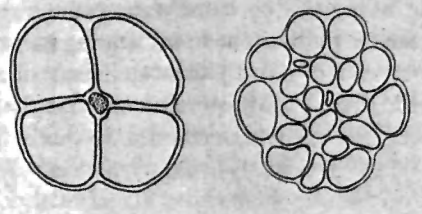
Varieties of note - Russian Red - Large, thick, nearly round bulbs with a copper hue and purple blotches. 8-12 cloves per bulb. The taste is fiery but quickly turns sweet and buttery. Spanish Roja - The standard when judging true garlic flavor. Cloves vary from teak to brown in color; bulb wrappers are purple streaked. Rich, spicy-flavored bulbs mature in midseason and store 4-6 months. May produce poorly in mild wet winter areas. German Red - Produces large bulbs with deep red color and 8-12 cloves. Fiery, spicy, rich garlic flavor. Does best in cold winter climates. Midseason maturity. Killarney Red - High yields, late maturation, one of the better Rocamboles for mild, wet winter areas. Similar in appearance to German Red and Spanish Roja. Sustained heat, rich garlicky-buttery aftertaste.

is the operative word: the plant itself is large, with a bulb exceeding 6" in diameter and weighing close to a pound, each containing 4-6 cloves which can reach 4" tall by 1" across.

While the plant's characteristics are strong, the taste of elephant garlic is mild. It can be used in quick stir-fry dishes, salad dressings (raw), and roasted whole. When roasted, it produces a large amount of a smooth-textured paste with very little garlic "zing." Compared to the more robust *Allium sativum*, elephant garlic is a bit like the taste of light beer.

Elephant garlic was first introduced into commerce by Nichols Garden Nursery in Albany, Oregon, which purchased stock from local Eastern European immigrant gardeners. Unlike stiff and softneck garlic, there is only one variety.

Elephant garlic should be spaced farther apart than true garlic, with 8"-10" between cloves. Crowding will adversely affect bulb size. It is much easier to grow than true garlic and is much more responsive to fertility inputs. Elephant garlic produces a seed stalk and sometimes fertile flowers and seeds. Production of a seed stalk indicates that the plant received an adequate winter chill (32-50°F.) for 6-8 weeks, and thus will produce a segmented bulb. Occasionally, elephant garlic fails to segment or produce cloves, resulting in an impressive, large, onion-like bulb. For biggest bulb size, the solid seed stalk should be removed. Often the bulbs will produce 6-10 small beige, thick-sheathed bulblets on the basal plate. These can be soaked in warm water until softened, then planted. Each will take two years to produce a full-sized bulb. Unlike the parent, these offsets have a fiery flavor. The bulbs mature early to mid-season.



Cross sections of stiffneck (left) and softneck garlics showing the clove arrangements

Garlic's Growing Cycle

In mild Mediterranean climates like that of Central California, garlic can be thought of as the "holiday plant." You plant it just prior to Thanksgiving, top dress, foliar feed or otherwise add supplemental nutrients on Valentine's Day and St. Patrick's Day, start to taper off watering on Memorial Day, and harvest around the Fourth of July. This catchy way of looking at the garlic cycle is not literally true across North America. Stiffnecks are planted a month earlier than softnecks, and in the north the goal is to establish root but not shoot growth before frost and snow, while fertilizing and harvest take place later in the cycle in areas with more severe winters. Still, the holiday reference can be a helpful guide in thinking about garlic's needs and its long, slow growth pattern.

Soil Preparation

Like most Allium species, garlic has a fibrous but non-branching root system. It is both superficial (4"-8" deep by 4"-8" wide) and inefficient at marshaling water and nutrients from the soil. This inefficiency, combined with a long growth cycle, means that growers must provide high fertility and supplemental feeding through all but the last part of its growth period. Because garlic often grows in the wettest part of the year, good drainage is essential. This requires a well-dressed raised bed with nutrients near the surface.

The garlic bulb is a modified leaf (as are all bulbing alliums—onions, shallots, etc.), thus it has a high nitrogen (N) requirement. Phosphorus (P) promotes root development and helps establish the plant early in its growth cycle. Potassium (K) is important for bulb development and food storage. One fertility option is a mixed compost made from horse manure with straw bedding (high K) and chicken manure (high N and P). The goal is to establish a large plant prior to bulbing—the bigger the plant, the bigger the resultant bulb at harvest.

Planting - September-November

Cracking bulbs and popping cloves is laborious but important. Sizing and sorting in the post-harvest phase will expedite this process. Gardeners often sort grades: the biggest bulbs for planting stock; the

More Garlic Varieties

Porcelain Group. With almost pure white bulb wrappers and a reflective sheen, Porcelains are eyecatching. Their tall, symmetric bulbs hold 5-8 plump, crescent-shaped cloves rivalling Elephant garlic in size, each with an elongated paper tail at the top. The clove skins are usually light brown to pink with some rose or red streaking. The cloves separate from the bulb and peel easily. The vigorous plants can reach 4-5 feet in height with the seed stalk extending up another 2-3 feet. These are the longest storing of all stiffneck types (5-8 months).

Varieties of note: Music - Indeed it is to the garlic lover's eyes and mouth! White-skinned with a pink blush and 5-6 large cloves per bulb. The highest yielding variety with a long storage life (7-9 months). A medium heat index sticks around in the back of the mouth. Georgian Crystal - Native to the Republic of Georgia. Large pure white satin bulb wrappers cover 5-6 light brown, red-streaked tall cloves that peel easily. Mild, almost sweet flavor, even raw. Georgian Fire - Very similar to Georgian Crystal except it has an arousing strong kick that shows off well in salsa.

Purple Striped and Marbled Group. These two very similar groups of ophio garlic show purple stripes on the bulb wrappers and a smooth satin sheen. The slender bulbs are not as tall as Porcelain types and contain 5-6 cloves, each with a distinctive paper tail. The taste of the purple stripes is moderately fiery at first but mellows quickly. This group roasts well.

Varieties of note: Chesnok Red - Large bulbs with 6-10 easy-to-peel cloves. One of the best roasting and cooking garlics as it holds its shape and flavor. White bulb wrappers with purple streaks. Stores 4-6 months. Performs best in northern climes. Red Rezan - Bulb color is a glazed purple with a hint of gold or copper and a satiny finish. Moderate storage (4-5 months). High flavor but not overwhelming. Purple Glazer - Similar to Red Rezan but with fatter cloves. Originally from the Republic of Georgia. Brown Tempest - Satiny bulb wrappers with faint, fine purple stripes. Light brown, rose-tinged cloves are short and plump. 6-9 cloves per bulb. 5-6 month storage. Fiery with a buttery aftertaste. Siberian - Perhaps the most outstanding of the purple stripe group. Large, white, purple-striped bulbs. 7-8 cloves are wrapped by light pink blush-red skins. Korean Red - An extremely large, tall bulb with intense red to almost black-red coloring. 4-8 cloves. The longest storing of stiffnecks (up to nine months). Hot, lingering taste.

Softneck Garlics

Artichoke Type. These have a lumpy, spreading bulb that vaguely resembles an artichoke flower.

Softneck Varieties continued...

Varieties of note: Inchellium Red - The best roasting of all garlics; 9-20 large, uniformly sized cloves; bulbs often greater than 3" in diameter. High soluble solids give it a denser, heavier feel and more edible portion than other garlics. Stores 6-9 months. A mild but lingering buttery taste. California Early and Calif. Late - The garlic of Gilroy and the California garlic industry (most of which is processed via dehydration). Very large, vigorous, and productive. Lumpy off-white bulbs with pink-tinged cloves. Tight bulb wrappers beget long (7-10 month) storage. Mild flavored, slightly sweet, tame taste. Many small unusable cloves in center of bulb. Machashi - Good-sized flat, uniform bulbs. Cloves often occur in a single layer and are thus user-friendly. Silky buttery aftertaste follows initial tongue-tingling fire. Simoneti - A large, uniform bulb with a rosy patina on bulb wrappers, with pink cloves. Very productive, with a mellow taste. Polish White or New York Polish - A monstrously big, uniform-shaped bulb; often the largest softneck type. Extremely cold hardy and does well in mild winter areas. Only 10-13 large cloves. Initially hot, but tones down quickly with a "sticks around" buttery sensation on the lips.

Creole Types. Genetically, these are softnecks that bolt early and appear stiffneck-like in their bulb and clove arrangement. They perform best in mild southern climates. Bulb wrappers are white, with distinctive red and purple clove skins. Harsh tasting when raw, these types are mild and sweet when cooked.

Varieties of note: Ajo Rojo - From Spain. Burgundy - A deep, solid burgundy, with 8-12 uniform cloves per bulb. Creole Red - Best tasting of its class. Spanish Morado - Intense purple clove color.

Silverskin Types. These softneck garlics are more demanding (á la stiffnecks) about climate conditions and soil fertility. Because of their silver-white exteriors, clean appearance and long, thin necks, they are excellent for braiding.

Varieties of note: Nichols Silverskin - The whitest of all silver skin types. Silver White - Highly productive in both coastal and hot interior climates, with a large bulb. Nootka Rose - From the San Juan Islands off the Olympic Peninsula. Five clove layers with up to 35 cloves, streaked red. Large bulbs with strong flavor.

Asiatic Types. While genetically softnecks, these unique garlics combine large bulbs with the single layer clove arrangement, false flower stalk, purple or marbled color, and plump cloves of stiffnecks. They generally mature a month before all but the turban types, (May 15-June 1 in central California), and must be harvested as soon as any leaves brown, or they will split apart.

Varieties of note: Asian Tempest - From South Korea. Large, finely striped bulbs with a purple blush and 5-7 big cloves. Produces well

Roasting Garlic

Arrange upright in a ceramic pan with a lid (or use foil). Remove the outer bulb wrappers from the top portion of the bulb and cut off the tip of the bulb (1/4-1/2"). Pour 1/4" of soupstock or olive oil marinade into the bottom of the pan. Drizzle the bulbs with olive oil, salt, and herbs. Cover tightly and bake at 375°F for about 30-45 minutes (depending on size and type of garlic). The roasted puree can be squeezed out onto grilled bread or crackers. Or it can be added to soups, sauces, or vegetable purees.

remainder of grades one and two for sales; the smallest size for processing and generic kitchen use.

It is important not to pop garlic cloves from the bulb until just prior to planting (one week at the most). An increase in oxygen at the basal plate (whence roots emerge) causes early root growth and can lead to rot if cloves are not in the ground. To the degree possible, the protective bulb and clove wrappers should be left intact. These wrappers have evolved to protect the cloves both in storage and in the ground. Any soft, injured, or diseased cloves should be discarded. Other things equal, the biggest bulbs will result from planting the biggest cloves from the biggest bulbs, and then big cloves from any bulb. The clove feeds carbohydrates into the emerging shoot tip and root growth, getting the new plant off to a vigorous start whatever the growing conditions.

Garlic cloves should be planted tip up, basal plate down, with the top of the bulb 1"-2" below the surface in mild climates and 2"-4" deep in cold weather areas. Garlic is a narrow-leafed monocot, and never really establishes enough leaf cover to protect the soil from the harsh influences of wind, rain, sun, freeze and thaw cycles. A light leaf litter or straw mulch can remedy this situation. Using a partially aged mulch of straw bedding from horse stalls allows rain to wash a manure "tea" into the root zone. Within rows, cloves can be spaced 4"-6" apart (stiffneck types), 6"-8" apart (softneck types), or 8"-10" apart (elephant garlic). Leave a minimum of 10"-12" between rows. Higher fertility levels allow for closer spacing without sacrificing bulb size at harvest.

Irrigation

After planting, soil moisture should be brought up to field capacity (a measure of how much water a soil can hold when saturated; field capacity occurs 2-3 days after a heavy rain or irrigation). Allow a good dry down to 50%-60% of field capacity before irrigating again. Prior to emergence, garlic cloves are prone to rot in overly wet soils. Once emergence has occurred (10-21 days in mild climates, 3-6 months in cold climates), soil moisture should be checked once or twice a week, and plants should be watered when the soil is dry 4"-8" deep.

Weeds

You can have garlic or you can have weeds, but not both. As a narrow-leafed, inefficient plant with restricted roots, garlic is a poor competitor with aggressive, broad-leaved weeds. Weeding is most effective before the seedlings get established, both above and below ground. It is important to control weeds all the way through harvest.

Bolting/Flowering

In late spring stiffneck garlics will send up a false flower stalk which should be cut just above the foliage. If left on the plant, it will reduce bulb size at harvest significantly (remember, stiffnecks already produce smaller bulbs than softnecks).

Pre-Harvest Care

Fertilizing garlic late in the season is virtually useless and can shorten storage life, as high nitrogen and water content make the bulbs prone to rot. During the last month of growth, the water needs of garlic decrease. Moisture is needed in the root zone, but detrimental near the bulb. The last irrigation is usually 2-3 weeks before harvest. In the latter stages of growth the plant will move nutrients from the leaves into the rapidly expanding bulb. As this starts to happen, the lower leaves will yellow and eventually senesce. Bulbs should be approaching harvest size, with

visible clove segmentation, when about a quarter of the foliage has senesced.

Harvest and Curing

Most softneck garlics are harvested when four or five green leaves remain on the plant. Some early stiffneck types and the Asiatic and Turban softnecks (described below) reach full bulb maturity even though all plant leaves are green or when only one or two lower leaves start to brown. Stiffnecks are generally harvested when five or six green leaves remain (a mature plant will have 12-15 leaves). If left in the ground past this stage the wrappers will decay and the bulbs will split open, making them prone to rot in the ground or early in storage.

Each green leaf on the plant represents an intact bulb wrapper at harvest and in storage. Inevitably, two to three wrappers will be destroyed in the harvest or after. Garlic stores best with a minimum of two intact bulb wrappers; with fewer than two, cloves can split apart, turn green from sunburn, and suffer the effects of dehydration or rot. Harvesting garlic slightly green or immature is safer than waiting until it's overmature. Good drying and curing conditions can compensate for a slight immaturity.

When ready for harvest, garlic bulbs should be pulled by hand or dug from the soil, depending on soil moisture and structure. In areas with little or no summer precipitation, garlic can be field cured. As the whole plants are pulled, they can be "shingled," that is, 6-10 plants can be laid out, with the bulbs of each bunch covered by the foliage of the next. This protects the bulbs from sunburn. Garlic stores longer and better if cured or dried with the whole plant intact. In areas with summer precipitation, garlic is best cured in an unused greenhouse or well-ventilated shed on wire screens. In humid areas, forced air aids drying. Curing can take as little as 5-10 days or as long as 3-4 weeks, depending on the maturity of the bulbs at harvest and subsequent environmental conditions.

Cleaning and Storage

Once the garlic bulbs have cured and lost sufficient moisture, the tops can be clipped to 1/2"-1". It is critical that the neck dry well to prevent rot. Note that overly long stems of stiffneck garlic cut at an angle can puncture surrounding bulbs in storage. Roots should be trimmed to 1/4"-1/2". Next, any soil should be gently brushed from the bulb wrapper and roots. Using either a toothbrush or a small fingernail scrubber, exert a gentle but quick stroke from top to bottom on the bulb. Try to keep as many bulb wrappers in place as possible, but peel off any that are broken. This usually entails removing one or two layers. The aim is undamaged, vibrantly clean bulbs with unbroken outer wrappers. After cleaning, cull damaged or misshapen bulbs and grade the remainder for size.

Fully cured, graded garlic can be stored in burlap or synthetic net bags. Synthetic material breathes better and harbors less

Garlic Varieties...

in wet, mild areas as well as cold ones. Rich, long-lasting flavor. Moderate keeper (4-6 mos.) Pyongyang - From North Korea. Bulbs have 6-8 cloves with a rose-purple blush and elongated paper tail. Very early harvest, poor keeper (3-5 months). Russian Red Streak - Big bulbs, firm and plump, with a very sharp initial taste and a heat that sticks around. Long storing (7 mos.). Japanese - 5-7 large tan/yellow cloves, similar in size and shape to elephant garlic.

Turban Types. Another cross-over type—technically a soft neck, but exhibiting the stiffneck characteristics: poor storage (3-4 months), bolting flower stalk, highly aromatic flavor, red and purple striping, and easy-to-peel cloves. As with the Asiatics, Turbans must be checked almost daily as they approach maturation and harvested at the first sign of any leaf senescence. These are the earliest-maturing of all garlics (May 1-15 in Central California).

Varieties of note: Dushambe - 8-11 bronze/mahogany cloves which separate and peel easily. Rich, buttery taste. Tzan - From China's Shandong province. Often grown and marketed as Mexican Red. Striped bulbs with a purple blush; 8-10 cloves in a single layer, ophio style. Xian - Similar to Tzan but earlier to mature. Chinese Purple - Early maturing (June 1); a pure white wrapper covers 7-10 brownish cloves with a purple splash. The mid-sized, tight bulb stores well (7-9 months) and has a fiery hot taste.

Softnecks, with higher soluble solids, are the garlics for roasting. Remember that distinctive varietal taste charac-teristics tend to be obscured by roasting. Garlic for roasting (stiff or soft) is at its pinnacle from just after harvest to about the time it would normally be planted in the fall. Then it starts to lose some of its sweetness and succulence, and develops a green shoot in the center. While usable thereafter, it loses its premier qualities as winter progresses. Δ

© Emma Skurnick

'Tzan' 'Georgian Fire' 'Dushambe' 'Creole Red' 'Asian Tempest'

mold and fungi. Garlic should be stored at low light levels, at temperatures above freezing and below 40°F, or at 50°-60°F with a relative humidity of less than 75%. Good air circulation between bulbs lengthens storage life. Remember, six months is considered long-term storage for stiffnecks, and 9-10 months for softnecks, so eat and sell your stiffnecks first.

Green Garlic

Green garlic is a marvelously broad concept. It entails harvesting, selling, and, best of all, consuming whole immature garlic plants. The cloves can be planted at 2" spacing and harvested from the bunching onion stage all the way through mature (but still green) plants with full-size, segmented bulbs. The flavor is generic (varietal characteristics express themselves during the curing stage), but because of the high water content, it is succulent and delicate—sweet and mild. Cooks clamoring for garlic after the winter stock has dwindled away or gone soft are eager to have it. By selling green garlic, growers can generate cash flow ($4-$7 per pound) early in the season.

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Stanley Crawford. *A Garlic Testament: Seasons on a Small New Mexico Farm.* New York: E. Burlingame Books, 1992.

Ron L. Engeland, *Growing Great Garlic.* Okanogan, WA: Filaree Prod'ns, 1991.

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'California Late' variety

Garlic "Seed" Sources

- Peaceful Valley Farm Supply, PO Box 2209, Grass Valley, CA 95945. (530) 272-4769, (888) 784-1722. <www.groworganic.com> 10-15 varieties.
- Johnny's Selected Seeds, Foss Hill Rd., Albion, ME 04910-9731. (207) 437-4301. <www.johnnyseeds.com> German X-tra Hardy, NY (Polish) White.
- Filaree Farms, 182 Concully Hwy., Okanagan, WA 98840. (509) 422-6940. Wide array of both softneck and stiffneck varieties.
- Irish Eyes with a Hint of Garlic (formerly Ronningers), PO Box 307, Ellensburg, WA 98926. Good selection of softnecks, stiffnecks and novelty alliums.
- Territorial Seed Company, PO Box 157, Cottage Grove, OR 97424. 20+ varieties.
- Nichols Garden Nursery, 1190 N. Pacific Hwy., Albany, OR 97321-4598. (503) 928-9280. High quality elephant garlic and the softneck variety Nichol's Silverskin.

Practicing Ethnoecology

Plants and Place

Michael Pilarski

At the southwest corner of the Olympic Peninsula, just below the Quinault Indian Reservation, the ocean's thunder never ceases. The heavy surf releases tremendous amounts of energy—shifting sand, nutrients, logs, and rocks. Here at the edge of the continent, the wind is strong and salty. The vegetation crowding down to the sea is shaped by the wind. Uniquely adapted to their environment, the plants of this windswept forest offer many insights to the careful observer, lessons a savvy permaculturist can apply to the design of cultivated landscapes.

This hardy plant community holds other treasures too, if we have eyes to see them.

Let's take a walk down the beach-

The structure of the forest is revealing. Sitka spruce *(Picea sitchensis)* is the main conifer, with shore pine *(Pinus contorta)* and western hemlock *(Tsuga heterophylla)* occupying sheltered areas. Alder *(Alnus)* and willow *(Salix)* are the tallest deciduous trees. Smaller decicuous trees and shrubs include twinberry honeysuckle *(Lonicera involucrata)*, native crabapple *(Malus fusca)*, red elderberry *(Sambucus racemosa)*, and salmonberry *(Rubus spectabilis)* in thickets. The lower shrub understory, largely evergreen, is dominated by evergreen huckleberry *(Vaccinium ovatum)* and salal *(Gaultheria shallon)*. These plants are both very useful from a human viewpoint and large amounts are harvested for the ornamental foliage industry.

Ground-story plants vary widely across the area, depending on the amount of available light. Sword fern *(Polysticum munitum)* and deer fern *(Blechnum spicata)* are common in some, but not all of the local ecosystems. Both of these ferns are harvested for the ornamental foliage trade as well. A common groundcover in open areas is the native beach strawberry, a beautiful plant with glossy evergreen leaves, pink flowers, and tasty berries. Ground-story plants are thinner in the forest and even in many of the shrub thickets. *Maianthemum dilatatum* predominates in the shady forest. In sunnier spots we find goldenrod *(Solidago)*, yarrow *(Achillea millefolium)*, butterbur *(Petasites frigidus)*, also known as western coltsfoot, and water parsnip *(Sium suave)*. All of these species have medicinal or multiple uses. There are more ground-story plants to be found here, but not in December...

What is happening to nutrients in this dynamic environment? The ocean edge is an incredible brew of nutrients, and some of it blows ashore. It rains a lot here and the rain brings nutrients down out of the atmosphere. There are at least four species of nitrogen-fixing flowering plants. Alders are the most common (and the largest). The Pacific wax-myrtle *(Myrica californica)* is a gorgeous evergreen shrub which deserves far greater use. There are also beach peas and at least one other pea specie.

The trees are covered with lichens,

which provide one of the major sources of nitrogen to this forest. Each tree species has certain relationships with particular lichens, mosses, and epiphytic plants. Usnea lichen, a medicinal antibiotic, is relatively common. Two species of licorice fern with medicinal rhizomes grow on the trees, *Polypodium glycyrrhiza* and *P. scouleri*. We even saw both species growing on the same tree. Food for the forest and medicine for us...hmmm.

From the beach you look up to steep bluffs broken by small stream canyons. To the average tourist it presents a beautiful pattern of windswept trees and shrubs. A wild forest. Nothing remotedly like a farm.

A cornucopia revealed

To a Quinault native who lived here 500 years ago and to me now, this "wild" bit of ground looks pretty promising. The plant communities in this area and products of the sea provided everything the humans of 500 years ago needed to survive. Even with my limited knowledge I note that 80% of the species I see have medicinal properties, 40% produce food. To my permaculture eyes it is an incredibly rich area. Many of its plants yield food and medicine I could use for subsistence or cash income. At the same time this plant assemblage is doing the incredibly important job of holding the land from sliding into the sea or from blowing away. Whatever I (the human) do here, it must not compromise this plant cover. Clearcut logging is totally out of the question, and even the most careful selective cutting should not happen on the foreshore. Some foliage clipping for ornamental brush or medicine might be acceptable with careful experimentation and monitoring. Berry and seed production are more acceptable forms of harvest, as long as trails and trampling do not compromise the windfastness of stands.

Putting humans into the landscape

Keeping in mind the permaculture ethics of Care for Earth and Care for people, could we use this Pacific beach seaside plant community without harming it? And if so, how might we do it?

Six strategies suggest themselves to me.

1. Leave it alone.

This may do no harm to the Earth here, but doesn't take care of people; and it requires that we use some land somewhere else to meet our needs. Will that other land be as bountiful? Will this land flourish without humans?

2. Restore it.

Extract nothing, but reduce the presence of non-native plants. In this place, the non-natives are still few, except for the beachgrass zone (which is dominated by a non-native grass). Foxglove *(Digitalis purpurea)* is observable in disturbed areas. Hand pulling could keep it from spreading. A bit of ivy *(Hedera helix)* and holly *(Ilex aquifolium)* were observed which could also be taken out.

3. Take only the natural surplus of the system.

Do careful harvesting of berries and seeds without compromising the vegetation. Huckleberry *(Vaccinium)* fruits are highly prized for food wherever they occur in the world. Fruits of red huckleberry and evergreen huckleberry are delicious and marketable. The local plant communities also have harvestable amounts of berries from salal and the native trailing blackberry *(Rubus ursinus)*.

4. Make small interventions to stimulate greater productivity in the system, concentrating on high value product, e.g., allow clipping harvest of "brush" or medicine.

Huckleberry twigs and leaves are an important herbal medicine and demand is increasing. The twig ends and leaves fetch a higher price for medicine than for ornamental foliage. Up until now, the vaccinium most used in the medicinal trade has been *V. myrtillus*, which is native to Europe and parts of Canada. The Northwest Vaccinium species are only now being tested for their medicinal constituents. Already we know that a number of Northwest Vacciniums are higher in active constituents than *V. myrtillus*. How *Vaccinium ovatum* and *V. parvifolium* will stack up to their relatives we do not yet know, but it is likely they have medicinal applications.

Clipping twigs might sound like a harmful thing to do to shrubs. However, native indigenous people and modern-day horticulturists like me, know that judicious pruning of shrubs causes them to grow denser foliage and produce more berries. Shrubs are adapted to browsing and pruning by animals in the wild. Pruning, clipping, or burning are common methods of shrub management to keep berry production up. Pruning can greatly increase yields of saleable foliage in a stand.

5. Manipulate the upper story.

The following suggestions in points 5 and 6 are only appropriate inland from the windward edge of the shoreline plant communities. Tree thinning can be practiced where ecological integrity will not be compromised. Thinning is not appropriate in foreshore stands.

Sustainable forestry practices of thinning can improve the quality of timber from a stand. Selective thinning of trees can also keep more light in the system. Understory foliage and berry production is dependent on the ratio of sun to shade. The optimal amount of sun or shade varies for different species. Therefore, understory crops will change depending on shade levels. Berry production needs close to full sun. But Sword fern and salal don't like full sun. Good foliage production and quality both go up with some shade. Too much shade and berry production goes down. Shadier yet, and foliage production falls off also. Dense shade stands can support some understory production from mushrooms, mosses, and shade tolerant medicinals.

6. We can use this plant community as a model for planting new systems on deforested land or on farmland.

We could use the same species in similar admixtures and amounts or we could change the relative proportions of the species to increase production potential of the system. We could, for instance, increase Pacific wax-myrtle in

the landscape to harvest for the herbal market. Perhaps wax-myrtle's nitrogen-fixing capabilities might make it a good interplant for boosting overstory tree growth. If we were planting this assemblage somewhere else, we could inoculate the trees with Usnea lichen, and plant licorice ferns on trees and appropriate rock faces, stumps, etc. In a sense this is a way of "farming" the overstory.

Indigenous people increase the amounts of favored plants in their environments. Native Americans did it before Europeans came to this continent. We can do it today. The plant species change from one place to the next, but these concepts and thought processes can be applied to all wild plant communities.

Here in this wild place on the Pacific Coast I am surrounded by abundance. If we can learn all the uses of the wild plants around us, we can reduce our need to clear land for farms. We can learn to live in harmony with the places we inhabit. We can surround ourselves with vigorous wild and semi-wild ecosystems. Like the indigenous people of long ago, we can learn to live from the resources in our area. We can reinhabit the land. It is a matter of time—and a matter of heart. The Earth asks that we live our lives as if we were going to live in this place for the next hundred generations. Δ

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Permaculture and Ethnobiology

Michael Pilarski

Permaculture is the science and art of designing and making ecologically sound human habitats. It addresses food, fiber, and natural resource production as well as architecture, energy, and social systems.

In addition to its sources in ecology, design, and modern science, Permaculture draws heavily on the historical and current agricultural and ecological practices of traditional peoples. We find that many traditional practices remain valid today. For example, permaculturists use systems of runoff agriculture developed by the Nabatean culture in the Sinai thousands of years ago. Michael Evanari and others in Israel have done much to make these ancient systems available for our use today. The chinampa systems of Lake Mexico in pre-Columbian times have been extensively copied by permaculture people around the world. The Maori people of New Zealand made compost on terraces and in pits, and this knowledge is being adapted by permaculture designers in other parts of the world.

I have been strongly involved in the organic agriculture movement since 1972 and I have studied and taught permaculture since 1981. I use and teach traditional agriculture techniques from Thailand, Peru, Botswana, Kenya, Java, and dozens of other countries. Books on ethnobotany, ethnoecology, and traditional agriculture have been common fare in my reading diet over the past 25 years. The cross cultural search for, and use of, traditional resource management techniques is a hallmark of permaculture inquiry and work around the world.

Something that sets permaculturists apart from many people who study ethnobotany and related disciplines, however, is that we put them into practice to create ecologically-sound, highly-productive ecosystems. We adapt traditional knowledge to modern challenges.

More than 20,000 people have completed the Permaculture Design Course. These graduates are at work in most countries of the world. Just as Bill Mollison, one of the co-founders of permaculture, worked extensively with the Pitjitjanjara and other aboriginal groups in Australia, hundreds of us work with indigenous peoples around the globe. We honor what they have to offer and they teach us. In return we teach them what we know and acquaint them with traditional practices from other cultures. In this way permaculture is a conduit for the movement of traditional knowledge between cultures. It is one of our ethics to help traditional peoples build and maintain their self-reliance and independence. Δ

From the Ethnobotany and Ethnoecology Resource Guide, *compiled by Michael Pilarski and Allison N. Lutz, and published by Friends of the Trees Society, Feb. 1999. Available for $14.95 plus shipping from Friends of the Trees, PO Box 4469, Bellingham, WA 98227. Friends of the Trees will send one free copy to any indigenous group that requests it.*

Eating in Season

Katúah Wild Forage Plants

Lee Barnes

Katúah is the Cherokee name for the southern Appalachian Mountains. This bioregion, covering parts of six southeastern states, is headwaters to many important rivers and is a "hotspot" of biological diversity in eastern North America. Most of the native species that are found east of the Mississippi and south of the Laurentian Shield are represented in Katúah, and so this list of plants has wide applicability.

Before eating any wild food, you should identify it properly and be sure that it is prepared so as to make it edible and non-poisonous. Also, be respectful of native populations. Do not take more leaves, mushrooms, roots, or seeds than the local patch can sustain. Ten percent is a good rule for leaves or roots, 25% for tubers, nuts, and seeds. Fruits may be harvested more heavily as most do not ripen all simultaneously, ensuring that some will be left for propagation and wildlife food.

Remember too, that wild populations cannot sustain the demands of commerce, with a few exceptions. The natural surpluses of healthy temperate forests occur as fungi and sugars. A modest trade in these items can be sustainable. However, forest herbs are being severely overharvested. Therefore, encourage all these natives on a portion of land that you steward; protect them as a resource. Get to know their cycles, their associated birds and animals, their seasons of flowering and seeding. These are truly gifts from the land.

Key to Part Used and Yield

Potato (P) - starch from root, tuber, or corm
Flour (Fl) - from dried/powdered roots, etc.
Fruit (Fr) - juicy fruit, drinks, teas, jams, etc.
Nuts/Seeds (N/S) - kernels/flour/oils
Greens (G) - require cooking to become edible
Salads (Sal) - raw leaves
Teas (T) - steeped leaves or roots

Plants are arranged by seasonal progression: first listed are those that yield some food throughout the year, followed by plants yielding in the late winter (syrups, hardy greens), spring (salads and greens), summer (greens, vegetables, and fruits), fall (fruits, nuts, and seeds), and lastly those plants offering foods (mostly tubers) through the cool seasons; many of these are aquatic. The list contains only two species of fungi, though many more may be found.

PLANT	SPRING	SUMMER	FALL	WINTER
Sassafras *Sassafras albidum*	tea	tea	tea	tea
Wintergreen *Gaultheria procumbens*	fruit/tea	tea	tea	fruit
Wild Onions *Allium stellatum*	salad	vegetable	vegetable	vegetable
Greenbrier *Smilax spp.*	shoots/flour	flour	flour	flour
Skunk Cabbage *Symplocarpus foetidus*	greens	flour	flour	flour
Solomon Seal *Polygonatum spp.*	P/Fl/shoots	P/Fl	P/Fl	P/Fl
White Waterlily *Nymphaea tuberosa*	potato/G	vegetable	seeds/potato	potato
Groundnut *Apios americana*	potato	potato	potato	potato
Maples *Acer spp.*	syrup			syrup
Cresses *Barbarea vulgaris*	salad			salad (late)
Chickweed *Stellaria spp*	greens			
Dandelion *Taraxacum officinale*	salad			
Morel *Morchella esculenta*	vegetable			
Pokeweed *Phytolacca americana*	greens			
Redbud *Cercis canadensis*	salads			
Violets *Viola spp.*	salads/teas			
Burdock *Arctium minus*	Sal/G/root		seed	
Curled Dock *Rumex crispus*	salad/greens		seed	
Basswood *Tilia americana*	salad	tea		
Blackberry/Brambles *Rubus spp.*	shoots	fruit/tea		
Day-lily *Hemerocallis fulva*	flour/potato	vegetable		
Jewelweeds *Impatiens spp.*	greens	greens		
Nettles *Urtica spp., Laportea sp.*	greens/tea	greens/tea		
Ramps *Allium tricoccum*	greens/bulb	salad		
Wood-Sorrel *Oxalis montana*	salad	salad		

more Katúah Wild Forage Plants...

PLANT	SPRING	SUMMER	FALL	WINTER
Kudzu *Pueraria lobata*	steamed shoots	greens		flour
Lambsquarters *Chenopodium album*	salad	greens	seed	
Wild Mustards *Brassica spp.*	salad	vegetable	seeds	
Elderberry *Sambucus canadensis*		fruit		
Juneberry *Amelanchier spp.*		fruit		
Mayapple *Podophyllum peltatum*		fruit		
Purslane *Portulaca oleracea*		salad		
Strawberries *Fragaria spp.*		fruit		
Blueberry *Vaccinium spp.*		fruit	fruit	
Passionflower *Passiflora incarnata*		fruit (late)	fruit	
Puffball *Calvatia gigantea*		vegetable	vegetable	
Sumac *Rhus spp.*		fruit	fruit	
Wild Grapes *Vitis spp.*		greens	fruit	
Beech *Fagus grandifolia*			nuts	
Butternut *Juglans cinerea*			nuts	
Hickory *Carya spp.*			nuts	
Chestnuts *Castanea spp*			nuts	
Chinquapin *Castanopsis pumila*			nuts	
Grasses			seed	
Hazelnut *Corylus americana*			flour/nuts/oil	
Honey Locust *Gleditsia triacanthos*			fruit/seeds	
Oaks *Quercus spp.*			flour/ seed	
Persimmon *Diospyros virginiana*			fruit	
Sunflower *Helianthus annuus*			Fl/S	
Walnut *Juglans nigra*			nuts/oil	
Wild Cherries *Prunus spp.*			fruit	
Wild Plums *Prunus spp.*			fruit	
Mountain Ash *Pyrus americana*			fruit	fruit
Arrowhead *Sagittaria latifolia, etc.*	potato		potato	potato
Bracken Fern *Pteridium aquilinum*	Sal/G/flour		flour	flour
Bulrush *Scirpus spp.*	flour/potato		seed/Fl/P	flour/P
Cattail *Typha latifolia*	potato		flour	flour
Evening Primrose *Oenethera biennis*	flour/Sal/greens		flour	flour
Jack-in-Pulpit *Arisaema artrorubens*	flour		flour	flour
Jerusalem Artichokes *H. tuberosus*	potato		potato/flour	potato
Nut-grass *Cyperus esculentus*	flour		flour	flour
Water Lotus *Nelumbo lutea*	P/Fl		P/Fl	P/Fl
Yellow Pond Lily *Nuphar spp.*	P/Fl		P/S/Fl	P/Fl

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Fiber Plants
for the Permaculture Landscape

Toby Hemenway

Fiber is all around us-and I mean that quite literally. In fact, we're usually enshrouded in at least two layers of fiber. We clothe ourselves in filaments from plants and animals, and then, for that majority of us who live in wood houses, we weave yet another layer of fiber around us for shelter. What is a stud-framed house but a large inverted basket of woven wood, sheathed in more wood to make it water- and weather-tight? Fiber, for us furless beasts, is the principal protection from the elements.

Yet we hardly notice the enormous role that fiber plays. Though we are doubly wrapped in fiber, it may as well be invisible. Fiber crops are among the last on the horticultural frontier to be folded into the home ecosystem. Even in permaculture landscapes we neglect plants for paper, rope, and cloth. The other uses we know well. We understand and promote the role of plants in creating and preserving habitat, soil, and climate. Herbs and roots for medicine and teas are likewise on the scene. And among the well-fed permaculture crowd, we, unlike our mainstream brethren, still nurture the art of growing and preparing food. But weaving, spinning, papermaking, basketry, and the other fiber skills once common to every household have largely vanished, shifted to machines and foreign workers. Our landscapes, in their paucity of specifically chosen fiber plants, reflect this change.

Cotton, Gossypium spp., *Malvaceae*

I've only recently understood the many values of fiber plants. A few months ago, while walking to a meal during a permaculture gathering, I passed tall, lanky Elias de Christo folded into a tight huddle with two young boys, all raptly engaged in some task. Earlier these two boys had been smashing a wasp's nest with rocks ("It was already broken, honest!") so I feared what Elias and they might be conspiring. The huddle opened, and the boys proudly showed me the rope Elias was teaching them to weave from sword fern stems. Suddenly a new realm opened before me. Fiber plants, besides holding potential delinquents at bay, are great instructional tools. Rick Valley, short on twine during a workshop, quickly wove red cedar bark fibers into the weight-string for an A-frame level. I've watched Jennifer Mishkin at Sandy Bar Ranch give workshops on making paper from plants and mushrooms. And during design courses, I now regularly see, along with the usual crew of knitters and tatters, participants plaiting and twisting wild fiber plants into twine and baskets. With a ready supply of fiber plants around the yard, idle hands can easily become productive and eager minds will grasp new skills.

Happily, most fiber plants are multifunctional, so even if you or a client have no immediate use for the strands themselves, the right plants will benefit the landscape and yield other products while silently waiting for your fiber consciousness to rise.

A prime example of a multifunctional fiber plant is milkweed. The stems of showy milkweed *(Asclepias speciosa)* and many others in this genus contain a long fiber for twine, cloth, and paper, with yields as high as hemp's and quality good as flax's. The silky floss from the seed pods provides padding and stuffing, and mops up oil spills. But the non-fiber uses of milkweed are legion. The plant is famous as habitat for butterflies and other insects. Its flower buds are delicious in salads, and when cooked the young shoots and leaves are edible. The young seed pods make a crunchy treat, and the seeds are tasty as well. Flower clusters can be boiled down to make a syrup. The stems bleed a latex that reportedly cures warts and can be dried into a chewable gum. The flowers and leaves yield a green dye.

Milkweed is only one of hundreds of multifunctional fiber plants. Others familiar to permaculturists are herbs such as nettle *(Urtica dioica)* and hop *(Humulus lupus)*, nitrogen fixing Sunn hemp *(Crotolaria juncea)* and kudzu *(Pueraria lobata)*, monocots such as agave and yucca, and even burdock, hollyhock, and okra. The reference table at the end of this article describes these and many more. Fiber plants have so many other uses that a clever designer might be able to use only fiber plants to sculpt a permaculture landscape that performs all the necessary functions of a good design.

How do we choose the right fiber plants for a landscape? We have an embarrassment of riches, so to weave our way through this many-specied wealth, we can cleave the long list into a few categories and select from those we're most likely to use. First, most plants produce their fibers in a particular part of their anatomy. Seed fibers, such as cotton, milkweed fluff, or kapok, are attached to seeds or inside seedpods. A second set of plants, the largest, are dicots that furnish soft fibers or bast from the

inner bark of the stems. This group contains the longest and generally most flexible, durable, and easily spun fibers, including jute, hemp, and flax. Next are leaf fiber plants—grasses and other monocots such as the agaves that yield sisal and henequen, and *Musa textilis*, a banana that is the source of abaca. These fibers, parallel bundles that run the length of the leaf, are best used for rope and twine. Wood fibers form the final major group. They are too short and brittle to be spun unless chemically processed into synthetics like rayon. Unlike most fibers, woody ones are at their best when left attached to the mass of cells with which they grow, to be used as whole stems-small ones for baskets, big ones for posts-or sawn into lumber.

Fiber plants can also be divided by function, shown in Table 1. These uses are also mentioned in the large reference table, and will help you pick the right multifunctional fiber plants.

Harvesting and Using Fiber Plants

I'll briefly describe the preparation of fiber plants for use to show that it doesn't require much technology. Those who actually want to use plant fibers should refer to the books in the bibliography, as my description is necessarily sketchy.

Fortunately for our multifunctional orientation, fibers can be collected after the plant has served other uses, whether as a crop, mulch, table flower, or wildlife fare. Dried stems left in the field are often the best source of bast fibers from nettles, milkweeds, and other non-woody herbs. Annuals should be harvested in late summer, when stems are thickest and most growth is finished. Woody fibers can be collected during pruning, from branches 3-9 feet long and 1/2-1 inch in diameter. Leaf fibers are best taken from plants two or more years old, as leaves should be 20 inches long or larger if possible. As with any plant, a hundred factors affect the fiber yield, including soil, temperature, irrigation, aspect, sunlight, and so on. Techniques for growing major fiber plants are well documented, but information is harder to find for cultivating the hundreds of non-commercial fiber plants, and you may have to carry out your own experiments.

Fiber yield also depends on processing. Most bast and leaf fibers require some low-tech preparation before they can be woven. For fibers like cedar bark and some other woody stem tissues, this can be as simple as whacking them with a mallet or rock until the fibers loosen. Rope, twine, and other crude cordage fibers often require no more preparation than this. But for spinning and fine papermaking, most fibers must be retted-soaked in water or a caustic solution until adjoining soft tissue rots away. This can be as simple as dumping a mass of stems on the ground to dew-compost for a few days or weeks until the durable fibers are released. Or retting may mean lowering the plant matter into a kettle of warm-to-boiling water or a hot lye solution for a few hours to several days.

Here's why retting is necessary. Plants are supreme sequesterers of carbon, performing their anti-global-warming magic by using sunlight to convert carbon dioxide and water into sugar. The plant then links these glucose molecules into chains to form cellulose. In fiber cells the cellulose chains are spun out in parallel bundles to create the cell walls. The bundles wrap around the cell in a spiral or helical pattern, layer upon layer, giving the cell an intrinsic twist. It is this inner helical pattern that makes fiber cells perfect for spinning: they inherently twist and lock around each other. Most fiber cells are short and must be connected into long bundles of cells to perform their role of supporting the plant. Gummy compounds called pectins—the same pectins that make jelly—bind the cells together. These bundles are what we know as fibers. Retting dissolves some of the pectins, releasing the fibers. But too much retting will rot the pectins that hold the fiber cells into bundles, leaving you with a slimy mass of loose cells. That's why easily controlled chemical retting is preferred over the traditional bacterial (dew-composting) method.

For crude fiber preparations—simple ropes and cords—only washing the fiber follows retting. Fibers for spinning need more processing. They are broken by pounding, rolling, or crushing to crumble any brittle woody cells that remain. The fibers are next beaten and scraped to remove the woody bits, a process called scutching. Hackling, or drawing the fibers across a set of vertical pins to separate and align them, is the final step before the line fibers, as the straightened bundles are called, are twisted into hanks and stored for spinning.

Fibers for papermaking follow a different process. Crude papers can be made simply by retting, mashing the fibers in water, and pouring the wet fiber mass onto a screen. But a more refined paper needs some care and artistry via the following steps. First, the retted, washed fiber is either simmered in an alkali solution for a few hours, or fermented in a milk or water solution for several weeks. This dissolves remaining woody particles. The damp fibers are rinsed, then placed on a slab and smacked with mallets or beaten in a blender or ball mill to create a slurry or pulp. This slurry is then poured onto a screen or into a mold, and the water drained off. The paper sheet forms as the thin layer of pulp dries. This process is used by paper artisans.

Many fiber plants can be used without processing for brooms, basketry, or, as Rick Valley points out, a quick garden tie. Meanwhile these same species will be performing a host of other tasks in the landscape: feeding wildlife, building soil, yielding medicine, and more. Put them in your designs, and they'll open new vistas of usefulness.

Table 1. Plant Fiber Categories by Use

Use	Examples
Textile Fibers	
Soft, or bast, fibers	Hemp, jute, flax
Seed and fruit fibers	Cotton, coir
Hard, or leaf fibers	Sisal, henequen, abacá, pineapple
Plaiting and weaving	Palms, grain stalks, papyrus, pandanus, bamboos, willows
Broom fibers	Palms, sorghum, broom
Stuffing fibers	Milkweed, kapok, cattails
Felting fibers	Paper mulberry, lace bark
Papermaking fibers	Milkweed, wood pulp, cabbage tree

Select Bibliography

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Toby Hemenway teaches and writes about permaculture design from Oakland, Oregon, and is at work on a book about permaculture gardens to be published soon by Chelsea Green.

Fiber Plants with Multiple Functions

Abbreviations: ed-edible; med-medicinal; N-fixer-nitrogen fixing plant; B&W-bird, insect, and wildlife habitat; pap-paper; cord-cordage; bask-basketry

Compiled by Toby Hemenway from material in the following: the Plants for a Future website (www.scs.leeds.ac.uk/pfaf/index.html); *Plant Fibers for Papermaking*, by Lilian A. Bell; *Handbook of Indian Foods and Fibers of Arid America*, by Walter Ebeling; and *A Weaver's Garden*, by Rita Buchanan. Several major commercial fiber crops (e.g., cotton) have been omitted because they are single function. The bamboos, important fiber plants, were omitted simply because there are as many species and uses of bamboo as among all the other plants combined, but don't you forget them!

Botanical Name	Common Name	Fiber Use	Other Functions
Abelmoschus esculentus	Okra	paper, cloth	ed, med, oil
Abelmoschus moschatus	Musk mallow	paper	ed, med, oil
Abies balsamea	Balsam fir	paper, cordage	ed, resin, timber, fuel
Abutilon theophrasti	China jute	paper, cordage	ed, med
Acer glabrum	Rock maple	paper, cordage	ed, timber, fuel
Acer macrophyllum	Big leaf maple	paper, cordage	ed, timber, fuel
Agave spp.	Agave	pap, cord, cloth, thatch	ed, med, needles, soap, soil stab.
Althaea officinalis	Marsh mallow	paper	ed, med, adhesive, oil
Ammophila arenaria	European beachgrass	cloth, bask, paper, thatch	soil stabilization
Apocynum androsaemifolium	Spreading dogbane	cloth	med, latex
Apocynum cannabinum	Indian hemp	cloth	med, latex
Araujia sericifera	Cruel plant	cloth	ed, B&W
Arctium minus	Burdock	cloth, paper	ed, med, B&W
Artemisia tridentata	Sagebrush	basketry, paper, dye	ed, med, fuel, repellent
Asclepias spp.	Milkweed	paper, cordage, dye, stuffing, cloth	ed, med, oil,
Asimina triloba	Pawpaw	cordage, dye	ed, med, timber
Avena spp.	Oats	paper, thatch, stuffing	ed, mulch, cosmetic
Betula spp.	Birch	paper, cordage, cloth thatch, dye, brooms	ed, med, charcoal, fuel, timber,
Boehmeria nivea	Ramie	cloth, paper	ed, med
Brachychiton populneus	Kurrajong	cordage	ed
Broussonetia papyrifera	Paper mulberry	paper, cloth	ed, med, timber
Canna indica	Indian shot	paper, cordage, dye	ed, med
Cannabis sativa	Hemp	cloth, paper	ed, med, oil, B&W
Caragana arborescens	Siberian pea shrub	cordage, dye	ed, N-fixer, oil, B&W
Chamaecyparis nootkatensis	Alaska yellow cedar	cordage, cloth	med, timber,
Chlorogalum pomeridianum	Soap lily	brushes, stuffing	ed, med, soap
Clematis ligusticifolia	White clematis	cordage, stuffing	med, shampoo
Corchorus capsularis	Jute	cordage, cloth, paper	ed, med
Cordyline australis	Cabbage tree	cordage, cloth, thatch, basketry, paper	ed, sweetener
Cornus sericea	Red osier dogwood	cordage, basketry, dye	med, oil, B&W
Corylus cornuta californica	California hazel	paper	ed, B&W

Botanical Name	Common Name	Fiber Use	Other Functions
Cytisus scoparius	Broom	cloth, basketry, paper, cordage, brooms, dye	ed, med, N-fixer, B&W, wood
Desmodium elegans	—	cordage, paper	med, N-fixer, fuel
Dianella spp.	Flax lily	cloth, cordage	ed
Elaeagnus commutata	Silverberry	cloth, cordage	ed, med, soap, N-fixer
Elymus arenarius	Lyme grass	cloth, cordage, paper	ed, soil stab.,
Epilobium angustifolium	Willow herb	cordage, stuffing	ed, med, B&W
Firmiana simplex	Chinese parasol tree	cloth, cordage	ed, med, shampoo
Genista tinctoria	Dyer's greenweed	cloth, cordage, paper, dye	ed, med, B&W, N-fixer
Girardiana platyphylla	—	cloth, cordage	ed, med
Glycyrrhiza glabra	Licorice	paper, stuffing	ed, med, N-fixer
Helianthus annuus	Sunflower	cloth, cordage, paper, dye	ed, med, mulch, B&W
Hibiscus cannabinus	Kenaf	cloth, cordage, paper	ed, med, oil
Hordeum spp.	Barley	paper	ed, mulch, fuel
Humulus lupulus	Hop	cloth, cordage, paper	ed, med, oil, B&W
Iris spp.	Iris	cordage, paper, basketry	med
Juniperus spp.	Juniper	cordage	ed, med, timber, fuel
Laportea canadensis	Canadian wood nettle	cloth, cordage	ed, med
Larix laricina	Tamarack	cordage	ed, med, resin, timber, fuel
Lavatera spp.	Lavatera	cordage, paper	ed, ornamental
Linum spp.	Flax	cloth, cordage, paper	ed, med, gum, oil
Lomandra longifolia	Longleaf mat-rush	cloth, basketry	ed
Lonicera spp.	Honeysuckle	cloth, cordage	ed, B&W
Lupinus spp.	Lupine	cloth, paper	ed, med, N-fixer
Malva spp.	Mallow	cloth, cordage, paper, dye	ed, med
Morus spp.	Mulberry	cloth, cordage, paper, dye	ed, med, timber, fuel, B&W
Phormium tenax	New Zealand flax	cloth, cord, pap, dye, bask	ed, glue, gum
Phragmites australis	Common reed	cloth, paper, thatch, basketry	ed, med, fuel, insulation, soil stab.
Plantago lanceolata	English plantain	cloth, dye	ed, med
Psoralea macrostachya	Large leather root	cordage, cloth, dye	ed, N-fixer
Pueraria lobata	Kudzu vine	cloth, paper	ed, med, N-fixer, soil stab.
Ricinus communis	Castor-oil plant	cordage	med, oil, repellent
Robinia pseudoacacia	Black locust	cloth, cordage, paper	ed, med, B&W, N-fixer, fuel, timb.
Rubus spp	Blackberry	cordage, dye	ed, med, B&W
Sabal spp.	Palmetto	cloth, cordage, paper, basketry, thatch	ed
Salix spp.	Willow	cordage, basketry	med, B&W, fuel
Sesbania macrocarpa	Sesbania	cordage	N-fixer, mulch
Spartium junceum	Spanish broom	cloth, cord, paper, brooms, dye	med, N-fixer, B&W
Stachys sylvatica	Hedge woundwort	cordage, dye	med, B&W
Taxodium distichum	Swamp cypress	cordage	resin, timber, fuel
Thuja plicata	Western red cedar	cloth, cordage, paper, dye	med, timber, fuel,
Tilia spp	Basswood, Lime	cloth, cordage, paper	ed, med, B&W, charcoal, timber
Trachycarpus fortunei	Chusan palm	cloth, cordage	ed, med
Typha spp.	Cattail	cloth, cord, paper, thatch	ed, med, B&W, soil stab.
Urtica spp.	Nettle	cloth, cordage, paper	ed, med, mulch, oil
Veratrum viride	False hellebore	cloth, cordage	med, insecticide, cleanser
Vicia faba major	Broad bean	paper	ed, soap
Washingtonia filifera	Desert fan palm	cordage, basketry	ed, carving
Wisteria floribunda	Japanese wisteria	cordage	ed, N-fixer
Xerophyllum tenax	Indian basket grass	cordage, basketry	ed
Yucca spp.	Spanish bayonet	cloth, cordage, basketry	ed, soap

Bamboo in the 21st Century

Adam Turtle, F.L.S. and Susanne E. Turtle

In the last 50 years or so, there have begun to appear widespread concerns about the resource base that might be available to future generations, and about the integrity of ecosystems—which we are beginning to understand as completely interconnected. There is increasing awareness of both our current total dependence on fossil fuels and the knowledge that supplies of these are finite. There is a gradual awakening regarding our profligate use of fossil water, also finite. Ditto a dozen or more particular factors.

Unfortunately, this growing awareness has not yet been translated into significant reductions in the consumption of resources. Modern Americans are accustomed to a very high level of material comfort and whim gratification, which has been achieved as the last stop (before the landfill) for material resources in a linear and predatory worldview. Mollison and others have adequately informed us that we cannot continue wholesale short cycle consumption of long cycle resources.

What does all that have to do with Bamboo?

Bamboo is one of (if not the) most abundant producers of short-cycle, high quality woody material—material that also possesses unique characteristics of fiber and natural form. And, people have used Bamboo sustainably for thousands of years. This culturally important and prolific tree grass has been made into everything from food and food wrapping to housing and house furnishings, from paper and even cloth (rayon) to plumbing. It has been instrumental in the rise of entire civilizations and has even been venerated as a spiritual force. For four primary reasons, Bamboo today has great potential to address the needs of a planet with an increasing human population and diminishing natural resources.

Why Bamboo?

The appeal of Bamboo is as great today as when prehistoric humans began using it. First, it is widely available: Bamboo is found naturally on every continent except Europe (at least in post Pangaean times). Second, it is easy to work with. Third, the plant regenerates quickly after harvest, and as a perennial it does not need replanting. And fourth, its characteristics of tremendous strength-to-weight ratio, unique form, fiber, and even chemical attributes give it an unmatched versatility.

For these reasons the use of Bamboo has persisted in most tropical and developing countries—the so-called Third World—in spite the increasing influence of industrial products from Europe and America. Now, as our plague of overconsumption is depleting so many long-cycle resources, it may be time to avail ourselves of older traditions with their wisdom of reliance on short regeneration cycle materials of local origin. Many readers will already be aware of some of the (mostly Oriental) traditional uses of Bamboo. You may not know that Africa and South America also have long and diverse Bamboo traditions. There are over a thousand catalogued low-tech or traditional uses of Bamboo from the rough-and-ready to the aesthetically refined, from the simple and direct to the intricate and complex.

High-tech applications have only recently been investigated, but Bamboo's unique chemical and physical structure holds tremendous promise of relieving various long-cycle materials shortfalls, allowing it to replace or reduce the quantity needed not only of timber but also in some cases of coal, mild steel, and even carbon fibers. So far modern high-tech applications include hot-formed Bamboo ply (for truck bodies), Laminated Bamboo Lumber (LBL) and Oriented Strand Board (OSB), utility poles (multiple whole canes encapsulated in recycled plastic), a promising substitute for expensive carbon fibers, non-tree paper, a re-bar substitute, biomass for power generation, and more.

Direct uses of the canes, shoots, and leaves range from airplane and high-rise apartment skeletons (especially in seismically active regions) to cable bridges to food wrapping (leaves and shoots have antioxidizing properties), from toothpicks to rural plumbing (imagine growing your own pipes as is being done in cash-poor parts of Africa!). There are more uses than can be listed here.

Even the unharvested living plant can make numerous contributions in local ecologies ranging from wildlife habitat to noise and dust abatement to erosion control, plus it is an ideal cover for ground water recharge areas. Bamboo's unique

beauty and the tranquility it induces can be appreciated in almost any setting.

Ecology and Cultivation

In the broad sense Bamboos are ancient members of the grass family dating back to the Miocene Era. The woody temperate Bamboos (the ones of most use to us in North America) are the most recently evolved—only a few million years old. Anthropological evidence indicates that Bamboo has been in service to people for over 5,000 years! Western botanists first took notice of Bamboo when the Englishman Walter formally described our native Bamboo (*Arundinaria gigantea* aka River Cane) in 1788. Since then over 1200 species have been described and assigned to more than 80 genera. Geographically Bamboos range from 50°N latitude on Sakhalin Island to 47°S on the slopes of the Andes in southern Chile. They can be found from sea level to elevations over 12,000 feet (3600m) in the equatorial highlands. In the U.S. native Bamboo grows from the Atlantic west into central Oklahoma and Texas and from the Gulf coast to just north of the Ohio River.

Most of the thousand-plus species of Bamboos are, of course, tropical; however, about 300 are suitable for warm temperate zone culture in North America. Of these, about 50 species, mostly in the genus *Phyllostachys*, are hardy tree types which can be grown in USDA zones 7-10. There are a handful that will do well even in zone 6 where winter lows reach -10°F. Species selected for ornament, erosion control, screening, shoots, animal fodder, paper, and light uses like basketry can even be grown in zone 5!

Of these hardy tree Bamboos most are rather forgiving of soil type, pH, and fertility (exception: wet = no, no). That is, they will live in a lot of conditions. But Bamboo, being a grass, is very responsive to cultural influences. Ideal conditions (as for so many plant groups) would be—a moist, well-drained soil of good tilth and a high organic matter content with a pH around 6 and a plentiful supply of both macro and micro nutrients. If you want to maximize size, quality, and quantity—treat it good!

The big hardy Bamboos are all runners, which needs to be considered when placing them. They need an area of ground with a diameter at least equal to their potential height, 30-70' depending on species. Growth habits are too complex for this brief article, as are details of harvest, curing, etc. Even with ideal culture you are eight to ten years from the first harvest of big, high-quality wood. After that you'll get an annual yield of the oldest one-sixth of the standing canes. Younger canes can be harvested for basketry and other light uses, shoots for food, etc.

A Future in Bamboo

While you are tending your Bamboo grove and waiting for your premium poles to achieve harvestable size and quality, you could still purchase poles and start learning joinery techniques and the insights of design. As you become more knowledgeable and accomplished, you'll open up an entire new world of possibilities limited only by your imagination and abilities.

The optimum use, of course, is home use—ain't it so with everything—but if and to the extent your work is of high quality or fills an unsatisfied niche, you'll find a ready market in either local barter or the cash economy. Right now there is very little domestic competition. Those who are good artisans of Bamboo can't finish work fast enough. Of course that will change, and has already changed somewhat, as more people enter the field. But home use—made it myself, grew it too—now there's the thing! A grove of versatile raw materials outside the door—or maybe shading the west side of the house, or...

So join the American Bamboo Society, subscribe to *Temperate Bamboo Quarterly*, get a few Bamboo plants, take a course. Each of these steps is progress on the road to more localized self-reliance and a Perma-Culture.

Bibliography

The Book of Bamboo. David Farrelly. Sierra Club, 1984. The One Bamboo Book.

Building Bamboo Fences. Isao Yoshikawa. Graphic-sha, 1998. Excellent step-by-step illustrations.

The Bamboos. F.A. McClure. Smithsonian Press, 1993. Best scientific Bamboo book.

continued, page 52

Some readily available hardy evergreen Bamboos with useful qualities:

Name	Max. size	Hardiness	Features
Arundinaria gigantea River Cane	20'x 1"	-25°F	Not the biggest, but the hardiest—and it is native.
Phyllostachysaurea aka Fishpole Bamboo	35'x 2"	0°F	Very decorative, hard, high-quality wood.
P. aureosulcata Yellow Groove Bamboo	40'x 2"	-10°F	Beautiful, tough, widely available.
P. bambusoides Japanese Timber Bamboo	70'x 5"	5°F	One of the best for shoots, wood.
P. dulcis Sweet Shoot Bamboo	40'x 3"	0°F	Mainly for shoots, also useful, medium-hard wood.
P. edulis Moso Bamboo	75'x 7"	-5°F	Most planted Bamboo; for shoots, wood, beauty.
P. nigra Black Bamboo	30'x 2"	0°F	Great for landscaping; expensive, high quality wood.
P. nigra 'Henon'	65'x2"	-5°F	Excellent, medium-sized poles.
P. nuda	35'x2"	-20°F	Beautiful dark canes, hardiest.

Bamboo Furniture Workshop

Adam Turtle

Last May Earth Advocates Research Farm hosted its second annual Bamboo Furniture Making Short Course led by Nicanor Non, a Philippine master now living in Minnesota. I had the pleasure of assisting him as we presented basic theory and application to eight students from across the United States and as far away as Brazil.

As we had a year earlier, we set out to build some background for the participants, who ranged in age from early twenties to mid-sixties and came from all walks of life. We wanted everyone to understand the structural nature of the Bamboo culm and to grasp the safe handling of tools before we began making first the basic joints, then some bamboo furniture.

Though Sue and I and Nico had hoped for a larger group, the small class size was great for the students. They enjoyed more space per person in our still snug and basic facilities, and we were able to move through the material faster and cover more ground than we had expected in four days.

With Sue and talented cook Lori Ann Asmus from California on tap for meals (and prepared for 20 persons), we ate well throughout the event. The group gained more than few pounds!

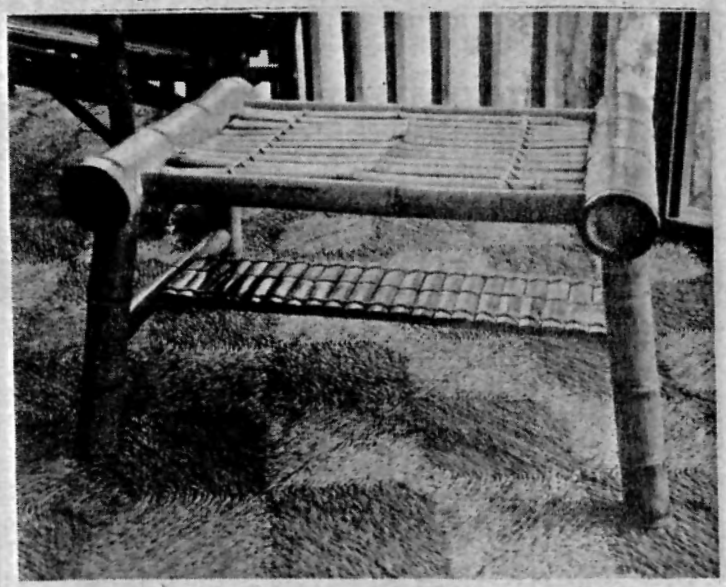
Following Monday night's opening supper and introductions, we assembled early Tuesday morning in the workshop with our tools and notebooks. Nico brought with him a 10-inch long scale model of a Bamboo loveseat he had made during the previous winter. He used this to discuss the types of basic joints, construction details, and principles. Typical of the style he both practices and teaches, the joints were so carefully and tightly made that no lashing had been needed to keep the piece firm—nor to conceal careless or hurried workmanship.

Nico demonstrated the procedure for making each type of joint. The participants then tried their hands at the "pipe" joint and "bird mouth" (also known as "fish mouth" or "saddle") joint. (See *Temperate Bamboo Quarterly*, Vol. III, 3&4 for detailed and illustrated step-by-step instructions on these two basic joints).

When folks had gotten a fair grounding in principles and procedures, and had honed the needed skills, they were each asked to design a first project. These were critiqued and discussed before any work on them began. Nico and I coached and kibitzed and generally tried to help each participant become a safe and proficient artisan. We corrected subtleties of technique and suggested easier or more effective approaches, etc. From time to time we would stop all individual work to discuss or demonstrate or sometimes just to call attention to a point of relevance to everyone. This went on for four full days. Evenings we met in the classroom for slides, videos, and more discussion. On the last night we shared another great meal, presented certificates, and said fond farewells.

Nico and I both felt the class went very well. The projects undertaken were fairly ambitious, as evidenced by the accompanying pictures, and the competence level achieved by the students was gratifying. Several participants have since then sent us photos of the pieces they began during the course and finished at home.

The Third Annual Bamboo Furniture Making course will be held May 15-19 and we have added two other Bamboo craft workshops to our schedule for 2000, one on basket making and another on bamboo implements for the home and garden. If we have enough early interest we will consider adding a six-day advanced Bamboo construction course. Come join us, its fun! Δ



Upper left, Albert Bates with A-frame level; lower left, Nico critiques plant stand made solely with pipe joints; upper right, Don Eicharundertook alow table during the workshop, but finished it later at home (above). Photo credits Sue Turtle.

Bamboo in the 21st Century, cont'd from pg. 50...

Bamboo and Cane Crafts of Northern India. Ranjan, Iyer & Pandya. Government of India, 1986. Hard to find but super.

Resources

- American Bamboo Society (ABS), 750 Krumkill Road, Albany, NY 12203-5976. Membership $35/year includes National plus one of 12 regional chapters; six newsletters plus annual journal and source list.
- *Temperate Bamboo Quarterly*, 30 Myers Road, Summertown, TN 38483-7323 Subscription $28/volume, back issues available.
- Earth Advocates Research Farm, same address as *TBQ*. Tel. 931-964-4151. Workshops, speakers, research.
- *The Permaculture Activist* No. 41, May 1999, "Building With Bamboo" by Darrel DeBoer, pp. 39-41. Δ

Coming from a non-academic background in ethnobotanical research, Adam Turtle, recently named a Fellow of the Linnaean Society, has been involved with Bamboo for 21 years and with Permaculture for 19 years. Adam and Sue Turtle own and operate 'Our' Bamboo Nursery, specializing in landscape-grade B&B Bamboo with over 200 species and forms available. They also publish the illustrated journal Temperate Bamboo Quarterly, *operate Earth Advocates Research Farm near Summertown, Tennessee, and are active in a number of related organizations. They speak, write, and consult, and serve on several committees to organize the ABS Annual Meeting at Zoo Atlanta in October.*

RESOURCES

Carbohydrate Economy Bulletin Published on the Web

The Carbohydrate Economy Bulletin reports on the growth of a new industry based on plant matter-derived industrial products, and on the growth of farmer-owned manufacturing enterprises. The Bulletin contains news on new technologies, policies, products, and businesses involved in this rapidly emerging industrial sector. The inaugural issue of the e-bulletin offered stories on ethanol-based aviation fuel, industry specifications for biodiesel, the use of biocomposite panels in auto manufacturing, a report on the planting of industrial hemp in Hawaii, a new venture in fiberboard from flax and polypropylene, coverage of recent legislation affecting fiber and oil crops, and news of farmer-owned manufacturing cooperatives.

The Bulletin is published by the Institute for Local Self-Reliance (ILSR), a 25-year old non-profit research and educational organization which promotes economic development that minimizes environmental damage and maximizes benefits to the host community. In addition to publishing the Bulletin, ILSR maintains a database of over 200 plant matter-based product manufacturers, news headlines, reports and events, at its Carbohydrate Economy Clearinghouse web site at http://www.carbohydrateeconomy.org

Subscriptions to the Carbohydrate Economy newsletter may be requested by emailing kmullen@ilsr.org, while comments, questions, news submissions, and requests to be added or removed from the email list should be sent to Jessica Nelson at jnelson@ilsr.org. Δ

Bamboo and Black Locust

Growing Fiber for Fences

Rick Valley

I planted my first bamboo nursery plot in 1982. I was filling my head with fresh info on how bamboo is traditionally grown and used in Japan; since bamboo poles do not last long in ground contact, Japanese redwood *(Cryptomeria japonica)* is commonly used for the posts. I found another tidbit to the effect that bamboo grown among trees was straighter with a longer distance between joints. Plus there was the idea that bamboo, a grass, loves nitrogen. So I thought posts made from rot-resistant Black Locust *(Robinia pseudoacacia)* would be an ideal complement to bamboo poles for construction of fences and arbors. Of course black locust is a nitrogen-fixing legume, and the combination made this species my first choice for planting with bamboo in that early plot. I now know that it works.

I began harvesting locust posts eight years after planting the tiny seedlings. Eighteen years later, one tree is now 50' tall and 18" dbh; the trees that grew faster had to be taken out earlier, so the bamboo did not get too much shade. I have seen little evidence of nitrogen deficiency in these bamboos grown with the locust. Black locust does not cast a deep shade; I have had to do less management pruning with locust than with other trees I have grown with bamboo. Of course if you are trying to minimize side branches to keep sky open for bamboo, you are also grooming a better tree for making posts.

I originally tried chipping the branches trimmed off the locust to provide for more rapid break-down. My garden-scale chipper was not up to the task; locust branches are hard and I bled too much from the thorns. In early years I did notice un-chipped branches causing some discomfort as I worked the bamboo. Now, however, it is much less a problem. I theorize that I have "built up" the soil to the point where the fungal population digests summer prunings more quickly. Instead of chipping I simply chop branches that are too small for firewood into pieces small enough to lie flat in the mulch layer. My tool of choice for this is the *ebinata*, or Japanese firewood hatchet, somewhat akin to an English billhook. For trimming branches on the locust I have an assortment of pole saws.

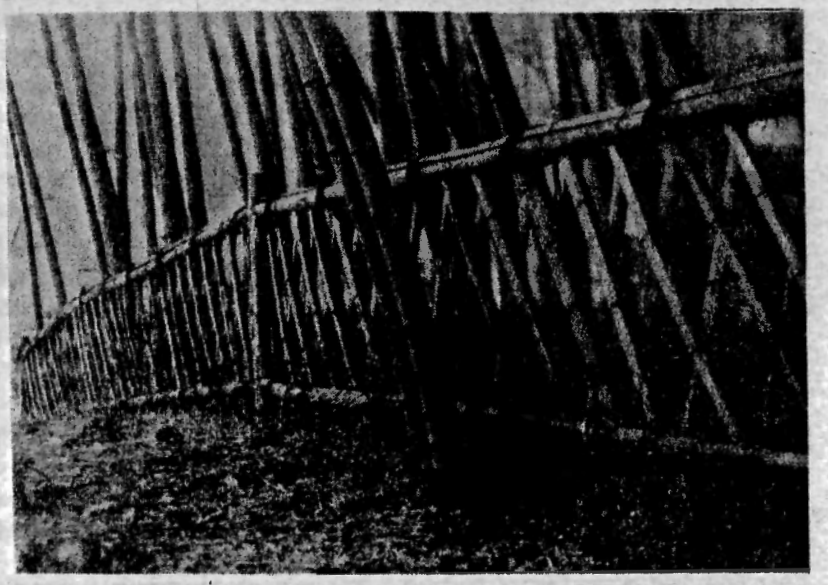
Any digging of the bamboo (for shoots or divisions) may cut the locust roots and cause suckers to grow up at those points. In my experience, this is no problem; only those suckers that grow in an opening in the bamboo canopy will be successful at growing up into new trees. In fact, I now choose which locust suckers to encourage. My nursery plot has fewer trees now than when I first planted the locusts. New locust trees that have grown from root suckers are mostly on the outer margin of the bamboo grove. I have also transplanted locust suckers to other locations.

When it comes time to cut down a Locust in the grove, I first do a normal thinning of the bamboo in the area where the limbs and trunk will drop. This gets all the marketable poles out of the way. I top the rest of the bamboo canes; with the upper half of the leafy, branchy tops removed, the bamboos lean less and are less likely to end up under a tree. Topping like this is a standard technique in highly managed bamboo groves in China. It leads to higher yields of straighter poles with less snow damage, in any case. Next, major branches are cut off the selected locust with pole saws or by climbing. Climbing with a chainsaw is something I hire or trade out to someone with equipment, training, and insurance! I work as the ground man, keeping the branches pulled away. At last, I bind the bamboos aside with ropes and bungie cords, and we drop the trunk into a clear slot.

Usually I split a locust log into quarters in place; splitting is easier when the wood is green, and the pieces to be moved are then lighter. I trim the posts to a rough finish with broad axe and adze; sapwood rots quickly and adds to the fertility of the grove.

In this system, I have worked out a polyculture that yields, among other things, a useful value-added product that I can produce with a minimum of machinery. I expect that with the normal 8-10 year life of a bamboo fence that I will replace the bamboo on a set of locust posts two or three times before I replace the posts. We'll see! Δ

Rick Valley grows useful bamboos and other plants, teaches permaculture design, and consults with a focus on water, landform, and horticultural systems. He is at work on a book about bamboo. Contact Northern Groves Bamboo Nursery, PO Box 1236, Philomath, OR 97370. Telephone: 541-929-7152. A Bamboo catalog is available for $3 or at on the Web at <http://www.teleport.com/~dbrooks/bamboo.html>



Industrial Hemp:
Saviour or Nightmare?

Stuart McMillan

Fiber is an important but little recognized point of intervention in the quest for sustainable economic solutions and a healthier environment. Much of agriculture and nearly all of forestry is focused on its production, at present by very destructive means. Forests continue to be chipped for pulp, tree plantations are diminishing biological diversity worldwide, and cotton is the most heavily chemicalized crop in agriculture. While recycling offers the long-term hope of reducing the demand for virgin material, any serious effort toward sustainability must address the means of production.

When people think of sustainable fiber options it seems inevitable that hemp enters their minds. Hemp has been touted as every thing from "the next wonder crop" to "industrial society's savior." But we must ask "Is hemp just the next resource intensive monocultural nightmare?" The answer lies somewhere between these two extremes.

The role of hemp as a fiber source is truly ancient. Hemp probably originated as a camp follower volunteering from the midden heaps of semi-agricultural societies. According to plant breeder and geneticist Nikolai Vavilov, the center of diversity for Cannabis is in central Asia. From this point Cannabis has followed humans to every continent except Antarctica, and from the equator to beyond the Arctic Circle. Few plants can boast this range of habitat, but the functionality and durability of hemp have invited its dispersion by many cultures over the millennia. *Ma*, the Chinese word for hemp, is only a slight intonation away from their word for mother. Hemp was likely one of the first agricultural crops, and certainly was the first fiber crop cultivated by humans. Hempen cloth was first worked between 9000-8000 BC in China, where the oldest known woven textile artifact has been found—made from hemp.

Hemp fiber figured importantly in all sorts of human endeavors; it satisfies the needs of hearth and home, commerce and war. The fiber can be spun as fine thread and delicate fabrics or into stout cables. It provides fishing nets and cords, bags, carpeting, clothing, paper, sails, and of course, ropes.

Hemp Goes Round the World

Many ancient trade routes were based on the export of goods spun from hemp fibers. Hemp then evolved into a major technical support for the entire sailing industry and the commerce brought by it. The word "canvas" derives from "cannabis," the Latin word for hemp. Caesar invaded Gaul to establish a secure source of "cannabis" fiber for his empire; Napoleon's control of hemp from the Russian ports nearly crippled the English navy. By the early 19th century when sail had reached its epoch, each large warship or merchant vessel required 50 to 100 metric tons of hemp fiber,

The author against a sea of Manitoba hemp.

which had to be replaced every one to two years. The Japanese invasion of the Philippines in World War II cut off the main US source of fiber, and forced that country, which had in 1937 made cannabis cultivation illegal, to reverse itself five years later and promote "Hemp for Victory."

Trade and commerce, which had brought hemp to prominence, just as surely drove its decline, as ships brought goods made from fibers such as sisal, manila hemp, and ramie (sunn hemp), which were produced more cheaply in tropical countries. Although many people want to believe that hemp was eclipsed because of clandestine actions by those who stood to benefit from its demise, competition from other fiber sources was a more important factor.

Though mechanization swept through all areas of agriculture and manufacturing during the industrial revolution, attempts to mechanize hemp fiber processing were largely unsuccessful. The relative dominance of fibers shifted rapidly with the introduction of the cotton gin. Ironically hemp assisted in its own demise as hemp ropes were used to bind cotton bales, making them easier to transport. Until the early 20th century hemp was harvested and processed primarily by hand labor. Processing the fiber was a major task for most of the winter, and required many hands. Around the turn of the century, a number of successful prototypes for removing the long fiber from the inner hurd were designed, but a lack of investors and the declining acreage of hemp prevented these machines from becoming widespread. Hemp slipped from its place as the leading fiber crop to one of minor importance.

An Ancient Crop Reemerges

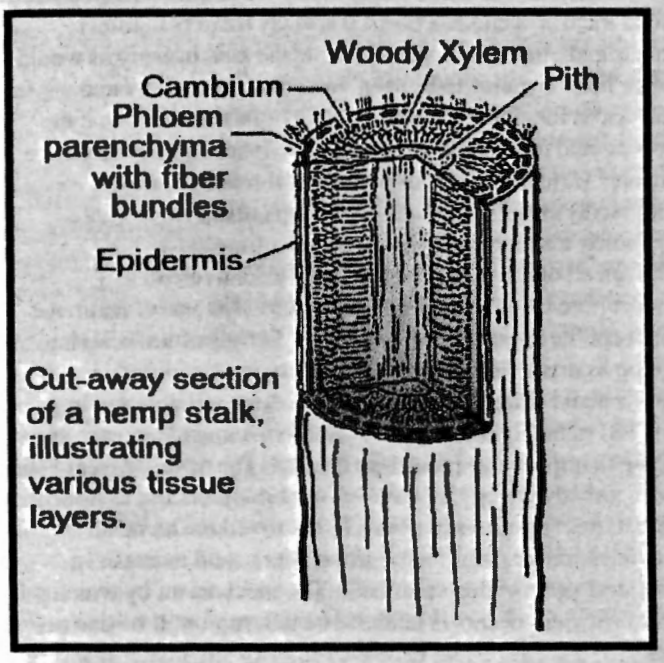
Throughout the post-WWII era, hemp cultivation continued on a reasonably large scale, mainly in areas of Eastern Europe, Russia, China, North Korea, India, and France, but the importance of hemp declined through the 1980s to the point

where it made up only 0.3% of the total fiber production for textiles. At the start of the last decade the role of hemp for fiber in North America had become historic only, the formerly essential crop having fallen into relative obscurity, its story (some of it printed on hemp paper, no doubt!) consigned to dust-covered archives. However, the '90s saw the global rediscovery of a multitude of potential uses for hemp, and along with it came increased lobbying for the legalization of non-psychoactive hemp varieties in those countries where hemp production remained guilty by association with marijuana.

Distinguishing Dope from Rope

Since the 1970s, in all areas where hemp production has continued, it has been based on non-psychoactive varieties, as required by the United Nations International Drug Control Programme (UNDCP).

Trials of Cannabis varieties began in Canada in the early '70s as well. Researchers began to understand that the psychoactivity of Cannabis was based on a group of 30 chemicals known as cannabinoids which were unique to that plant. They learned that Cannabis has three typical patterns of chemical content that were responsible for relative psychoactivity. Drug strains had either high levels of THC (tetrahydracannabinol) and low levels of a



Cut-away section of a hemp stalk, illustrating various tissue layers.

chemical known as CBD, or intermediate levels of both. Certain varieties had no psychoactivity, showing very low levels of THC and very high levels of CBD. The research showed that each variety's chemical composition was stable, and that the traits did not breed out. Even with this knowledge, it took nearly 30 years for western governments to examine the potential of hemp seriously.

In the past decade Austria, Australia, Canada, Germany, the Netherlands, and Switzerland all legalized cultivation of Cannabis varieties with less than 0.3% THC, the chemical responsible for the "high" of marijuana. The production of industrial hemp rose steadily through this time as ideas of hemp's potential roles were put into practice.

China remains the largest producer of hemp fibers globally. There most hemp is used within the country for textiles and food production. In Europe, machine processing has allowed hemp to compete in the market for high quality paper. The hurd, or inner bast of the stem, has been used mostly for stable bedding, as it can absorb four times its weight in liquid. In France, where hemp fibers and hurd have been incorporated into mortars and masonry since at least 1300, new methods are being applied, under the name Chanvriotte, to an old building practice.

In Canada, hemp is sold mainly in the specialty food market, but substantial increases are expected soon in fiber use, as two companies, Kennex and Hempline, are currently processing the fiber into automotive panels and carpeting respectively. In 1998, 259 farmers harvested about 6,175 acres of hemp, mostly in Ontario and Manitoba. In 1999, 674 farmers harvested more than 35,000 acres, nearly a sixfold increase.

A Hemp Renaissance?

The number of products fashioned from hemp has recently compounded with the increase in technological capacity. Now hemp fibers are incorporated into concrete as a stabilizer and can be transformed into laminated beams, particle board, medium density fiber board, and polymers. Finely sifted hemp fibers make an excellent addition to earth plasters and adobe floors. Hemp fibers not only continue to be used in woven fabrics for everything from clothes to curtains, but also are processed in a non-woven form into matting for erosion control, automotive padding, and more. Applications for bio-composites are becoming more widespread all the time. Tests on hemp based bio-composites showed very broad temperature thresholds without cracking or warping.

The need for a shift away from a hydrocarbon-based economy toward one based on carbohydrates has fueled much of the interest in hemp cultivation. This global imperative, coupled with the wide range of potential uses for hemp gives it the aura of a wonder crop. Yet the shadow of the drug wars looms long over this plant and may yet hold the key to its resurgence or marginalization. Nor should enthusiasm over its potential blind us to the limitations of hemp production.

Sifting Fact from Fiction

The view of hemp as a saviour may be the unavoidable mirror of its demonization, both pictures being distortions of the truth. As hemp's profile was expanding in the '90s, its most enthusiastic supporters in research and writing had never actually grown it, nor seen it, nor had they any background with fibers in any form. These early promoters, armed only with outdated and incorrect USDA articles from the turn of the century, and dog-earred copies of *The Emperor Wears No Clothes* by Jack Herer, promoted hemp with abandon. Their actions and information did inspire many people to work with hemp, however.

Unfortunately, some of these early claims were entirely incorrect. It was, for example asserted that "Hemp can be grown on wastelands and pastures." It has been widely observed that hemp cultivated during WWII in Kentucky and Wisconsin

persisted as "ditchweed" and so the species became associated with waste places and marginal lands. While hemp is adaptable, it is nevertheless a demanding crop that grows best on loamy soils with good drainage, as it can be easily damaged by flooding when young if planted on poorly drained land. Most agriculturists would recognize that pastures are often located on land not suited to annual cultivation.

Another refutable statement is "Hemp has no insect and disease pests." All plants have some insects adapted to predate them, and hemp is no exception. Indeed it success almost ensures that it has many potential pests. Although there are reports of over 300 insects that infest Cannabis, the most serious of them include hemp aphid *(Phorodon cannabis)*, flea beetles *(Psylloides sp.)*, hemp budworm *(Helothis obsoleta)*, Lygus bugs *(Lygus sp.)*, hemp borers *(Grapholita delineana)* and European corn borer *(Ostrina nubilalis)*. Hemp is also susceptible to a few disease organisms such as Botritis, Verticillium, Sclerotinia, and Fusarium. While the severity of damage these organisms cause normally doesn't warrant control measures, free of pests hemp is not.

The claim that "Hemp requires next to no fertilizers," is perhaps furthest from the truth. Hemp is a heavy feeder; it requires a lot of nutrients in order to meet its incredible rates of growth. Some organically grown crops have been severely limited by a lack of required nutrients. Hemp may grow in ditches as a wild plant but to achieve the quality of fiber and quantity of seed that is needed for an economic return, supplemental fertilization is absolutely necessary. With industrial monocrops, this is achieved through rates of inorganic chemical nitrogen application up to 100 lbs/acre. The potential for nitrate leaching from hemp fields is lower than most crops, however, because the plant is such an efficient scavenger for resources. Bacterial or actinomycetal symbiosis may well enhance nutrient availability. Although it has not yet been investigated, it is likely that Cannabis grown in low nutrient conditions forms mycorrhizal associations of the vesicular arbuscular type which facilitate a greater uptake of nutrients. Rotation is of critical importance in sustainable hemp cultivation. Planting hemp after a perennial legume such as clover or alfalfa can greatly improve growth. This offers the double advantage of hemp shading out the few weeds promoted by perennial legumes, leaving the field very clean.

Hemp is in all regards a hardy plant with a broad tolerance for environmental extremes, but is still only a normal biological organism with constraints like any other.

It was not only promoters of hemp who made incorrect statements about it, however. The US remains one of the few countries where hemp production is still illegal, and because of this there is much misinformation within the government agencies. A recent USDA study doesn't see much demand for any of hemp's uses. "All of the (hemp) fiber, yarn, and fabric that the United States currently imports could be grown on less than 2000 acres of land," says the study by the Agriculture Department's Economic Research Service. Gen. Barry McCaffery, head propagandist for the Drug Enforcement Agency (DEA), called hemp "a novelty product that can only sustain a novelty market." If you asked anyone 50 years ago about the future importance of soybeans the answer you might have received would in all likelihood have been very similar. Very few could have imagined that an obscure Chinese legume would lead to the huge number of industrial and agricultural products now based on soy. Compared to soybeans, hemp has a higher proportion of soluble protein, provides oil of a better nutritional quality, and contains more of it. On top of its nutritious seeds hemp provides large amounts of high-quality fiber and can return abundant biomass to soil or for use as fodder.

More Mad Science

One of the most serious concerns facing the hemp industry today is the proposed goal of the UNDCP to eradicate the global supply of Cannabis, coca, and poppy by 2007. Many people would view any attempt to eliminate a plant as ludicrous. Apparently not the governments of Britain and the US, however, who together are strong funders of research conducted for the UN at the Institute for Genetics at Tashkent, Uzbekistan, the USDA Research Center at Beltsville, Maryland, and the University of Montana at Bozeman. This research involves bioengineering strains of Fusarium for increased virulence and specificity to their host plants. The strains would be mass-cultured in laboratories, then dispersed by airplanes. Fusarium is a fungal disease with different species that infects roughly 80 different cultivated plants around the world and has crossed species barriers to infect humans and other mammals. Whether the new organisms would change hosts remains to be seen, but adaptation is key and evolution is inevitable in biology. It is highly unlikely that the disease could differentiate psychoactive from non-psychoactive Cannabis varieties, and such a disease, if released, would undoubtedly cripple the emerging hemp industry.

Agronomy and Economic Botany of Cannabis

Given all of these facts, does hemp have a role in a permaculture landscape? It certainly does. The use of hemp has many benefits in designed ecosystems. Permaculturists seek to develop as many functions from each element as possible. Hemp's dense foliage makes it suitable for a windbreak. Strips of hemp left in the field can reduce wind erosion and increase snow drifting to improve soil moisture content. The same dense foliage creates a shady canopy that allows soil biological life to flourish. Hemp in field rotations has been found to reduce harmful nematode numbers, limit weed populations, and increase subsequent grain yields up to 10%. The mechanism by which this increase in yield occurs is unknown, but it may well be due to improved soil texture and increased soil organic matter from residues. Hemp foliage has been used as a deterrent to pests of stored grain in India. Hemp promotes pollen eating insects, as a single male plant can produce up to 40 grams of pollen.

Besides its ecological functions, hemp has offers many economic benefits.

Small-scale plots of hemp for fiber can easily support cottage industries such as papermaking. Hemp produces 2 to 2.5 times more fiber for pulp production than the same area of forest. Paper made from hemp is more durable, and requires fewer chemicals to process than wood-based paper. The concentration of alpha-cellulose in the raw fibers of hemp can reach 90%, compared to the 50% to 54% cellulose concentration in softwood and

hardwood fibers.

Hemp grown for seed sustains smallholdings and offers opportunities for income. Currently the bulk of the seed grown in North America is sold for human consumption or is pressed into oil. The various grades of oil are suitable for human nutrition, animal feed, or industrial application depending on their quality. Seed yields in Canada have been as high as 2000 lbs/acre, but the average has been 800 lbs/acre.

The same nutritious seed crop supports various wild and domestic seed-eating mammals and birds. Hemp offers poultry nourishment at the end of season after providing shade, shelter, and insect forage during the growing months. The high level of carotenoid content of hemp leaves has been shown to increase the yellow color of egg yolks as well.

Widely spaced plantings of hemp produce stout plants with spreading branches that support climbing vines and offer multi-layered planting possibilities. If the correct species were incorporated more nutrients could be supplied, beneficial insects attracted, or other potential stacked functions achieved. Climbing legumes, such as vetches or grass pea *(Lathyrus sp.)*, may be able to supplement the high nitrogen needs of hemp, yet not be shaded out by the dense canopy. However, specific combinations and interactions would need to be explored by creative permaculturists in each region.

Hemp truly offers the holistic-minded grower a multi-functional fiber source. Whether policy allows greater cultivation of hemp by a broad range of agriculturists remains to be seen.

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Resources for Industrial Hemp

compiled by Jennifer Pittet

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Learning Traditional Craft

A New Silk Road

Heather Steele

For the person interested in working with fiber from within the forest garden framework, silk may come to mind. Well, maybe not immediately to mind, but it's fitting. Silk fiber comes from the cocoon of the silkworm, which has as its primary food source, the leaf of the mulberry tree. The preferred mulberry species, *Morus alba*, has a wide growing range here in the States and is well suited to the permaculture context.

I became interested in sericulture—silkmaking—at the point in my learning of all the vagaries of land-centered life when I was looking into making fiber. The practice seemed compelling yet methodical. I knew the it must be fairly involved because the cocoons, once spun by the silkworms, had then to be made into thread. Silkmaking seemed to have a certain untouchability, having been shrouded for ages in the realm of clandestine science, secret art. But then, not all that obscure because it had been attempted in America as a cottage industry under colonial patronage. Climate, resources, interest, all seemed to be in favor of this practice and I began to pursue my interest.

I had a suspicion that sheer complexity was the main hindrance—that the Chinese had developed such highly particular techniques that people were deterred. This was part of it, but they had held a veritable monopoly on the craft not only because they guarded their technique like crazy, but because they kept a tight lid on the silkworm stock they had selectively bred over the years. That monopoly lasted, it is said, until two Nestorian monks smuggled eggs out from the East in their staffs. So the craft spread to the West. But it never really made it very far in America because cotton and tobacco addressed themselves to the immediate concerns of the colonists. Those were ready-return cash crops. But what about now, when the basic necessities of our society have been provided, and there is a call for the special and the unique? Over the next few years I continued my inquiry. I read what I could find, scanned websites, and even came across a few sericulture enthusiasts who had dabbled in rearing silkworms and who collected wild species. I still hadn't been able to see it done. I could walk through the process in my head, but it was sort of like gardening—some things you just had to see to understand.

Mulberry trained as a shrub for easy harvesting

A Journey to Kerala

In due course I learned about an opportunity in India, at an educational rural development community devoted to the vernacular trades and open to cultural exchange; I decided to go. Called Mitraniketan, it was located in Kerala, about as far south as you can get in India. The main thing I would focus on there would be the rearing of silkworms. Of course I had hoped to come across the trade in its whole form, from rearing to weaving, as a small collective tradition, but knew that such a situation would most likely exist as a family or village endeavor, and to be able to locate, and, as a foreigner, come into it as an apprentice, seemed remote. I wasn't holding out for it. I would learn in whatever fashion I could.

Essentially there are three parts to silkmaking—rearing, reeling, and mulberry cultivation. The first is the most involved, the second depends on the kind of technology you're going to use, and the third depends on where you are. The rearing is so involved because after millennia of coddling, the silkworms have become extremely wimpy and particular. And as we in the quandary of wild-versus-domestic realize: rigorous care gives fine results and will demand rigorous care. Thus the rearing is quite technical. The second part—reeling—has as a basic premise the loosening of the cocoons so that the end filament of each can be taken up, combined, and unwound. Each cocoon is one continuous filament, and 6-10 filaments make a thread. As for the cultivation of mulberry, it's trained as a shrub for easy harvest, and if you understand plant cycles, it's basic. Fertilize, deal with competing undergrowth, prune.

Hosing down more trays for the fast-growing silkworms

In India rearings are done up to five times a year because there's no dormancy, so cultivation is intensive: I got some very condensed learning.

At the time I arrived at Mitraniketan, the mulberry crop needed a bit more growth before a rearing could begin. I followed a lead that took me east to Tamil Nadu, the other state sharing the southern tip of India. A Gandhian rural university community there was rumored to practice sericulture. In fact, they did dyeing and weaving but no sericulture. The Gandhian ethos of nonviolence would not sanction raising silk because in order to make use of the fiber of the cocoon, the silkworm inside must be stifled. That was a reality I would also have to reckon with in time.

An Exacting Pursuit

Back at Mitra, the rearing was to begin. We had the shed ready, as the silkworms are kept indoors, on trays in racks, and the leaves brought in. For the first feeding we only needed a handful of leaves, which we cut in centimeter squares. The worms had hatched that morning and from then until the time they would spin their cocoons—about a month—would be fed ever increasing amounts of leaves. Four times a day. The harvesting would happen in a small window of time. After the sun had evaporated the night mist off, and near enough to the 10AM feeding for the leaves to cool off and air out. But not to dry out. The leaves must be fresh but not damp, dry but not wilted. If they were dusty they were to be wiped off. Just before feeding we chopped the leaves to a size corresponding to the stage of growth of the silkworms, then sprinkled this over the trays.

All these things were laid out in the manuals, which I had borrowed from the library until my own arrived, and which I was lurchingly following. Indian technical jargon, with its British tone, can be ungainly at times: "...we propose to deal in this chapter with the main factors which merit the attention of a sericulturist if he is not to face the bleak prospect of poor harvest." Much of this was made easier by a sericulture advisor who happened to have her office at Mitra. Sherrine was a government officer and we developed an interesting and rewarding relationship—it really is to her that I owe much of my understanding of silk. But first some background.

Government Support

In India the field of sericulture has been, for the last 30 years or thereabouts, under the stewardship of the government. I don't know that this has improved it—it has organized it. Farmers will purchase their eggs from local stock banks, rear them, then sell the cocoons back. Reeling houses then buy the cocoons and turn them into skeins of thread. The skeins in turn are sold in bulk to weaving houses. It's less cottage and more industry, and India now exports 40% of its silk internationally. The way this trickles

down to the farmer is by way of introduction of high yield stock and of technology. They get more return, but this demands a higher input of labor and cash—it ain't the old practice that it used to be.

The farmer and author mounting mature silkworms onto bamboo racks where the cocoons will be spun.

I ended up working in two rearings. After the rearing at Mitra it was arranged that I participate in an officer training in the north of the state. This was given under the auspices of the Kerala government, and I was the only person not from Kerala; also the only woman. I stayed at the local Franciscan convent and took the bus out to the farm. The training was conducted in Malayalam, which I was far from having mastered, but a lot of the technical stuff was in English and I had my manuals. Trying as that context was, I got a lot of the technique down—mainly because they were so damn pedantic about it. They were trying a high-yield breed from Japan that turned out not to do so well in south India's tropical climate, but that was a problem I wouldn't face so I wasn't derailed. In fact, sericulture is a recent endeavor in Kerala; it'll take some time before things are ironed out, and I think it'll come from the farmers just as much as from above. I was grateful to be able to see how different rearers went about their work.

And Farmer Innovations

Sherrine, the advisor at Mitra, went out to call on the area's farmers and would invite me along. Most of their queries had to do with poor leaf quality, which stemmed from lack of nutrients in the soil. No big surprise in a land that's been cultivated for 5,000 years. Their fields, however, with the ancient system of irrigation canals, were awe-inspiring. One farmer had a fine approach to pest deterrence. He mounted the trays in one suspended stack from the ceiling, which looked neat and could also be managed from all sides. And one woman, as an alternative to the regular sprinkling of disinfectant over the beds, was trying tamarind powder. She also had developed a low-impact method for cleaning the beds, in which the silkworm crawled up onto the new leaves. This made for less injury, less interference, and seemed to work well. Her cocoons, Sherrine conceded to me, were the best in the region. Seeing this level of attention made me realize that, yes, silkmaking is a highly involved process.

I figure that it takes about 150 hours to raise enough silk for a meter of cloth. We're always asking ourselves here what our labor is worth. Doing the math makes it obvious that silkmaking wouldn't pay in our culture. But maybe it's really a matter of what we are going to spend our time doing. I think Margaret Mead was right on when she asked whether we as a society are going to remain focused on worldwide ego sparring or whether we are going to emphasize the valuing and flourishing of extraordinary pursuits and the potential of our cultures for their own sake.

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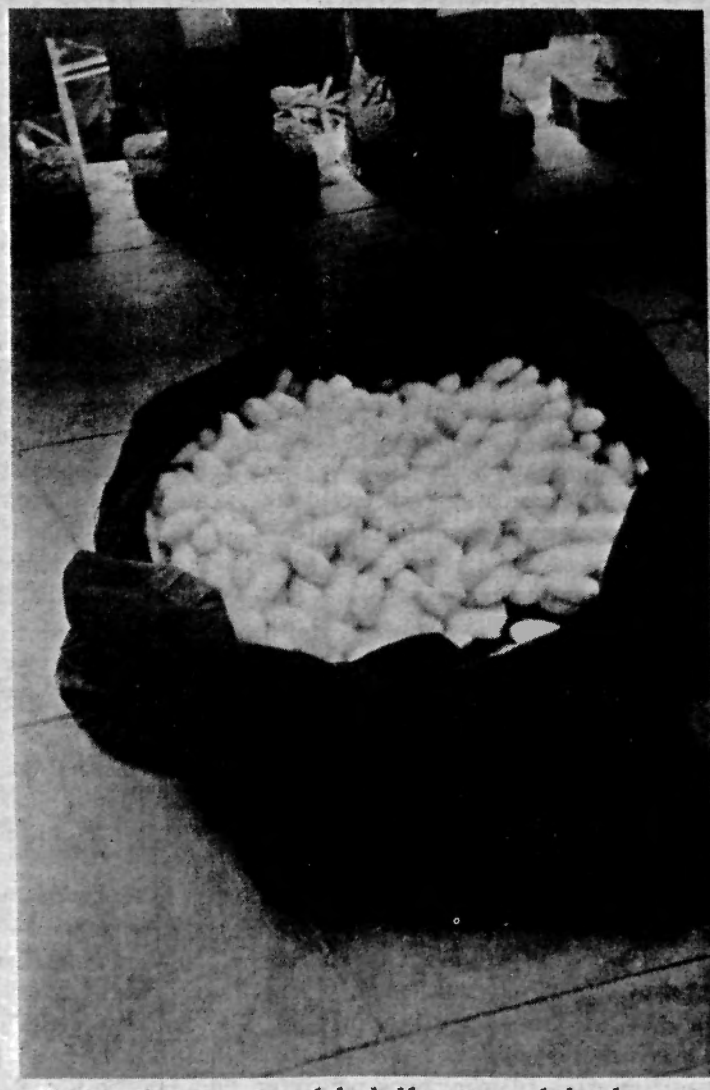


Harvested cocoons enough for half a meter reeled and woven. Photo credits to the author.

A Skein of Many Threads...

"Sericulture, the rearing of silkworms for the production of silk filament, was an invention of Neolithic farmers living along the Huang Ho in north-central China more than four thousand years ago. Through the centuries the state encouraged sericulture by making taxes payble in silk. And it controlled production to ensure the prestige of silk—to make its use, in effect, an imperial prerogative demonstrating the special status of an aristocracy.

"Traditional sericulture (in China) was a specialized activity of farmers. Each stage of the labor-intensive production demanded skill and coordination. At maturation the silkworm spins a cocoon of silk filament. The keepers had to be alert for the right moment to gather the cocoon and unwind the filament, which might be almost a kilometer long. If the chrysalis emerged from the cocoon, the continuous filament was broken."

— Silk Roads • China Ships, *Vollmer, Keall & Nagai-Berthong. 1983. Royal Ontario Museum, Toronto.*

The culture of silk had many intricate offshoots and silkmaking may be considered one of the first "high-tech" industries. The delicacy and careful observation required to rear silkworms and process the filaments from their cocoons were part of a heritage that gave the Chinese pre-eminence in science and technology until at least the 15th Century.

Silk filaments, though very thin, are extremely durable and have a tensile strength exceeding that of steel. Their ability to withstand strain and manipulation allowed the development of many intricate loom-controlled techniques capable of producing a wide range of subtle variety in silk fabrics.

Besides their great strength, reeled silk threads have lustre because no irregularities mar the reflection of light along the length of the smooth filaments. This reflective quality is highlighted in satin and damask weaves and by the use of silk thread for embroidery on plainer fabrics.

Exploiting the natural qualities of this extraordinary material gave rise to further technical advances. The requirements of embroiderers for extremely sharp and precise instruments stimulated the invention of refined sewing equipment, including needles with eyes, thimbles, and needle pushers. One of the earliest forms of scissors was developed in China.

Though plantation culture is a response to the increasing demands of the market, traditional sericulture took place in the context of a polyculture of multifunctional elements. Easily propagated from seed or cuttings, the mulberry is of course a highly edible and nutritious plant, its fruits delectable to humans and avidly sought by poultry and swine. The leaves are edible not only by silkworms but by other livestock as well. The tree has a huge ecological niche, ranging in North America from Nebraska to Florida and from favored intermountain valleys of the Southwest to much of the West Coast including Hawaii. It thrives today in many complex semi-aquatic arrays of perennial plants and animals across south China.

Silk filament is obtained from the *Bombyx mori* moth; the insect has to be "stifled" at just the right time to prevent it emerging and destroying the long filament which makes up the cocoon. Since the silkworm is edible and considered a great delicacy, the dead chrysali are typically roasted and eaten by Chinese farmers, making an important periodic addition to diet. The frass or manure of the silkworms makes a near ideal potting medium and amendment to garden soil. Δ

Fiber Plants in the Garden

Rick Valley

I am always in need of a tie while gardening, (and I don't mean I dress English style) for every purpose from bundling harvested material to tying berry canes. I detest having non-biodegradable twine loose in the garden— it makes take-down and composting much more complicated. Since I began growing fiber plants in my polycultures, I have become much less wrapped up in orange poly baler twine. Best of all, when I need a tie, it's close at hand.

I've not found any lack of possibilities:

- *Spartium junceum* (the Latin could be translated "rope-like rush-like," but we call it Spanish Broom) is a commercially harvested fiber plant that also fixes nitrogen. It's a fine pioneer for forest gardens.
- Most irises can be used. Here my native is *Iris tenax*— any time you see "tenax" in a Latin name, there's a good possibility of "tenacious" fiber!
- Yuccas are terrific fiber plants. Some have herbal uses and most have edible flowers. I've used them well in hedgerows.
- For the mild climate folks, *Phormium tenax*, or New Zealand Flax is an appreciator of wetlands, with a wide range of selected forms. These days you get ornamental leaf color choices, but the Maori had different habitat and fiber types.
- Basket willows are definitely handy to have around, and there are very few of us living too far poleward to grow willows!
- Kniphofia leaves each have three threads, which pull out long and easy. A friend recently demonstrated their use as dental floss. Down with Dupont!
- I've just had the chance to try pawpaw bast fiber and the stuff's terrific. So long suckers!

There are myriad others to choose from, but these are some of my most-used favorites, so that wraps it up. Δ

The Pampas Mulch Bed

Gustavo Ramirez

This article is based on a three-year experience. We hope this will help grazing area farmers control grass growth. We invite everybody to try the method and share their conclusions with us.

Gaia Ecovillage has been designed using permaculture principles since June 1996. This project ocupies 20.3 hectares (50 acres) in the *Pampa Humeda* (Humid Grassland) bioregion, 110 km (70 miles) southwest from the city of Buenos Aires in Argentina.

Within our farming zones at Gaia, we have emphasized the development of a forest garden, using an existing stand of *Acacia blanca* (Robinia pseudoacacia)—black locust to North American readers. We do most of our cultivation in the area immediately surrounding this woodland of approximately 6000m² (1.5 acres).

The local soil is deep, with a high clay content and 4.9% organic matter. The original ecosystem is locally called *Pastizal Pampeano*, or pasture ground. The most dominant species are grasses. For this reason, and to allow the implementation of a Permaculture system, we have been focusing on the study of efficient strategies to control the growth of Gramilla grasses *(Cynodon dactilon)* from spring to fall, and *Cebadilla Criolla (Bromus Uniolodes)* from winter to spring. Gramilla growth is terribly invasive.

During the development of a forest garden and farming spaces, we have tried several different methods. One was the classic "instant garden" or "mulch bed" as described by Bill Mollison in *Introduction to Permaculture*. In this practice, layers of newspaper or cardboard are used to suppress existing vegetation and to provide additional organic matter for soil development.

Under the conditions of vigorous grass growth, previously described, it was necessary to use a minimum of 20 sheets of newspaper for this method to work efficiently. We were faced with a problem when we needed to mulch big areas, since this took lots of newspaper and cardboard, and both are limited resources in this rural area. Wind is also a near constant in our flat country, making laying of the mulch a cumbersome process. So we came up with a more appropriate method for our *Pampeana* reality.

Method Development

To start a forest garden large amounts of mulch are required and in many cases this must come from an external source. Since at the Ecovillage we have an extensive grazing area, we are able to produce our own hay for mulch. The grass is harvested and baled in large rolls of 1.10 x 1.25 m (44" x 50"). These are easy to unroll and quickly produce a compact mulch cover. We use this hay for all our different cultivations and windbreak tree plantations.

Since the mulch is produced locally very quickly, and is of low cost to us, it has become an appropriate substitute for newspaper and cardboard in the traditional mulch bed.

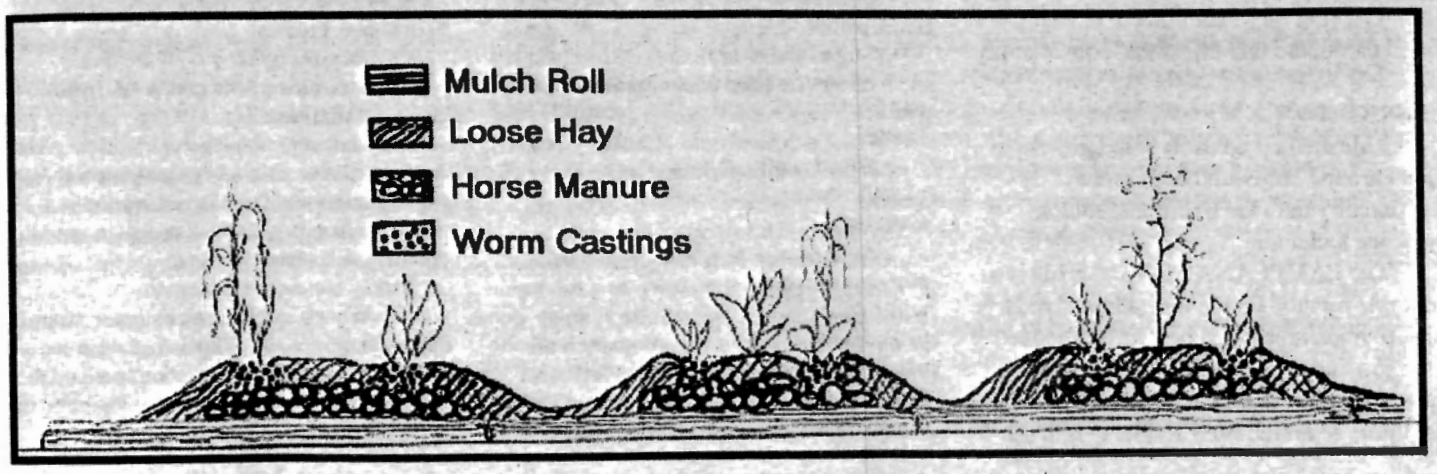
Method Used

After several trials we found the following structure to be the most successful. Two round bales are unrolled one next to the other in four to six layers, ensuring that the layers of each roll are as close as possible to avoid grass growth in between (at the joint). This method allows us to make beds 1.25 m wide, leaving the remaining sides for paths.

We cover the layers of mulch with horse manure which has been previously worked over by chickens. The chickens eat any seeds that might have been left from the incomplete digestion of the horse, and they simultaneously add nitrogen to the mix.

Over this layer we add another 20cm (8") of mulch. Then we open two parallel furrows in the new bed, fill them with compost, and sow or transplant species mentioned in Table 1.

In the center of the bed we make other furrows with compost where we plant comfrey *(Symphytum officinale)* to produce mulch and add minerals, shrub sesbania *(Sesbania punicea)* to fix nitrogen and produce flowers, Lantana *(Lantana camara)*, a mulch producer and abundant floral, and *cedron (Lipia citridora)*, an aromatic shrub.



All the species planted have superficial roots and are hardy enough to adapt to the mulch bed conditions during the first year.

Results

The growth of plants was very good during the first year and excellent during the second. When we compared these results with the traditional mulch bed we saw that the *Pampeana* had better results.

In a year the layers of mulch were down to about 3cm. In this period the mulch layers and manure became an ideal site for the development of red worms *(Eisenia foetida)*, which transformed very rapidly all the layers of organic matter.

After two years there was no evidence of the layers of mulch initially placed, and other worms *(Allobophorus sp.)* had intensified their activity. The soil, at this point, had an optimal structure and organic matter integration.

The following advantages were established over the traditional mulch bed:

- Better control of grass growth;
- More organic matter contribution.
- More red worm activity;
- No soil preparation, crushing, or cutting of vegetation was necessary prior to the mulching (since the rolls are heavy);
- No problems were presented when starting a bed on windy days;
- Beds are higher during the first six months, making it easier to work them;
- During the first year, soil exposure to extreme weather is lessened, accelerating microbe and worm transformation processes;

Some disadvantages:

- If you are not in an area where rolled hay is easily available and cheap you have an added cost, however the time saved by not carrying large amounts of newspaper and cardboard can offset this considerably.

Conclusion

This method controls weed growth in and around cultivated beds more efficiently than the traditional mulch garden technique.

The PAMPEANA MULCH BED is a simple method that is well adapted to large cultivation areas, and best recommended for grazing regions. It allows smooth rounded beds to be formed. Because of the volume of mulch used and its height the method is also suited for making swales by following the contours of the terrain, thus retaining sediments caused by runoff. (It might be a good idea to add a water line in these cases.) Δ

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Species for sowing and transplanting in mulch

Amaranth - Elephant Head *(Amaranthus gangeticus)*
Amaranth - Love-lies-bleeding *(A. caudatus)*
Basil *(Ocimum basilicum)*
Borage *(Borago officinalis)*
Bok Choy *(B. rapa)*
Calendula *(Calendula officinalis)*
Cucumber *(Cucumis sativus)*
Echium *(E. vulgare)*
Hyssop *(Hyssopus officinalis)*
Leek *(Allium ampeloprasum)*
Lettuce *(Lactuca sativa)*
Mustard green - Mizuna *(Brassica juncea)*
Mustard green - Osaka Purple *(B. juncea)*
Oregano *(Origanum vulgare)*
Verdolaga purslane *(Portulaca oleracea)*
Radishes *(Raphanus bipinnatus, R. sativus)*
Marigold *(Tagetus minuta)*
Spinach *(Spinacea oleracea)*
Tomatillo *(Physalis ixocarpa)*
Watermelon *(Citrullus lanatus)*

Broccoli *(Brassica oleracea)*
Brussels Sprouts *(B. oleracea, gemmifera group)*
Chard *(Beta vulgaris)*
Chives *(Allium schoenoprasum)*
Comfrey *(Symphytum officinale)*
Gourd *(Lagenaria siceraria)*
Hollyhock *(Alcea rosea)*
Lantana *(L. camara)*
Mint *(Menta spp.)*
Nasturtium *(Tropaeolum majus)*
Sweet Pepper *(Capsicum annuum)*

Chicken Feed

CARBOHYDRATES & GREENS

(containing under 16% protein), to comprise 40-50% of feed:

Grains

Grains may be sown as cover crops or for forage in rotated poultry runs. Straw can be used as winter bedding, and seed heads/stalks can be tied up in bundles and stored without threshing. Pulses can also be dried and stored, or planted as a forage crop in rotation.

- Oats, Barley, Wheat, Flaxseed, Buckwheat, Millet, Corn, Rye (9-12% protein);
- *Chenopodium spp.* (lambsquarters, quinoa, grain amaranth) Superb all-around nutrition for poultry or humans; edible leaves; the high protein seeds (16-20%) are loved by poultry.
- *Galium aparine* (Cleavers/Goosegrass) Entire plant edible.
- Kitchen grains or flour gone bad (weevils and moths make good poultry protein!); stale breads.
- Wheat germ and bran - Cheap by-products of white flour milling in some areas.

Greens

Greens provide important high-quality nutrients, vitamins, iron, calcium and trace minerals. Although their protein analysis seems low because they are predominantly water, do not discount their value. Lambsquarters are 4% protein, but 90% water—that's 40% protein dried! Their seeds are also a good source of protein.

- Lambsquarters, Shepherd's Purse, Green Amaranth/Pigweed, Chicory, Dandelion, Purslane, Chard, Kale (winter), Seaweed, some Comfrey, Broccoli, Radish and Mustard leaves, Curled Dock, Plaintain, Burdock, Sheep and Wood Sorrels (greens, protein seeds)
- *Solanum americanum* (a not-deadly Nightshade) dark ripe fruit, a nutritive, iron-rich herb, *Macuy* or *HierbaMora*, eaten readily in Central America; used for poultry forage by the author.
- Dill, fennel, parsley, and other beneficial, insect-attracting umbels (protein seeds, too).
- *Lemna* and *Spirodela sp.* (Duckweed!) *see above, Proteins
- *Nasturtium officinalis* (Watercress)
- Alfalfa, clover, and grains - as fresh cover crops, for forage or hay.
- Kitchen scraps and garden wastes: greens & vegetables of all kinds, potatoes/tubers, fruits, banana peels (devoured; a good potassium source), seeds of pumpkin, squash, crucifers, and weeds (protein).

Make your chicken strawyard or "tractor" your compost pile. Using an oat/grain straw or hay bedding, almost all kitchen and garden wastes can be recycled and composted by the poultry.

A Self-Forage System for Chickens

Susana Kaye Lein

The biggest expense for the organic chicken farmer in the USA today is purchased chicken feed. Yet small farmers 50 years ago produced flavorful meat and eggs with very little outside expense. They used chickens to recycle nutrients on the farm, exhibiting one of the principles of a permaculture system. A farm system designed according to permaculture principles will make it possible to feed poultry with very little outside expense: it does require an open, inquisitive mind and an initial investment of time and creative planning.

For a healthy productive life, chickens—like people—need a good balance of protein, carbohydrates, and fiber, vitamin and mineral-rich greens, as well as sunshine, exercise, and fresh air. Though chickens are omnivorous, they prefer live protein in the form of insects to most other foods. An average laying hen eats 70 lbs (32 kg) of food per year. Science has shown that feed with 16-20% protein is ideal: 16% for laying hens to 20% for young growing poults or meat birds. However, scientifically-balanced commercial feeds do not support good poultry health because the sources of these nutrients are questionable and not diverse. And, of course, almost all commercial chickens (and eggs) are produced in large factory houses where the birds are denied fresh air, sunshine, exercise, or any live food, and are further subject to diseases and stresses from close confinement in large numbers, a fundamentally unhealthy situation. To try to correct these inherent limitations, non-organic commercial feeds contain chemical additives such as growth hormones, vitamins, and antibiotics (which people then ingest from the eggs and meat). Yet disease problems in factory poultry farms are rampant.

Chickens and guinea fowl foraging

The permaculture principle of diversity promotes long-term stability (if one crop fails, you can fall back on others); it also applies to a healthy diet. A permaculture farm incorporates as many forage and fodder sources as possible—especially perennial, self-seeding, and native plants which serve many other functions on the farm.

The Chicken Knows Best

To give poultry a 16-20% protein diet, feed about equal quantities of protein and carbohydrate sources for laying hens; more of the proteins for growing chickens or meat birds. Provide forage for insect and worm proteins (important sources), and feed plenty of greens and kitchen scraps. Give the birds an occasional protein boost such as a "red-wiggler" manure worm feast with surplus worms from a composting system. Since it's impossible to monitor or control exactly how much is being eaten, especially of forage species, kitchen wastes, insects, worms, slugs, etc., trust the chickens to balance their own diet; they do a surprisingly good job when given good choices.

Miscellaneous Tips

In order to lay eggs, chickens need good calcium sources in their diet: egg shells (Some believe feeding shells might encourage egg pecking; can roast in oven to prevent this.), crushed oyster, snail or sea shells, greens (as above).

Grit or small pieces of gravel replace teeth to grind food in the chicken's gizzard; this is especially important with whole grain feeds and winter feeding. Grit is naturally available in pastured poultry or tractoring systems.

Provide a place where the birds can "dust" themselves: they do this to control mites that live on their feathers. Lastly, chickens, like most animals, need sunshine (to produce Vitamin D), fresh air, and exercise (which builds muscle tone and increases bone density).

Chickens in the Landscape

The species listed above have many potential functions in a permaculture system other than poultry forage. They can fix nitrogen to improve soil; make windbreaks, living fences or hedges; yield high quality wood or kindling, human food, fruit, or larger animal forage; attract beneficial insects; treat greywater; provide compost, bedding material, or bee forage, etc.

"Tractor" your chickens over the gardens to employ more of their many permaculture functions: they will till soil (beats a rototiller!), control pests, manure and compost, and can help to build fertile raised beds. Pasture them in the orchards for pest control and to clean up fallen fruit, especially at the end of the season. If you have large animals, chickens make great companions in the barnyard (except with hogs): they will control pests and clean up feed which would otherwise be wasted. They can also provide heat in greenhouses during the winter (see *Introduction to Permaculture*, p. 154).

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In the Northeast, two excellent local examples of chicken tractor systems may be seen at:

- Heifer Project International's Overlook Farm, Dale Perkins, Rutland, MA 508-886-2221.
- Many Hands Organic Farm, Julie Rawson, Barre, MA, 978-355-2853. Δ

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This material was prepared for a workshop presented at the Summer 1999 Conference of the Northeast Organic Farming Assn. (NOFA).

PROTEIN SOURCES

(containing at least 16% protein, dry weight), to comprise 40-50% of feed:

Trees & Shrubs—
Nuts, Seeds, Beans, Berries & Fruits

These plants provide the backbone of a chicken forage system. Plant them where there seeds will drop into chicken runs or yards, or move fencing to enclose the birds near them during the season of bearing. Trees can provide important shade and protection from raptors, which must dive at a certain angle and cannot manoeuver under tree canopies. Trees and shrubs can also provide windbreak, nectar and pollen for bees, and will help fertilize soils by dropping leaf matter. Use them where their foliage and branches will provide needed screening and where their roots can prevent soil from eroding on slopes.

The Top Three

Shrubs to small trees, these will provide a range of top quality forage throughout the growing season.

- *Caragana arborescens* (Siberian Pea Shrub) Excellent, hardy chicken feed producer; seeds have 36% protein.
- *Elaegnus spp.* (Silverberry/Autumn Olive/ Russian Olive) Fruiting hedge for forage, fresh or dry, late summer to fall.
- *Morus spp.*(Mulberry) High protein fruit (many seeds); plant near chicken runs; bears mid- to late-spring.

Other Good Choices

- *Fagus americana* (American Beech) Small nuts, seeds, and leaves are all nutritious raw; protect seedlings.
- *Quercus spp.* (Oaks) Bur Oak has best acorns; 5-8 years to bearing, but almost all edible for poultry; keep for months in damp earth or poultry run; a recommended poultry food in Britain during WW II.
- *Corylus spp.* (Hazelnut/Filbert) Hardy, edible hedge plant, bearing nuts in 3-4 years.
- *Robinia pseudoacacia* (Black Locust) Flowers, pods, and seeds (boiled or sprouted); tree can be weedy and sucker; rot-resistant polewood.
- *Gleditsia triacanthos* (Honeylocust) High-yielding: 95 lbs. of seed pods harvested from one eight year-old tree in Virginia; seeds drop gradually; thornless varieties; excellent hardwood for fuel.
- *Ceratonia siliqua* (Carob/Locust bean) Sweet pods rich in protein, dry or roast seeds to store; warm temperate to Mediterranean climate.
- *Cajanus cajan* (Pigeon Pea) High protein (24%) seeds, tropical nitrogen-fixer; is being grown in southeast USA as an annual, or wintered in greenhouse.
- *Rhus spp.* (Sumac/Squawberry) Berries, leaves, and shoots edible; protect seedlings.
- *Cotoneaster spp.* Fruits relished by wild birds; place hedge inside chicken run at bearing time!
- *Sambucus spp.* (Elderberry) Same as above, late summer to fall.
- *Lysium sp.* (Boxthorn, Wolfberry) Berries hold into winter; eagerly sought by poultry.
- *Hippophae rhamnoides* (Sea Buckthorn) A hardy nitrogen-fixer; fruits high in vit. C.
- *Asimina triloba* (Pawpaw) Small shrubby tree with delicious fruits that do not store; grows in partial shade.
- *Crataegus spp.* (Hawthorns) A hardy hedge plant with edible fruits.
- *Amelanchier spp.* (Serviceberry) Summer fruit forage with almond flavored seeds; can dry like raisins.
- *Ribes spp.* (Gooseberry, Currant) Very hardy berry bushes adapted to the understory.
- *Prunus, Malus, Amygdalus spp.* (Apples, stone fruits) Poultry can forage a fruit orchard for windfall and spoilage, providing insect and fruit worm control.

Herbs & Annuals

As in any system, herbs and annuals will precede the longer-lived perennials and provide opportunistic crops. These can be used in short rotations within chicken runs, or the birds can be turned into fields or beds to glean after crops have been harvested. Plant these around the edge of chicken yards.

- *Helianthus spp.* (Sunflower, wild sunflower) Natives with 40% protein seeds, store seed heads by hanging.
- *Apios americana* (Groundnut) A legume with seeds like peas or beans, and tubers containing 17% protein; can be collected all winter and fed raw.
- *Oenthera biennis* (Evening Primrose) Oil-rich seeds for year-long storage, or forage from late August through winter; entire plant edible.
- *Lemna* and *Spirodela spp.* (amazing Duckweed!) Scoop from your greywater pond and dry on the ground, 30-45% high-quality protein when dried; can provide up to 40% total weight of feed. (*see April '95 *Permaculture Activist* #32, p. 27-28)
- Pumpkin & squash seeds (Cucurbita spp.) Spread on screen or newspaper to dry and store, or throw in chicken run.
- Clover *(Trifolium spp.)*, alfalfa *(Medicago sativa)* Seeds or meal, sprouts, hay, cover crops.
- Green peas and beans - Use fresh and overipe discards from gardens, or dried pods.

• Dried beans, lentils, soybeans, etc. - Cook or sprout to make digestible to poultry.

Chickens avoid dried beans (which are indigestible unless cooked or sprouted), but almost all beans and grains can be left to sprout in the chicken strawyard, either from a previously planted cover crop or from soaked seeds thrown unto the straw bedding. Poultry will then enthusiastically devour the sprouted beans which have increased in protein and vitamin content over the dried bean.

The seeds, beans, or fruit of any edible plant are the highest source of protein. Watch what wild birds eat!

Animal Sources

Chickens are omnivorous by nature. They prefer insect protein but will eat mice, shrews, voles, lizards, and frogs within reach.

• Bugs, slugs, worms, insects, earthworms, composting or manure worms. THESE ARE BREAD AND BUTTER TO THE CHICKEN.

You may also supplement:

• Meat and fish scraps from the localbutcher (chickens seem to have no moral problem eating parts of their butchered sisters).

• Broken or discarded eggs (cook them to prevent chickens developing the habit of eating raw eggs).

• Road-kill (if ya' live in Kentucky)!

• Blood and bone meal from large slaughterhouses is the primary protein source in many commercial concentrates (know your source if you use it).

• Milk leftovers and by-products (from dairy or goat farmers). Δ

REVIEWS

Catching up with the Ancients

Review by Peter Bane

SALLY FALLON with (Pat Connolly)* &Mary G. Enig, Ph.D.
Nourishing Traditions: The cookbook that challenges politically correct nutrition and the diet dictocrats.
1st edition. ProMotion Publishing, San Diego. 1995. (out-of-print)
2nd edition. NewTrends Publishing, Washington. 1999.
668pp+xvi. line drawings. $25.00.

RONALD F. SCHMID, N.D.
Native Nutrition: Eating according to ancestral wisdom.
Healing Arts Press
Rochester, VT. 1987, 1994.
270pp. paper. photos. $14.95

Both these books rest on the important scientific work of two men, Drs. Weston Price and Francis Pottenger, who deserve to be better known and whose discoveries about nutrition and health will help form the foundation for any permanent culture we might hope to build. The authors do not remark on whether these two pioneers of modern nutrition knew each other; born a generation apart, Price and Pottenger nevertheless did most of their ground-breaking work as contemporaries in the 30s.

Price was born in 1870 in Ontario, raised on a farm, and trained as a dentist. After completing his degree in 1893 and moving to the United States, he began his practice and a research career that brought him wide recognition in his field. The work for which he will be most enduringly honored, however, was his anthropological studies of the diets, teeth and bone structures, and health of traditional peoples. His first career led directly to the second.

Price did his work at a unique moment in history. In his lifetime, the North American frontier closed and mass migration from farm to city began. Industrial production reorganized agriculture and food processing. White flour became the dietary standard. With the final destruction of the passenger pigeon and the buffalo herds, wild meat largely disappeared from the national diet. Observing thousands of patients he noticed problems appearing in children that had not affected their parents: dental arches were shrinking, jaws were misshapen, teeth didn't fit the mouth, and third molars were becoming impacted. He suspected that nutritional changes were responsible for these skeletal changes, and he set out to establish a baseline for human health and nutrition by investigating isolated groups of people around the world who still ate their traditional diets of wild and self-provided foods.

"Diets based on high-quality raw foods and some essential foods of animal origin had assured the health of indigenous communities all over the planet for untold centuries."

We are fortunate that this prescient scientist seized the opportunity presented to him. Prepared by his training and practice to assess genetic health, afforded means by his career, able to avail himself of relatively convenient worldwide travel and communication for the first time in history, and contemporary with a wide range of extant traditional cultures just beginning to be contacted and brought into the modern world, Price documented in photographs and gave voice to a story of incomparable importance that continues to divide order from disorder for human beings at the dawn of the third millenium.

From 1931 to 1939, when he published *Nutrition and Physical Degeneration*, Price visited dozens of tribal and village peoples on the Pacific Islands, New Zealand and Australia, in the Andes and the Amazon jungle, across the plains and forests of Africa, in remote Swiss mountain valleys, on the islands of the Outer Hebrides, and above the Arctic Circle in Canada. Wherever he encountered communities hunting wild game, fishing from the sea, herding livestock, or cultivating traditional cereals and vegetables, and most imporantly, eating a diet free of refined foods, Price also found healthy, happy people of great beauty, vigor, and character. Though their diets varied widely, the subjects of Price's studies all ate a significant fraction of of animal foods containing high quality and essential fatty acids. Where children of these peoples or related groups in closer contact with modern society had begun to consume refined foods they showed rapid deterioration of health: dental caries, shrunken dental arches, tuberculosis, arthritis, and cancer appeared where before there had been none.

By incontrovertibly establishing the health and vigor of widely separated human communities, as measured by teeth and bone structure, ease of giving birth, freedom from chronic and degenerative diseases, resistance to infections, and longevity; and further, comparing the dietary and nutritional factors that accompanied this evidence, he has given succeeding generations the Rosetta Stone of the human constitution.

Francis Pottenger, though a prominent Los Angeles physician who devoted much of his career to the treatment of tuberculosis, would seem to have played the less heroic role of this historic duo. In an attempt to determine the efficacy of adrenal supplements and various

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diets in the treatment of tuberculosis and asthma, he undertook a controlled laboratory study of cats from 1932-42. Some of the cats had their adrenal glands surgically removed and were fed various apparently wholesome diets based on meat and milk products. Those animals fed cooked meat and pasteurized or processed milk exhibited progressive symptoms of physical degeneration similar to Pottenger's patients; the cats invariably failed to reproduce past the third generation. On the other hand, a diet containing raw meat, raw milk, and particularly milk from cows on fresh pasture, proved sustaining to many feline generations. Though humans have different nutritional requirements from cats, both species consume products of animal origin and (as Price had shown of Eskimos) some human groups had thrived for millenia on high-fat diets consisting almost entirely of animal food. Pottenger's study demonstrated the effect of heat treatment on essential nutritive factors in animal food.

Price's and Pottenger's studies rest on the same foundation—that nutrition forms the basis for health—and arrive at parallel conclusions. The cats fed cooked food and the humans eating refined foods exhibited similar degenerative problems. Diets based on high-quality raw foods and some essential foods of animal origin had assured the health of indigenous communities all over the planet for untold centuries.

But the picture of human nutrition and the science of human health are complex. And here I must beg your forgiveness, dear reader, for this lengthy digression. The books of which this review treats are two important efforts to interpret the works of Price, Pottenger, and others for a modern audience, and any appreciation of them depends on an understanding of the basic insights of these pioneering scientists.

Ronald Schmid is a Naturopathic Doctor and his book has the flavor of a gentle counselling session with one's physician. Besides extensive background on the works of Price and Pottenger (from which I have drawn for this synopsis), Schmid reviews other studies of long-lived peoples: Andean peasants of Vilcabamba, Ecuador, Caucasians of Georgian Russia, and Hunzacuts of remote Kashmir, among all of whom the eldest often exceed 100 years in age. He summarizes the protective characteristics of native nutrition: raw foods of high quality rich in enzymes, meat and particularly organs of animals consuming fresh pasturage, raw milk and cheese, abundant fiber from vegetables and whole grains, seafoods including sea vegetables, and other sources of essential minerals, fat-soluble vitamins and fatty acids were present in varying combinations. All traditional diets eschewed refined sugars, oils, and starches, and used very little of concentrated sweeteners. Canned food was largely unknown; preservation consisted of various ferments, drying, or salting, all techniques that added or liberated nutritive factors needed in the diet.

Schmid offers a review of several well-known contemporary diets (Pritikin, Gerson, macrobiotic, etc.), assessing them against these criteria, and he suggests, with the respect for individual differences one would want in one's doctor, how the reader might adapt these nutritional insights to create a diet using available ingredients today. This leads to a discussion of food quality and organic versus conventional produce and of range- or pasture-fed versus feedlot-raised meat. He includes chapters on diets for healing and longevity and considerations for special conditions. There is an extensive survey of the characteristics and habitats of many common seafoods, and a brief chapter on each of the major food groups: dairy, vegetables, fruits, nuts and seeds, meats, as well as oils, sweeteners, condiments, and food supplements. Appendices provide a look at laboratory tests, food irradiation, and exercise. An extensive bibliography concludes the text.

Nourishing Traditions, as may be deduced from its subtitle, is a more truculent book. It is also a cookbook and takes a very different approach and form of organization from the one adopted by Ronald Schmid in *Native Nutrition*. Sally Fallon is a professionally trained gourmet cook with a strong interest in ethnic food origins. She and her coauthors go into much greater detail about food constituents and the effects of their various combinations than does Schmid. They also make bold and direct recommendations for the reader's nutritional choices. Besides differences in temperment and style, *Nourishing Traditions* was written eight years later, in a different political and cultural climate. Events have moved all considerations of food and agriculture to the forefront of political debate. Media are more concentrated and commercial disinformation has burgeoned. It no longer seems sufficient to argue quietly for personal choice and responsibility in diet when threats to the world's environment and food supply are legion, and global trade has placed all traditional knowledge and cultural distinction at risk.

Deemphasizing the historical and anthropological synthesis that I found so helpful in Schmid's book, Fallon et al nevertheless present evidence for the same in overwhelming abundance. Virtually every page has an outer column sidebar with quotations, stories, and anecdotal evidence from the literature regarding health, nutrition, and the diets of traditional peoples. These are very entertaining and give the book a big "edge." It is easy to dip into. The same message is everywhere. If there be wisdom in repetition, in saying the same thing many ways, these women have learned its lesson.

The first fifth of this weighty volume is a detailed introduction to nutrition by food groups, beginning with a look at fats—in the authors' opinion the most misunderstood and badly handled category. They go on to review food selection and combining, and equipment for the kitchen, and then provide a pithy set of tips for enhancing nutrition, handling tricky ingredients and organizing kitchen work. A large section called "Mastering the Basics" sets out the staple elements of a healthful diet: cultured dairy products, fermented fruits and vegetables, sprouting of grains, nuts, and seeds, the making of soup stocks, salad dressings, and sauces. Most of the remainder of the book consists of recipes (accompanied by the ubiquitous anecdotes). The appendices offer limited-time cooking suggestions, sources of ingredients, and answers to a quiz that runs through the book on popular processed foods. There are also introductions to the Price-Pottenger Nutrition Foundation (PPNF) in San Diego (of which Patricia Connolly has been executive director for 20 years), a list of the top fast-food and food-processing companies world-wide, and suggestions for further reading. An index to recipes complements a separate index to subjects. *(The second edition has dropped Ms. Connolly as an author and references to PPNF have been supplanted by referrals to the Weston A. Price Foundation for Wide Traditions in Food, Farming, and the Healing Arts, of Washington, DC. We can imagine that some divergence of views or interests has come between Fallon and Connolly.)

Apart from the much greater range of practical detail offered in *Nourishing Traditions*, the strengths of the book include its focus on fermented and cultured foods, and the depth of information about food chemistry and nutritional science. Mary Enig is a certified nutritionist and an international expert in lipid chemistry, and it is in this area that her contribution to the text shines through. Ferment is a largely invisible process, both physically and, in today's world, culturally. As such, the contributions it makes to health in traditional diets are easily overlooked by modern people, for whom fermented foods are a quaint, humorous, or even distasteful reminder of an earthy past. Fear of germs and a morbid attitude toward earth, soil, the dark, and death

itself, leave Westerners adrift on a sea of cultural ignorance. This book is an oar by which we can regain direction.

These two books are not the same, though they stem from the same premise and are founded on the same fundamental research. From reading Schmid's book I garnered the insight that the struggle against genetic engineering and corporate control of the food supply at the beginning of the 21st century is a continuation of processes set in motion by the first industrializing of food. The world-wide assault on culture which began with the refining of sugar, flour, and vegetable oil, for profit, was the beginning of a war for control of the human body at the cellular level that continues today. And the stakes could not be higher. Schmid's patient telling of the story lends itself to reflective thought.

I do not know if I like *Nourishing Traditions* as well. It is more disturbing, yet unarguably richer in information. It seems that both God and the Devil are in the details. And the details are here! For all its breadth of knowledge, perhaps because of it, the book has a hard edge. The authors' justifiable and scarcely veiled scorn for purveyors of dead food is exceeded only by their criticism of food dogma, medical ignorance, false nutritionists, and other industry shills. It may be that this book asks more of its readers, nay, demands it: Get moving, learn a new way, feed your family proper food... for a change; and here's how. One can make no morally responsible argument with that. Nor do I doubt that righteous anger is needed to derail the juggernaut of industrial food.

I am immensely grateful for the efforts of these authors to educate an ignorant and misguided public about humanity's true genetic and cultural heritage, and I urge others to read and to apply the lessons of that heritage as well. Δ

And for the Squeamish...

Review by Peter Bane

DAVID DEL PORTO & CAROL STEINFELD

The Composting Toilet System Book:

A practical guide to choosing, planning, and maintaining composting toilet systems, an alternative to sewer and septic systems.

The Center for Ecological Pollution Prevention, Concord, MA
234 pp. paper. illustrated. $21.95

Offering a more elevated look at the same subject as *The Humanure Handbook*, this large-format tome reviews composting toilet systems, both manufactured and homemade. Del Porto is an engineer and Steinfeld a writer and editor. They collaborate at The Center for Ecological Pollution Prevention in Massachusetts, a state with a strong history of interest in alternative wastewater treatment, including the New Alchemy Institute, and Anna Eddy's Sol-Viva research. Made aware that the septic tank and leachfield system had caused extensive groundwater pollution in that cold, rocky, and boggy landscape, the state legislature in 1992 also adopted pioneering legislation permitting artificial wetland alternatives.

If you want to make or maintain a composting toilet, this is the book for you. The authors cover the problems of waste disposal, the science of digestion, compost organisms, pathogens, vectors of disease, and the design criteria for accommodating them. They review local regulations, performance of standard units, lifestyle considerations, capacities, costs, and how to install and adapt composting toilets to home construction. Maintenance gets its own chapter along with a useful section on troubleshooting. Hardware and accessories are covered and a lengthy chapter profiles owners, operators, and composting toilets in overseas applications (where they are more common and better documented).

The authors devote a chapter to greywater and conclude the book with a speculaton on the future of composting toilet systems. Like Jenkins in *HH*, they review state regulations in the U.S. and provide a glossary. In addition, they offer a page of annotated references to book, institutional, and web resources on the composting of human waste. The appendix contains a short historical essay by Joel Tarr of Carnegie-Mellon University on the origins of the piped society and a description of how sewers and septic systems pollute. There is also a step-by-step checklist for choosing a toilet system, some useful reference sections on soil and nutrient science, and a one-page outline of a new paradigm for design of wastewater systems.

This well-illustrated book will be useful to teachers of appropriate technology, designers of waste systems, and to the home owners and builders who wish to incorporate composting toilets into their construction. I appreciate the broad perspective, extensive examples, and technical information provided by the authors. The impression is one of experience and dedication to reform of public practices and of careful design learned through many applications, summed up the chapter heading, "Shift Happens!" Regrettably this play on words is about the extent of the authors' attempts at humor, a technique so effectively employed by Jenkins to shift consciousness. In general, they soft-pedal the cultural and psychological issues, identifying with a presumed desire of the public not to see its own shit.

No one will accuse Del Porto and Steinfeld of being rash: though they carefully advise home humanure composters how to apply the finished product, their remarks are still tainted by residual fecophobia, "bury under 6-12 inches of topsoil,... because no one can really know..." This is regrettably the necessary and expected stance of the professional, who must sustain a climate of skepticism and doubt in order to achieve scientific credibility, avoid litigation, and also to encourage business. I point this out not because the authors have done us some disservice—on the contrary, their work has great application at the community level—but because Americans are and will for some time remain privileged to be able to employ wastewater engineers, while billions of humans will go on having to deal with their own shit directly. We too should know that this is possible, simple, safe, sustainable over years, **beneficial to soil health and our own nutrition,** and does not represent a danger to public health. Only then will we be fully informed and able to make responsible decisions about health regulations, public investment, and agriculture, to all of which waste treatment is linked. Δ

Lovely as a Tree

Review by Peter Bane

GLENN KEATOR with Artwork by Susan Bazell

The Life of an Oak: An Intimate Portrait

Heyday Books. Berkeley. 1998.
$17.95. 256 pp. paper. illustrated. color photos.

Oaks are one of the largest and most widespread families of flowering plants on Earth. This modestly sized and handsome volume is an attempt to encompass the splendor of the venerable tribe. If the sense of reverence and wonder inspired in this reviewer

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are any measure, artist Susan Bazell and author Glenn Keator have succeeded admirably.

Though a product of the modern printing industry with its enormously complex high-speed presses, this book, which is published by Berkeley's California-focused Heyday Press and the California Oak Foundation in nearby Oakland(!), evokes the magnificence of a hand-made artifact. Its graceful design and flawless execution achieve a near perfect example of the bookmaker's craft. In choice of subject, visual appeal, balance and interplay of text and illustration, and breadth of careful scholarship lovingly rendered for the reader, *The Life of an Oak* achieves a righteous and pleasing marriage between science and art.

I could not imagine a finer or more accessible introduction to the botany, ecology, and evolutionary biology of trees than this. Keator writes from his own sense of awe to an intelligent lay reader. We are guided on a clean and shining train of thought with great care through the architecture, life cycle, diversity, relationships, evolution, and habitats of oaks by a powerful engine of curiosity rolling along smooth and intimate tracks of easy, active, and muscular language. One is confident of arriving refreshed at the journey's end and is liberated to enjoy thoroughly the magnificent scenery!

Illustrator Susan Bazell has given us a masterwork revealing a talent at once refined and extremely versatile. Botanical drawings in full color and in black-and-white vie for pride of place with lavish color photographs (most by Keator or Bazell) on every other page. Calligraphic elements enliven nearly every page of text and most of the artwork. The lambent sketches and bold initials give a personal quality to the text which is winsome and completely unexpected in a glossy paperback.

In explaining the morphology, symbiotic relationships, sexual proclivities, and enormous adaptability of oaks, author Keator reveals much about the workings of the natural world that is immediately useful to the practical horticulturist. Permaculture readers will appreciate his references to the "design" of the oak, its role as a keystone species in environments both temperate and tropical, and to its tantalizing and mysterious biogeography. We are treated to admissions, unusual from a well-studied writer, of the limits of knowledge in a familiar field. And we are met throughout the text with a large mind embracing the stimulus of wide-ranging subjects: embryology, linguistics, taxonomy, geology, biochemistry, gastronomy.

On our way from the elegant color sketches of the title page to the thorough and useful glossary and index, we learn more than a little bit of mushrooms, epiphytes, wood structure, leaf pigments, and the life strategies of insects. We tour the world of oaks from California to Costa Rica to the Great Smokey Mountains to Greece, China, and Southeast Asia. And in the broad sweep of this noble story, we taste the profound influence oaks have had on human life and human civilization.

Read this book and learn, buy it and enjoy, give it and inspire others to value and celebrate the magnificent life of oaks. Δ

GMO? I Don't Know.

Review by Chris Roth

MARTIN TEITIL, Ph.D.
KIMBERLY A. WILSON
Genetically Engineered Food: Changing the Nature of Nature What you need to know to protect yourself, your family, and our planet, Foreword by Ralph Nader.
Park Street Press, Rochester, VT. 1999.
194 pages.

This is an impressively readable and informative treatment of what is rapidly becoming one of the hottest topics in agriculture and food. Much of the rest of the world has resisted the imposition of this new technology in foodstuffs, with letter-writing campaigns, protests, crop burnings, trade barriers, and government policies emphasizing that this new direction in agriculture, championed in the United States, is not welcomed by the average world citizen. In the US too, the voice of consumer protest is growing, leading to a decline in the total acreage of genetically engineered crops planted this year.

Nevertheless, commercial acres planted in "genfood" (a class of GMOs, "genetically modified organisms") have risen from none in 1989, to six million in 1996, to 58 million US acres in 1998, 70 million worldwide. Corn, soybeans, and rapeseed (canola) are among the most common GMO food crops; other genfoods include certain varieties of potatoes, tomatoes, squash, eggplant, cabbage, lettuce, broccoli, grapes, peanuts, apples, rBGH milk... the list goes on. Despite widespread consumer support for labeling of GMO foods, it is not required in the US, and the system for voluntary GMO-free labeling is cumbersome. The only common ways to avoid genetically engineered food are to grow your own, ask the farmer, or buy organic (certification guidelines prohibit genfoods).

What is genetic engineering, and what's the problem with it? *Changing the Nature of Nature* answers many basic questions, and poses many more. The authors explain the "science" of genetic engineering (which some would liken more to a crapshoot or Russian roulette than to a science) in straightforward terms, and trace the history of its use on foodstuffs. They explain what foods are likely to contain GMOs, and why (a clue: Monsanto, Novartis, or another multinational corporation always has some investment at stake). They discuss the many ramifications of these "test tube foods" and their presence in our fields and in our food supply.

"Most of [the] 'unanticipated' consequences [of GMOs]," the authors write, "could be easily anticipated if genetic engineers developed an ecological set of values. But then, perhaps, they wouldno longer be genetic engineers—they would be ecologists, and they would not be inclined to engineer life to achieve their goals."

By splicing genes from a naturally occurring soil bacterium, *Bacillus thuringiensis* (Bt), into common crops, genetic engineers have virtually ensured that pests will develop resistance to this natural pesticide, once a mainstay of organic farming, which maintained its effectiveness because it was applied only selectively so pests would not have a chance to develop resistance. Monsanto's line of "Round-up Ready" crops, sold and grown in conjunction with its trademark herbicide, carries unknown consequences in the areas of food safety, nutrition, and environmental impact.

Development of the notorious "Terminator" technology, in which plants kill their own seeds, thus necessitating the purchase of new seeds with every generation, has been put on hold by Monsanto, but the holders of 27 other terminator patents have not yet followed suit. The use of Recombinant Bovine Growth Hormone may have myriad negative effects on both human and cow health. The incorporation of allergens into genfoods has introduced another wild card into the diets of those with food allergies.

GMO-caused "gene jumping" and antibiotic resistance are two vast, troubling potentials on which virtually no research has been done to establish safety. Genetic

pollution—the drift of GMO pollen to non-GMO and wild crops—is already documented, and genetically-engineered "farmaceuticals" and medical food crops pose other potential dangers. Evidence about the unexpected environmental effects of genfoods (such as Bt corn, toxic to monarch butterflies) is mounting. Moreover, questions about the legally-sanctioned ownership of life upon which GMO development is based have never been openly, democratically discussed or agreed upon.

In short, genfoods appear fraught with potential perils and unanswered questions, and have been introduced into the food supply without public consent. They offer no known benefits to consumers; in fact, some genfoods have been shown to be nutritionally inferior to their natural cousins. Their only benefits seem to be profits to the multinational seed-pesticide-pharmaceutical-agribusiness corporations (yes, each corporation is all of those) which develop and sell them to what is essentially a captive market of farmers.

Changing the Nature of Nature provides not only background information and troubling questions about genfoods, but also examples of how citizens have made a difference in bringing light to this issue, and lists of resources to help each of us do the same in our own communities and networks. There's even a short section on organic seed saving.

The most powerful chapter for me was "Crossing Swords with an Angel," which addresses genetic engineering from a moral and spiritual, not merely practical perspective. The authors describe religious traditions and belief systems which would never sanction the hubris and desecration inherent in acts such as genetic engineering of our food. In many ways, the modern ecological viewpoint is a continuation of this historical spiritual perspective. "Most of [the] 'unanticipated' consequences [of GMOs]," the authors write, "could be easily anticipated if genetic engineers developed an ecological set of values. But then, perhaps, they would no longer be genetic engineers—they would be ecologists, and they would not be inclined to engineer life to achieve their goals."

Is this true?, the devil's advocate in me wondered. Are ecology and religion, on the one hand, and engineering, on the other, diametrically opposed? If it were done in the spirit of the common good rather than for corporate profit, might we not look upon genetic engineering in a more favorable light? Where do we cross the line between appropriate interaction with our environment, and inappropriate action which can lead to profound disruption and great danger?

In the case of numerous technologies, we have been pushed over the line to inappropriate, dangerous action without having had a chance to make informed choices—the most recent, glaring examples being the widespread adoption of nuclear power, and the proliferation of genetically modified organisms in our environment. In the case of genetic engineering, we have let the genie out of the bottle, but we must hope it's not too late to contain its potentially negative effects, at least until we know what we've gotten into.

Changing the Nature of Nature is unabashedly critical and one-sided, but given the nature of the debate (or non-debate) about this technology so far, the authors' stance and their questioning are entirely appropriate. When genetic engineering can be done in a way that is shown to be safe, with intended benefits to society rather than to a few large companies, then it may be time to reexamine its merits. Until then, we need to ask the questions this book poses, and keep asking them until they're answered. Δ

Prickly Business

Review by Peter Bane

JEFF NUGENT
Permaculture Plants: Agaves & Cacti
Sustainable Agriculture Research Institute, 1999
PO Box 10, Nannup WA 6275, Australia
Tel: 61+ (08) 975-61271
200pp. paper. illustrated.

Jeff Nugent has done the permaculture community a great service in compiling this small volume of essential information about two of the world's most important plant families. Drawn from an unfinished compendium, *Permaculture Plants: A Tropical Companion, Agaves & Cacti* offers all the uses of the members of these two families that the author could find in what was obviously extensive research. Nugent has added to this information about the plants' habitat, climatic requirements, and cultivation cues. Approximately 600 species are referenced by all known botanic as well as any common names the author came across. Of these about 40% are illustrated. In addition the book provides a short glossary, an appendix of suppliers of seeds and plants organized by region, a listing of Cactus and Succulent Societies in the U.S., Canada, Europe, Australia, and New Zealand, some 80 scholarly references, an index to species, uses, and common names, a brief guide to cultivation, a succinct overview of Permaculture (for interested readers unfamiliar with the term), and a charming introduction replete with a moral on the importance of diversity.

Nugent lives in Western Australia, among the driest regions of the driest continent on earth and so comes by his interest in these plant families quite naturally. His assertion that more of us should be interested in them has good support in ethnobotany and the science of climate change. If, as present trends seem to indicate, we face a hotter climate with greater extremes of precipitation, the adaptability of cacti and agaves to low rainfall and extended drought will prove as important as their wide utility. Important sources of food, fiber, and medicine, they have been cultivated for more than 9,000 years. Nugent argues for greater attention to these precious plants for other reasons as well: not only has too little practical thought gone into the classification of plants generally, but these dryland dwellers are increasingly threatened by human development in their customarily fragile native environments.

Fruit of the do-it-yourself desktop publishing era, this slender volume is on the whole handsomely designed and thoughtfully laid out. The author writes with a spare, intelligent style well suited to his purpose in conveying useful information to the working farmer or designer. He adopts a cryptic but sensible format he calls "broken English" for the main body of species listings, giving shorthand, rapid-fire summaries of essential characteristics and uses for each plant. This format and the thorough index will make the book easy to use.

As a non-horticulturist not native to drylands, I freely confess my knowledge of these plants is cursory at best. I am in no position to critique the accuracy of much of the information given by this book, however, the seriousness of the author's announced project and the intelligence of his approach are evident. I can say from experience that proof-reading of technical material is the most

challenging of editorial tasks and a home-produced text of this nature might be expected to display a number of typographic errors. Among the dozen or so that I spotted no grievous loss of meaning or information could be found, however the reader should take caution in particular with addresses, where Nugent's lack of familiarity with American or European names and forms has resulted in slightly erratic listings. The world headquarters of Apple Computer for instance, appears as "Cupertino, CA." Numbers are of course impossible to verify without references.

The brief introductory text section could have been made more readable by the simple device of indenting or separating paragraphs, a stylistic flaw that detracts from the book's otherwise simple elegance. Mr Nugent follows the Australian custom, slowly migrating to other English-speaking regions with the spread of optical character reading devices in automation, of abandoning many periods following abbreviations. While this has obvious advantages for the typist and can produce a a less fussy-looking text, I found the general dearth of punctuation marks slightly uncomfortable. (The reader will be hard pressed to find many commas either). In his introduction, the author appeals to the indulgence of English-speaking readers for his adoption of a style he believes will be more accessible to non-native speakers of the language. We can hope that a future edition of this important work will refine its presentation without sacrificing the laudable aims Jeff Nugent has set forth.

The book cover announces no price and I received my copy by mail with compliments of the author during his brief sojourn in western Canada last summer for a permaculture course. The book had at that time just been released. Awkward communication has thus far prevented me from obtaining information about the price. Interested readers will have to contact the publisher directly. Δ

...from the Regions

A Community Gardening Success

For all the diversity of human life in big cities, their streetscapes are often drab and sterile spaces. Linking these yields and needs to make a more productive system is the essence of urban permaculture. Greening the streets and growing food in cities are two key strategies that come together in an essential leverage point: the community garden. By creating places for people to grow food in their neighborhoods and to meet each other in a natural setting we accomplish more good things than can be written about: green spaces, clean food, improved nutrition and health, good neighbors, safer streets, opportunities for youth; one success leads to another. The challenge with any design, however, is getting started. With that in mind, bioregionalist and city afficionado Bea Briggs advises the urban activist to do three things to be effective: 1. Stay healthy; 2. Meet your neighbors; and 3. Get a project. Here's a success story from one of the continent's biggest cities.

Richard Griffith

In the spring of 1997, I was a member of a small environmental organization in suburban Toronto. Our office was located in an anonymous strip mall on the north side of Eglinton Avenue, a busy commercial artery, and was surrounded by huge apartment blocks. Right next to the office, however, was an island in the sea of concrete: a seven-acre patch of grass owned by the board of education, and reserved for a high school. For some reason, the school had never been built, and we sensed an opportunity. We approached the board and asked them for permission to use the land for a garden. "Fine," they said, "You may have it for five years. Just don't ask us for any money!"

We were delighted with this response. That splendid donation was the first important step forward. It was the "garden." Now, all we had to find was the "community." At this point, however, we differed about tactics. One fellow wanted to head right out there the very next Saturday morning and start ripping up sod, practically with his bare hands. The rest of us admired Charlie's enthusiasm but realized we needed another approach. He was a member of the environmental group but he didn't even live in the immediate area. In fact, none of us did. We knew that, to have any hope of success, the garden could not be foisted on the community; it had to come from the community. We told him that we had to be patient; that it was probable that no gardening at all would take place in this, the first year. None of the groundwork had been laid, so to speak. Charlie didn't like this kind of talk, and he eventually stopped coming to the meetings. That was unfortunate, but the rest of us agreed that we had to move forward.

photo credits Richard Griffith

Imran Amin delights in the new garden.

In May, we printed 100 flyers and distributed them to many local apartment buildings, businesses, schools, and libraries. We also announced our intentions at a meeting of the Scarborough Hunger Coalition, another local group with influence and ties to more NGOs. At the first meeting, held in a local school at the end of May, seven people showed up. Not many, but enough. Those who attended included local residents Ken and Vanetta Ferguson, and Cathy Cooke, from the Scarborough Health Department. The second meeting, held in July, attracted a few more people, including Kathy Hoover, from the Toronto Housing Authority.

A key element of our success was our ability to attract and hold on to these extremely able and useful public servants. Cathy and Kathy both knew how to write letters, make sales pitches, and obtain support from higher-level bureaucrats and from potential funders. Equally supportive was the parks department, which immediately understood what we were trying to do and gave us all kinds of assistance. Soil tests, which were contributed by a local university, had told us that the land was free of contaminants, but that it was high in clay and contained very little organic matter. In fact, it was virtually hard-pan. In November the parks people mechanically plowed up 8000 square

feet, a truly daunting task if we had had to do it manually. The owner of the McDonald's next door agreed to provide another vital contribution: water.

We continued to meet one night a month all winter, but it was so difficult to sit still! We looked for and obtained donations of seeds, seedlings, tools and a fence. We held a contest in the local schools to find a name and logo for the garden. "The Always Growing Garden" was the winning name. In April, the parks department returned with the rototiller, and then dumped topsoil and compost at the site.

Significantly, nearly all the gardeners live in the neighborhood, so it is easy for them to visit every day. Some of them can even see the garden from their own windows, which adds an additional measure of security. There has been some degree of theft, but very few cases of actual vandalism, which is perhaps the worst threat to a budding community effort. But the only real answer to theft or vandalism is to invite more people to become participants. More participants means more eyes in the garden itself, and it also translates into a greater degree of emotional involvement.

Nalek and Roslen Ressani show the healthy alternative to fast food

In May 1998 we held our first official work day. The plowed area was divided into 20 plots, each of 200 square feet. There was also a large "common area" in the middle, which we filled with sand. Each plot was assigned to a family or an individual, for the nominal annual fee of five dollars. The gardeners had to sign a form promising not to use any chemical fertilizers, herbicides, or pesticides. It had been exactly one year since that original meeting of only seven people!

Those first months had moved quite slowly and at times it was easy to imagine that the garden would never amount to anything. But if you're persistent enough to get the ball rolling, it can pay off eventually. In the spring and summer of '98, we obtained generous donations from many sources. One nursery delivered whole flats of tomatoes, onions, cucumbers, hot and sweet peppers, asparagus, raspberries and strawberries. In July we were awarded $500 from the "Scarborough Heart Health Network," and then in the fall, a huge award: $8000 from Canada Trust. Much of this money went to pay for a permanent fence.

When people are allowed to have a say in the decision-making process, they begin to think of it as their garden and their land. Long-term security doesn't come from fences, it comes from a sense of community ownership.

Starting out with very little, we had come a long ways. Besides a good idea and enthusiasm, and the help of capable people, one thing we had going for us was visibility. A lot of eyes were on us and as the changes we brought to the area were positive, we drew a lot of good feeling. Once the positive energy cycle began it took very little effort to ramp it up: everybody wants to be part of a successful project. It is important to note, however, that none of the donations would have materialized without considerable thinking and planning on our part.

Two years later, the group is still gaining in numbers, confidence, and organizational skills. In fact, there was such a long waiting list that the garden actually doubled in size in 1999. The latest addition is a beautiful wooden gazebo, donated by a lumber supply store and built by local carpenters. The garden is now feeding dozens of people, and is certainly one of the loveliest sights on drab old Eglinton Avenue.

"The Always Growing Garden" has become exactly that. Δ

Richard Griffith helped organize the Permaculture Community Action Worknet in Toronto, where he resides part-time. A peripatetic carpenter and sometime permaculture teacher, he is building a straw-bale home north of the city. Contact <mulchman@web.net>

Co-Intelligence to the Rescue

Jerome Osentowski

I came to Permaculture with the experience of several years of market gardening in the high semi-arid region of Colorado. As my skills in teaching and applying permaculture design developed, I kept my hands in the soil, but the shape of my garden changed. The system of intensive production I had developed, based on greenhouses and beds of salad greens, gradually gave way to an edible forest.

The evolution from market gardening to permaculture forest gardening was a natural process. One by one, I mulched out the market garden beds and replanted them with forest garden guilds. In his book, *The Forest Garden*, Robert Hart defines a forest garden as "an attempt to imitate the natural forest eco-system, comprising a wide diversity of plants, occupying seven levels or 'storeys,' but unlike the natural forest, almost all its plants have been carefully chosen to meet human needs." Referring to his homeland, Patrick Whitefield, author of *How to Make a Forest Garden*, expressed this more directly when he wrote, "...a forest garden models an English woodland."

In more recent years, I have redefined Forest Gardening as: "A low-maintenance, productive system of mostly perennial plants, mulched with six inches of leaves in the late fall, that lies dormant under a foot of snow during the winter months while I catch a ride on the tail feathers of the last Canadian goose heading south."

And south is where I headed this winter. In December I spent three weeks in the cool temperate rain forest of southern Chile, working on the design for an eco-tourist

facility. Then I was off to the humid pampas of Argentina to teach a five-day workshop on forest gardening and greenhouse design. This was at the Gaia ecovillage in Navarro, 100+ kilometers southwest of Buenos Aires.

Drifted on the further shore

Once arrived, I unpacked, settled into my room, and found myself very disoriented with yet another change of climate and bioregion. It was a sweltering 100°F (38°C) outside, with the humidity at about 100% too. The only relief was in my room, which was insulated by a massive thermal shield of bricks and which retained some of the cool air from the previous night. In that moment, I wasn't sure what I was doing there and didn't have a clue as to how to go about teaching the course. This was a whole different place, a whole different culture, and a whole different ball game.

Laying down on the bunk, I picked up the latest copy of *The Permaculture Activist* (#42), which my host, Gustavo Ramirez, had given me, and started to read. First, I turned to Peter Bane's article on the Navarro community in the "From the Regions" section. After reading it, I began to get a sense of the place. He made it all sound great. He was wishing he could be there, and, to tell the truth, at that moment I would gladly have traded places with him! After finishing Peter's article, I turned to Tom Atlee's articles on Co-Intelligence.

That's when the lights went on. Atlee's essay put it all together for me. All I had to do was tap into the collective intelligence of the group and everything around me, share the experiences and resources I had to offer, and the rest would be magic!

Well, I'm not a complete stranger to how group energy works, but I hadn't completely opened myself to the process in a classroom situation where I was the teacher. I could write a doctoral thesis on Mollison's phrase, "Everything gardens," but hadn't had much success with gardening people. Even though I had co-taught numerous Design Courses, and many more Permaculture workshops, on only a few occasions had I felt the kind of magic that the co-intelligence article talked about. Here was my chance to test the theory.

What hadn't hit home for me was that each and every interactor had an equal part in the process of creating the garden. The thistles' work was as important as the teacher's. "Co-intelligence... this dance of mutual gardening, of co-influence, of co-creativity..." and the idea that "... we, as leaders, are peers with the other co-creative organisms in the garden/community, as responsive as we are causative," were the keys I needed to bring into my classroom to teach in a truly holistic way.

Now, I just needed to open myself for this process to kick in during the workshop. The article was a catalyst, just the inspiration I needed to get started. Having read Attlee and Peter's briefing on the ecovillage, I made a plan. I would commit myself to the co-intelligent model.

Using hay to control the grass

A cast of characters

As it turned out, 20 people showed up on short notice to learn about forest gardening, with another ten people there as supporting staff. The creative charge was so great that the three-hour lunch and siesta were needed as much to tone down the group energy as to digest lunch and beat the heat. I knew we were off to a great start. But besides the folks in the workshop, the co-intelligent community we were working with included the village residents, the land, and the plants and animals of the area. If forest gardens were to happen here, they would have to grow out of all those voices together.

Navarro is near the center of one of the world's great cultivated grasslands, the pampas. To grow anything, whether garden vegetables, arable crops, or edible forest species, the ecovillagers had to deal with the grass. A tenacious variety of couch grass was their public enemy #1. It had thick roots and long runners and it kept coming back. So developing strategies that would keep the ground covered long enough to kill out the grasses was of the utmost importance.

Some of the intelligence we needed was already in use. Gustavo, his partner Sylvia Balado, and the other community members had been working on the vegetable gardens for over four years. They had also started planting out areas into Forest Garden, and had come up with many great ideas that were working in the conditions and soils of the farm with minimum effort and input. Gustavo is a good example of someone who sits back and patiently analyzes a process to see how little he can do to get the desired results.

Solutions at hand

They used a method that worked well for them: they began creating garden beds by rolling out at least two to three layers of hay from large bales cut for them by a neighbor. These were perfect for mulching large areas and were grown right on the property—nothing imported. The mulch beds would then be planted with sweet potatoes. The yields from this strategy are four-fold: 1. Build soils under mulch. 2. Mulch and sweet potatoes help shade out grasses. 3. Harvest a good crop of sweet potatoes. 4. Propagation material for sweet potatoes to be planted in another area to continue this process. The following season, more mulch would be added to the new bed, and it could either be planted into a forest garden or left as a mulched annual garden. They had proven the worth of mulch gardening under the most challenging conditions imaginable and they had been successful because they had kept at it.

Gustavo was especially proud of his

Mulched Three Sisters Garden. After rolling out three layers of mulch from the large bales he planted corn, beans, squash, and melons. These further shaded out the pampas grasses, and yielded bumper crops to boot.

In other areas we took our cues from the healing work begun by the plumeless thistle. Tapping into the collective intelligence of the thistle we recognized that it had already been at work for several years, pulling up minerals from the sub-soil, laying down the minerals in its mulch, building top soil, and choking out

The group produced strong designs.

the "Evil Grasses." This wouldn't be obvious to the casual observer. It would be easy to see the thistles as "noxious weeds," when in fact they were a good example of that permaculture adage, "The problem is the solution." By bush-hogging the thistles and covering the residue with two or three layers of hay from the big rolls the area was quickly prepped to plant a forest garden. We also had the collective intelligence of 20 bright, eager, willing, and excited course participants. We pooled our collective experience, cut back the weeds, rolled out the bales, spread the manure, and planted out the guilds. All I had to do was sit back and enjoy the ride.

Drawing on the Group

At one point, it was too hot to do this mulching stuff out in the sun, so we retreated into the shade of the acacias. We began talking about different ways of killing the grass. Inez, a veterinarian from Missions Argentina working in the north of the country, said some of the farmers in her group were having success using a variety of peanuts for beating back their grasses. That reminded me of a small, wild peanut that grows in the Brazilian Amazon and is now being used in Honduras and other places as a cover crop for pineapples. Gustavo told us that he thought laying down some brush before the mulch would make the mulch a little more effective because the grass would then have to grow a little higher to reach the sunlight. The next time we rolled out the round bales of hay, we first put down a layer of cut thistles or acacia branches to test Gustavo's theory. The co-intelligence of the group was working again.

Listening to the land

Another key came from asking a question Patrick Whitefield posed: "What does the land want to return to?" In the wooded area surrounding the gardens a tree legume, white acacia, had shaded out the grasses. The land was wanting to return to woodland. So, our strategy was to tap into the co-intelligence of the white acacia and co-create an edible woodland. We would not interfere with this reforestation in-process, but rather co-create with it by adding edible species to complete forest garden guilds. We did this by making small openings in the canopy to allow enough sunlight in to establish the new species.

Co-intelligence is available to us everywhere, but we have to learn to listen for other voices, to hear the music of the land as it begins to heal. For me at Navarro, these insights began to come when I went into the woods just to clear my head from the torpid summer heat. Paths meandered among the white acacia, black locust, and eucalyptus. The bird song was deafening. Here was a landscape that had been devastated. This 20 hectares (50 ac) surrounded an old powdered milk factory. Cattle had run over it for years. To one side the land was waist-high in thistles, to the other it was planted in transgenic sunflowers. Everything seemed chaotic. Yet to eyes that were open to see it, there was a richness returning. Doves and pigeons were nesting everywhere, a great wealth of protein. Though the community was vegetarian, my mouth was watering! Where the cattle had been taken off the pastures, seven or eight species of umbels had come in. These were providing a banquet for the beneficial insects. The gardens of the ecovillage were surrounded by an unseen army of allies keeping pests at bay. They were buffered by these incipient natural processes and they probably didn't even realize it. At the fence lines the neighbor's cattle stood and looked longingly at the diversity on this side. An iguana took to begging at the kitchen door for banana peels. In a sea of devastation, the Gaia ecovillage was a riot of life!

It was evident there was already an artist out there preparing the forest garden beds for us; laying the groundwork for paradise to return: choking out the weeds. Gustavo and crew, the plumeless thistle, the white acacia, the sweet potatoes, and the three-sisters gardens were well on their way to creating forest gardens right in front of our eyes. Reading the landscape you could see it. But conventional agriculture would miss this and would either burn it down or plow it up, wasting all the richness that had been slowly accumulating.

Even now Navarro returns to fill my dreams. I draw great hope from what I saw there. The work at Gaia shows that ecovillage communities can plop down in the most unlikely places and make it happen! Δ

Along with Gustavo Ramirez, Peter Bane, and a team of local experts, Jerome Osentowski will lead a course a Permaculture Design Course in southern Chile in February 2001. For more information please visit <http://www.crmpi.org>, or contact Central Rocky Mountain Permaculture Institute, Box 631, Basalt, CO 81621. Tel/fax: (970) 927-4158. email: jerome@permaculture.net.

Sylvia Balado (2nd from left) and friends helped feed us well.

Movement Musings

Agroforestry Pioneer Dies in Britain

Peter Bane

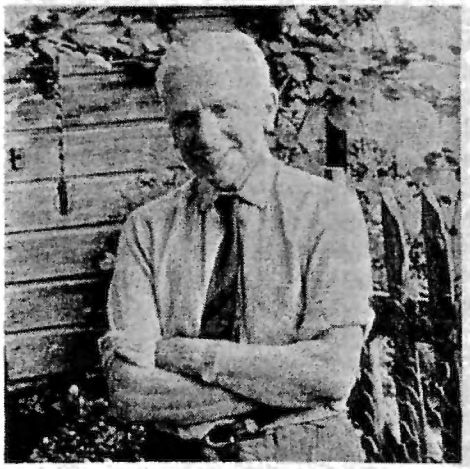
Robert Hart died peacefully on 7th March 2000 at a nursing home in Church Stretton, Shropshire. He had been ailing for the past few years.

Best known as the author of *Forest Gardening*, and with South African J. Sholto-Douglas, coauthor of *Forest Farming*, Hart was a quiet visionary man dedicated to Gandhian principles of non-violence who had a profound impact on the permaculture movement with his demonstration and advocacy of multi-layered perennial cropping systems for cool climates. On a tiny holding in the English West Midlands near the Welsh border, he cultivated fruit, nut, and herbaceous perennial crops for over 30 years, putting into practice his forward-thinking ideas for the regeneration of agriculture.

Robert when I met him in 1993 at Wenlock Edge was gracious and unassuming. He welcome me, my young daughter, and travelling companion Chuck Marsh with the same courtesy and generous spirit he showed to thousands of pilgrims—for that is what we were—over the years. Then in his seventies (it appeared), Robert still exuded a robust vitality that belied the weakness and hardship of his early life. He shared the simple surroundings of his cottage, showed us the gardens, which were a tangle of edible plants, and reported on his latest correspondence. Though living essentially a peasant's life, Robert remained at all times engaged in a very worldly conversation with individuals from many countries.

Though personal travails, from illness in childhood to the burden of caring for his disabled brother to unpleasant relations with the neighbors who owned his house, undoubtedly brought suffering to Robert's life and kept him bound, especially in later years, to a very limited physical world, he transcended those limitations to achieve a lifework of great importance. From his two acres in Shropshire the sphere of influence he created was enormous. The image of the forest garden, which was his great gift to the world, not only brought agroforestry and tree-cropping within the reach of ordinary people in Britain, Europe, and North America, it proved that permaculture could work in cool climates, that it was not just a solution for deserts and tropics.

Hart reached out to the world from his



Robert A. de J. Hart

relative isolation with the vision and power of his ideas. Besides the two works for which he is best known, he authored two other books which spoke to his fundamental concerns for right relation between humans and the earth. *The Inviolable Hills*, published in 1968, offered a plan for regeneration of the British uplands. Well ahead of the main wave of environmentalism, Hart foresaw the importance of restoring "natural capital" to a future humane society, and called attention to the root connection between human life and the soil. *Forest Farming* with Sholto-Douglas was published in 1973, expanding awareness of tree crops as a global solution to the crisis of growing population and eroding soils. A third book, *Ecosociety*, published in 1981, was more openly a work of spiritual ecology, elaborating the lines of a society that would in fact care for the earth rather than exploit it. And of course, *Forest Gardening*, which began as a small pamphlet issued in 1987 under the title *The Forest Garden*, summed up the essential message of Hart's life. He showed as much as expounded, how one individual on a small plot of land could apply the core principles of ecology and personal responsiblity to make a better world.

Quietly at work since the late sixties growing a seven-story agriculture in his back yard, Robert was ready when the students appeared. The bridge to earlier researchers and teachers in the same tradition (J. Russell Smith, Kagawa Toyohiko) that he offered to young cultural visionaries was invaluable. Andy Langford, one of the lead teachers and designers of permaculture in Britain, writes that when he met Robert in 1986 and saw Wenlock Edge, he drew great strength and inspiration for the daunting task of teaching permaculture. He credits Robert as one of his main mentors and a very real support for the whole permaculture movement in Britain today. Robert welcomed this attention, opening his smallholding to visitors through inclusion in *The Permaculture Plot*, and came in later years to be viewed by British permaculturists as a treasure.

Robert's legacy is the hundreds and thousands of forest gardens across the planet that have sprung from his words and his example. His friends mourn the world's loss and celebrate an abundant future which Robert's vision and his work have helped to bring into being. Δ

Peter Bane publishes The Permaculture Activist, *and teaches permaculture design from his home at Earthaven Village in the Blue Ridge Mountain of North Carolina.*

Permaculture International Journal to Cease Publication After 21 Years

Permaculture International, Ltd., the charitable trust that publishes *Permaculture International Journal*, has announced that issue #75 of the 21 year-old magazine, to be published later this month, will be its last. Directors concluded, at a meeting on March 30, that the new Australian goods and services tax (GST), commencing 1 July 2000, would place too great a strain on the organization financially and administratively.

P.I.J. was launched in 1979 by Terry White, and was for many years the flagship publication of the permaculture movement worldwide. Terry set a standard for creativity and usefulness that inspired other permaculture advocates to undertake the necessary but ill-paid work of maintaining visibility, communication, and networking among a far-flung and very thinly spread community of designer-activists. The middle '80s saw journals launched in the U.S. (*The Permaculture Activist*, *Permaculture Drylands Journal*) and Britain (*Permaculture News*, now succeeded by *Permaculture Magazine*). In 1990, *The Permaculture Edge* joined this tiny club of essential publications.

Meanwhile, Terry stepped down from the editor's chair at *PIJ* after 28 issues and Robyn Frances took over. She reorganized the magazine as part of PIL, and attracted more staff. Efforts were made to reestablished lapsed links to the U.S., and the formal cooperation between this magazine and PIJ dates from that

era (1991). The highwater mark of the *Journal* may have been the years from 1991-96. Shortly after broadcast of *The Global Gardener* series on Australian national television, public interest in Permaculture exploded in that country and circulation of the *Journal* jumped from about 3,000 to over 40,000 in a few months. Riding this wave of popular and financial success, Steve Payne and a new editorial team launched a major effort to extend the *Journal's* worldwide reach and keep it abreast of its expanding constituency. Senior staffer Andrew Bodlovich travelled the globe in 1993, visiting projects in most major regions, and meeting at the Fifth International Permaculture Conference in Scandanavia with representatives from four of the five international magazines then being published (only the *Drylands Journal* was absent). Higher levels of cooperation and mutual understanding grew out of this meeting with co-distribution, exchange of articles, and much goodwill.

The *Journal* expanded its page count, increased its catalog offerings of books and other resources, and pressed distribution internationally, entering the U.S. newstand market independently of its long-standing arrangement with Pc Activist. Advertising content increased and from all appearances things were going well for several years. The attempt to transform PIJ into a "mass-market" magazine, however, (remember that its Australian circulation was equivalent to a U.S. magazine of 500,000), introduced tensions within its core readership and possibly with staff. The editorship changed again as Steve Payne stepped down and Eve Sinton took on the job. The difficulty of maintaining relevance for a worldwide readership (and thus fulfilling its name and its historic role, grew manifest as increasingly sophisticated journals in the U.S. and Britain made *PIJ* marginal in those large English-speaking markets, while Internet communication offered alternative access to news for many readers. The *Journal's* largely Australian focus was enhanced by an internationalist perspective and enlivened by occasional reports (usually by Australian travellers) from hotspots around the globe: Cuba, Kosovo, Brazil. Yet the magazine, whose fortunes had risen so precipitously on Bill Mollison's media coattails, appears fated to follow its famous benefactor and fan (Bill writes that the *Journal* is his favorite reading material) into quiet retirement. Its voice will be missed.

Pc Intl. Ltd. will continue as a non-profit organization providing information and networking services, as well as ongoing support for permaculture projects. The exact nature and scope of PIL's future activities, however, will not be determined until a new Board of Directors is elected at mid-year.

U.S. subscribers with prepaid issues beyond #75 may claim a credit or refund from Permaculture Activist (details will be sent by letter). Selected back issues from #47 to #75 are still available at $6 postage paid, orders of five or more get a 20% discount. Δ

EVENTS

Permaculture Design Courses Southern Indiana

Permaculture Fundamentals
Dates: •June 9 - 18

Permaculture Design Practicum
Dates: September 8-16
Location: Bloomington, IN
Instructors: Patricia Allison, Mollie Curry
Contact: Beverly Skinner
Turtle Island Center
1916 Arden Dr.
Bloomington, IN 47401
812/330-9010
blessbe@aol.com

Permaculture Design Course Central Iowa

Dates: June 5-29, 2000,
Location: Maharishi University of Management, Fairfield, IA.
Contact: Michael Lockman,
PO Box 45472
Seattle, WA 98145
(206-459-7022)
michaellockman@juno.com
www.sustainablelivingnews.com

Permaculture Fundamentals Orangeville, Ontario

Dates: May 30-June 7
Description: The basic Permaculture material presented in eight days of community building with hands-on examples and the stimulus of eager learners from far and near. Subjects include ethics, principles, and patterns, natural systems, cultivated ecologies for home and community, plants & animals, water, waste & energy, financial systems, and settlements for town and country. The Ecology Retreat Center is located is on the Niagara Escarpment, a beautiful and diverse natural area one hour north of the Toronto Intl. airport.
Cost: Cdn$900, includes tuition, material, all meals, dormitory accommodation, and subscription to *The Permaculture Activist*.
Contact: Russell Scott
Ecology Retreat Centre
RR #1, Orangeville, Ont.,
Canada L9W 2Y8
519-941-4560
ecorc@ionsys.com

Permaculture Design Practicum Texas Hill Country

Dates: Oct 6 - 14
Location: Dripping Springs, TX
Instructor: Patricia Allison
Contact: Mary Talbot
100 Hill Cove
Dripping Springs,
TX 78620-3533
512-894-3605
peacefulhill@earthlink.com

14th Annual

Permaculture Design Course Central Colorado

Dates: August 19-29, 2000
Location: Basalt, Colorado
Description: A full certificate course presented at our high-altitude demonstration site. This is one of the most mature forest gardens in North America and most of the food served at the course will come from our garden and greenhouses. Training inludes Permaculture philosophy and design, observation skills and site analysis, natural cycles and pattern recognition, mapping and surveying, soil building, erosion control, composting, ponds, swales, and keyline systems, animals and their place in the landscape, agroforestry management and tree crops, local self-reliance, appropriate technologies, marketing strategies, medicinal herbs, Integrated Pest Management, greenhouse and other building technologies, forest gardening, and much more. Join our expert instructors from around the country for this incredible opportunity.
Instructors: Jerome Osentowski, Director CRMPI - John Cruickshank, Appropriate Technology, Sunrise Ranch - Ken Kuhns, Local CSA Farmer - Scott Chaplin, Water Conservation - and others.
Cost: $800-$850, sliding scale, $100 non-refundable deposit, $50 discount for registration by June 30, $100 couples discount.
Contact: Central Rocky Mountain Permaculture Institute
PO Box 631 Basalt, CO
970-927-4158
jerome@permaculture.net
www.crmpi.org

Permaculture Design Courses: Blue Ridge Mountains, NC

Permaculture Fundamentals

Dates: July 7 - 15

Village Design Practicum

Dates: August 11-19

Description: Unique comprehensive natural design courses at Earthaven Ecovillage. "Fundamentals" includes Principles; Climate; Soils; Plants & Animals; Energy/Water/Waste; Developing Settlements; Urban Applications, more. Lecture, discussion, hands-on practice. "Practicum" completes Design Certificate requirements with mentored small group design projects, and covers Fieldwork; Meta-Systems; Community Design; Broadscale Landscape; Project Management; Earning a Living.

Instructors: Chuck Marsh, Peter Bane, Patricia Allison, Andrew Goodheart Brown, Keith Johnson, and guests.

Cost: $600-800 each course (camping, meals, materials, tuition).

Permaculture Work-Study

Dates: July 5 - August 19.

Description: Summer residency at Earthaven combining certificate courses above with four weeks' directed work projects applying design skills and techniques. Spend summer in the mountains. Help build a village. Anchor learning with action for self-reliant living! Application with references required.

Cost: $1800 (camping, meals, materials, tuition).

Contact: Culture's Edge, 1025 Camp Elliott Rd., Black Mountain, NC 28711
828-669-3937, culturesedge@earthaven.org, http://www.earthaven.org

Permaculture and Community Workshops in Northern, MI

The Eco-Learning Center at Ndibendaagwaz is one of a growing number of models of experiential education with focus on the harmless integration of human activities into the natural world. We aim to preserve a sustainable oasis in which ordinary people can explore the extraordinary task of growing organic food, building natural shelter, using alternative energy, practicing sustainable economics, developing sustainable community, and living a healthy and joyful life as an Earth-centered culture (Permaculture).

Building Sustainable Community

Dates: June 23rd-25th

Description: Participants will work together in guided activities from which the concepts of community will emerge. As a result the group will define for itself what is means to be sustainable.

Instructor: Steve Niezgoda, 21-year community member at Skywoods Cosynegal and co-presenter at The Farm (Tennessee) and Earthhaven (North Carolina).

Cost: $135

Permaculture: An Overview

Dates: August 19-20th

Description: This is the introductory portion of the basic course for understanding Permaculture Fundamentals grounded in theory and practice. It provides participants with the same beginning information as students who will continue in the intensive program that will lead to certification (see next listing).

Instructor: Jillian Hovey

Cost: $200

Permaculture Fundamentals

Dates: August 19-27th

Description: This is the intensive course for those who wish to accomplish certification. This basic program follows a rich curriculum that will cover the first half of the two week Permaculture Design Certificate, and will include hands-on experience.

Instructor: Jillian Hovey

Cost: $650

Permaculture Design Concepts (Practicum)

Dates: August 26th-28th

Description: A hands-on design weekend in which students will create and execute a project that brings the Permaculture Fundamentals coursework to life. For those students working on certification, this will be the start of your required one week Design Practicum. The Permaculture Fundamentals, or the introductory weekend, are a prerequisite.

Instructor: Jillian Hovey

Cost: $200

"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn."

Contact: Jayne Leatherman Walker
Ndibendaagwaz, an Eco-Learning Center
10277 E. Bingham Road, Traverse City, MI 49684-9551
email: walke106@pilot.msu.edu

Permaculture Design Course Northwestern Pennsylvania

Dates: August 6-20

Location: Sandy Lake, PA

Description: An intensive course aimed at training participants as permaculture design apprentices. Three Sisters Farm is a 12-year old bioshelter / market garden farm in rural W. Pennsylvania. Students will participate in planning and design of our pond and gardens, evaluation and application of appropriate technologies to the bioshelter, and further addition of perennials to our landscape.

Instructors: Darrell Frey has studied and practiced permaculture design since 1980. Co-designer of Three Sisters Farm and consultant to the Harmony Homestead at Slippery Rock U., Darrell has over ten years experience teaching PC.

Costs: $750 includes food, camping and course materials. Textbook, *Permaculture: A Designers Manual* required reading. (not included in fee). Please pre-register with $100 deposit by July 1.

Contact: Darrell Frey
Three Sisters Permaculture
134 Obitz Road
Sandy Lake, PA 16145
defrey@bioshelter.com
724-376-2797
www.bioshelter.com

4th Annual Oregon Permaculture Gathering

Dates: September 22-24

Location: Dexter, OR.

Description: The Eugene Permaculture Guild and Lost Valley Educational Center aresponsoring a three-day conference for those interested in permaculture and sustainable agriculture. This weekend gathering will offer educational and networking opportunities including hands-on demonstrations, workshops, presentations, slide shows, and roundtable discussions, all centered around sustainable and self-reliant living. Topics covered will include an introduction to permaculture design, soil ecology, composting and sheet mulching, bekeeping, tool care, hedgerow and shelterbelt development, small pond building, wild food harvesting, and much more.

Cost: $50-100 sliding scale

Contact: Lost Valley Educ. Center
81868 Lost Valley Lane
Dexter, OR 97431
541-937-3351
www.lostvalley.org
permaculture@lostvalley.org

Permaculture at Lost Valley Educational Center
Willamette Valley, Oregon

Practical Permaculture Intensives

These week-long intensives will be focused on work appropriate for the season. Permaculture Design Course graduates will find the Intensives excellent opportunities to incorporate and apply what they learned in the Course. Take one session or any combination.

Summer Intensive

Dates: June 18-24

Description: Permaculture principles and design methods, irrigation design and setup, greenhouse operation, Spring garden preparation, native seed collection, exotics removal, patterns, beekeeping, chicken tractoring, small scale no-till grain production, swales and ponds.

Fall Intensive

Dates: September 17-22

Description: Harvesting and processing of fruit, berries, and vegetables, seed collection and saving, cottage businesses for urban and rural permaculturists, irrigation methods, beekeeping and honey extraction, grain processing, compost toilet design and use, edible landscaping, water catchment and greywater.

Cost: $500/week. Tuition includes organic vegetarian meals, lodging, access to Lost Valley facilities, and a full instructional program.

Permaculture in Community Apprenticeship

Dates: March - September

Description: Our future depends on our ability to live together lightly on the Earth. Permaculture is a new tradition which applies ecological wisdom to design sustainable living systems. It reflects Earth-centered, life-affirming values, using both ancient and modern knowledge. At Lost Valley you will have the opportunity to learn skills for creating a sustainable culture. Our apprenticeship provides hands-on instruction, lectures, field trips, and time for deep reflection. Apprenticeships are available from March through September. The minimum time commitment is one month.

Cost: $400-$550 per month, sliding scale, including organic vegetarian food and lodging. Partial scholarships may be available to those with limited funds.

Pond Construction Workshop

Dates: June 9-11

Description: Learn pond design and construction as we build a medium-sized (2,000 s.f.) pond on site. Rick Valley, an experienced pond maker and Permaculture teacher, and the Lost Valley Program teachers will be on hand to teach theory, design, and construction techniques.

Cost: $150-$200, sliding scale includes organic vegetarian meals & camping.

10th Annual

2-Week Permaculture Design Course

Dates: November 26-December 9
Lost Valley Education Ctr.

Description: This intensive two-week course brings together three of the Northwest's leading practitioners and teachers of permaculture. If you are seriously interested in permaculture, this course is a great way to dive in. Upon completion of the course, participants will be certified as Permaculture Design Trainees and entitled to use the term "Permaculture" in pursuit of a livelihood and for educational purposes.

Instructors: Rick Valley owns and operates Northern Groves Bamboo Nursery in Corvallis, OR. He is experienced with wetlands restoration, underutilized plants, culinary herbs, seed gathering, and fiber plants. Jude Hobbs owns Cascadia Landscape Design and also works with Agro-Ecology Northwest, researching and consultating with small-scale farmers. Toby Hemenway is a contributing editor of *The Permaculture Activist*. His background includes ecosystem, evolutionary, and molecular biology; conventional and natural building; gardening and forest farming; and appropriate technology. He is currently working on a book about permaculture sites in North America.

Cost: $850-$1050, sliding scale includes organic vegetarian meals and lodging.

Contact: Lost Valley Educ. Center
81868 Lost Valley Ln
Dexter, OR 97431
541-937-3351
info@lostvalley.org
(www.lostvalley.org)

Summer Courses in Social Ecology: Vermont

Planning, Design, and Construction for Sustainable Communities

Dates: May 26 - June 16

Description: Using the Institute for Social Ecology's 50-acre site as a laboratory, we will explore design principles and practical skills that can be applied to any task: a building, a garden, an orchard, or a campus. There will be demonstrations, hands-on projects, and discussions on: * Layout and Design Principles * Drawing, Drafting, and Mapping * Permaculture and Ecological Restoration * Construction Techniques * Principles of Sustainability * Organic Agriculture * Appropriate Technologies.

Ecology and Community

Dates: June 23 - July 21

Description: This month-long, intensive residential learning experience offers workshops and practica in the field of social ecology. Participants will study and live together in a community setting that reflects the ISE's belief in self-reliance, democracy, and participation. There are a variety of educational activities, from studies on activist history and strategies, to philosophical explorations of society and nature, to work in the gardens. Courses include: * Culture and Resistance in the Global Economy * Ecological Movements and Social Activism * Key Concepts in Ecofeminism * Radical Agriculture and Ecological Technology * Toward Directly Democratic Communities * Public Education and Community Action

The Institute for Social Ecology offers a college-level curriculum. This option is available as an outside educational program of Burlington College for an additional fee.

Contact: ISE, 1118 Maple Hill Rd.
Plainfield, VT 05667 USA
(802) 454-8493
ise@sover.net
http://ise.rootmedia.org/

Women's Intro to Permaculture

Dates: June 9-11
Location: Pragtri Farm
Arlington, WA
Contact: Jude Hobbs
541/342-1160.
hobbsj@efn.org.

4-Weekend Urban Design Course Seattle, Washington

Dates: July 7-9, 29-30; August 26-27; September 23-24

Description: Focused on urban design, community development, and a multi-disciplinary approach to sustainability, the course will be geared toward professional designers, planners, architects, social workers, landscapers, as well as nonprofit and municipal government employees. Offered for college credit through Antioch University, Seattle.

Instructors: Michael Lockman, Emily Heindsmann, Jonathan Scherch, and guests.

Cost: $1065 (for credit, ENC 969); $800 (General Fee for non-students)

Permaculture Rendezvous and Bog Toss!

Dates: July 14-16; $100

Location: Orcas Island, WA

Description: It's back! Join us on beautiful Orcas Island for a weekend of networking, education and hands-on work in the wetland. Anyone interested in Permaculture is invited to attend. The seminar will feature hands-on workshops with some of the region's most experienced Permaculture teachers. Limited to 75 participants. Register early.

Cost: $125. Student/Low Income: $100 Single Day: $50; includes camping, five meals. YOU MUST PRE-REGISTER TO ATTEND.

Permaculture Design Course Skills Intensive on Orcas Island

Dates: August 3-20

Location: Orcas Island, WA

Description: Using examples on the Bullock Brothers' 18-year old working farm, participants will learn to apply ecological design and permaculture while living it. Hands-on topics for this certificate course include: mapping, water systems, greenhouse operation, plant propagation, food forests and orchards, wetland restoration, wildcrafting, natural building, solar water heating, solar electricity, and ecovillage design.

Instructors: Douglas Bullock, Samuel Bullock, Michael Lockman, Emily Heindsmann, Toby Hemenway, and guests.

Cost: $1000 includes meals, tent space, materials, certification. Limited scholarships available. To register send your name, address, and phone number along with a $200 non-refundable deposit payable to WE-Design.

Contact: Michael Lockman
PO Box 45472
Seattle, WA 98145
206-459-7022
michaellockman@juno.com

Permaculture Design Course Andean Patagonia, Chile

Dates: February 15-28, 2001

Location: La Luz Permaculture Site
Anihue XI Region,
44°S, 73°W, Chile

Description: This certificate course will be taught at a 25,000-acre temperate rain forest preserve owned by the Juan Carlos Sydowski family. A small, low impact eco-tourist/educational facility is being designed and developed. The site is home to the new Permaculture Institute of Chile; this will be the first PDC ever presented in the country. Teaching facilities now under construction include a caretaker's house, meeting room, dormitory, and greenhouse—all located at an abandoned homestead on a beautiful tidal estuary. Taught in English and Spanish. Participants can arrive early and stay after the course to enjoy and explore this spectacular region at no additional cost. For more information visit www.crmpi.org.

Instructors: Peter Bane, Jerome Osentowski, Gustavo Ramirez, and others.

Cost: $800 includes Tuition, meals, dormitory lodging, and curriculum materials. Scholarships and tuition assistance available for Chilean citizens.

Contact: CRMPI, P.O. Box 631
Basalt, CO 81621 USA
(970) 927-4158
jerome@crmpi.org

Community Design Golden Bay, New Zealand

Dates: February, 2001

Location: Golden Bay, New Zealand

Description: Earthcare Education Aotearoa will offer a 3-week advanced course (plus an optional one-week "field practical") entitled "Design for Sustainable Community," for Permaculture designers and community development workers, at Tui Community in Golden Bay, Aotearoa/New Zealand. Attending to all facets of sustainability, with an emphasis on "social design," the course aims to equip Permaculturists with the skills and knowledge to work competently with community, ecovillage, and bioregional design.

Contact: Robina McCurdy,
Tui Community, Wainui Bay, RD1, Takaka, Aotearoa/New Zealand.
Ph. 03-525-8488; fx/-8659. robina@win.co.nz

7th Annual

Southeastern Permaculture Gathering Celo, North Carolina

Dates: August 3-6

Location: Arthur Morgan School
Celo, NC

Contact: Tony Kleese,
2525 Booker Crk Rd, 15H
Chapel Hill, NC 27514
919-929-5900

Networks & Resources

Seaweed Improves Pastures, Yields Healthier Livestock, Better Meat

The Stockman Grassfarmer reported in February on research conducted jointly by Mississippi State, Texas Tech., and Virginia Tech. Universities demonstrating that seaweed extract sprayed on pastures or seaweed meal fed directly to cattle resulted in better weight gains, improved carcass quality, and better resistance to disease. The research begun at Va. Tech. by Vivien Allen, began as a project to fight fungus infestation in tall fescue. Seaweed was effective in suppressing the fungus and produced other benefits.

Ascophyllum nodosum, applied in an extract at three pounds per acre stimulated the immune systems of cattle feeding on the sprayed pasture. Similar results were obtained by feeding seaweed meal directly to the animals. Δ

Web Resources for CSA Farms

compiled by Elizabeth Pike

http://www.terrafirmafarm.com/;
(My favorite—read the newsletters!!! Large graphics-slow loading, but worth it!)
http://members.aol.com/catalpacsa/index.html
http://www.eatwell.com/
http://asylum.sf.ca.us/pub/u/howitt/cauldron.html
http://www.geocities.com/NapaValley/5009/index.htm
(CSA members, not individual farm)
http://www.igc.org/frugal/lunableu.html
http://members.aol.com/joincsofc/index.htm
http://www.putney.net/csa/home.html
http://www.geocities.com/Eureka/Concourse/9700/index.html

Natural Building Resources

Timber Framers Business Council
PO Box B-1161
Hanover, NH 03755
603-643-5033 fx/-5044
<jerry.f.rouleau@valley.net>
www.timberframe.org

Natural Building Calendar

June 9-11. Traverse City, MI. Strawbale Construction Overview. Jane Leatherman-Walker, 231-620-4775.

June 12-July 28. nr. Taos, NM. Vaulted Straw Bale Construction. Women Build Houses, 1050 S. Verdugo, Tucson, AZ 85745. 520-206-8000. wbhwbhwbh.aol.com

June 18-24. Litchfield, CA. Women's Cob Mini-Symposium Earth Building Experience. Jace Crowe, PO Box 103, Litchfield, CA 96117. 530-260-2753 (wknds.only). cobalot@hotmail.com

June 20-25. Lake Elsinore, CA. Cob Garden Sanctuary. Cob Cottage Company, 541-942-2005. www.deatech.com/cobcottage

June 23-29. Lake Elsinore, CA. Cob Finishing Touches. Cob Cottage Company, 541-942-2005.

June 24-30. No. Vermont. Basic Cob & Carpentry. Cob Cottage Company, 541-942-2005.

June 25-July 2. Taos County, NM. "Build Here Now" Natural Building and Permaculture Convergence. Lama Foundation, PO Box 240, San Cristobal, NM 87564. 505-586-1269, fx/-1964.

June 25-July 3. Denmark. Cob, Thatch and Natural Building. Cob Cottage Company, 541-942-2005. www.deatech.com/cobcottage

June 25-July 8. Mayne Island, BC. Cob and Community. Cob Cottage Company, 541-942-2005.

June 27-30. Orangeville, Ontario. Strawbale Carpentry Workshop. Ecology Retreat Centre. 519-941-4560. ecorc@ionsys.com

June 30-July 2. Orangeville, Ontario. Strawbale Construction Workshop. Ecology Retreat Ctr. 519-941-4560. ecorc@ionsys.com

July 7-15. Denmark. Cob, Thatch and Natural Building. Cob Cottage Company, 541-942-2005.

July 10-16. Corvallis, OR. Basics of Cob. Cob Cottage Company, 541-942-2005. www.deatech.com/cobcottage

July 16-21. Traverse City, MI. Strawbale Camp. Jane Leatherman-Walker, 10277 E. Bingham Rd, Traverse City, MI 49684. 231-620-4775.

July 24-28. Occidental, CA. Natural Building: Floors & Plasters. Occidental Arts & Ecology. 707-874-1557, fx/-1558. oaec@oaec.org www.oaec.org

July 24-28. Eugene, OR. Finishing Touches: Cob Interiors. Cob Cottage Company, 541-942-2005.

July 24-28. Marshall, NC. Toolmaking for Woodworkers. Country Workshops, 990 Black Pine Ridge Rd., Marshall, NC 28753. 828-656-2280. langsner@countryworkshops.org

August 5-18. nr. Ottawa, ON. Cob Construction & Healing Architecture. Cob Cottage Co. 541-942-2005. www.deatech.com/cobcottage

August 6-11. Mayne Island, BC. From the Ground Up. Cob Cottage Company, 541-942-2005.

August 6-12. Nevada City, CA. Basics of Cob. Cob Cottage Company, 541-942-2005. www.deatech.com/cobcottage

August 11-20. Summertown, TN. Natural Buildings Immersion. Ecovillage Training Center, Box 90, Summertown, TN 38483. 921-964-4474 or 4324. ecovillage@thefarm.org

August 14-19. Mayne Island, BC. Cobbing On, the Next Step. Cob Cottage Company, 541-942-2005.

September 2-8. Port Orford, OR. Basics of Cob. Cob Cottage Company, 541-942-2005.

September 17-23. So. Central Michigan. Cob Building Intensive. Jane O'Mahoney, 824 Forest #D3, Evanston, IL 60202. 847-866-6316. omjane@hotmail.com

September 23-29. Orcas Island, WA. Basics of Cob & Healing Architecture. Cob Cottage Co. 541-942-2005. www.deatech.com/cobcottage

mid-October. Ojai, CA. Cob Construction & Fireproof Houses. Cob Cottage Company, 541-942-2005. www.deatech.com/cobcottage

October 21-27. Prescott, AZ. Finishing Touches on Strawbale Octagon. Cob Cottage Co. 541-942-2005. www.deatech.com/cobcottage

November 25-December 8. Tlaxcala, MEXICO. Traditional and Experimental Building. Cob Cottage Company, 541-942-2005.

LETTERS

Seeking Low Tech Answers

To whom it may concern:

I really loved your issue #41 on Natural Building; please do another issue along the same lines. One specializing in low-tech (no electric or gas) issues such as cold rooms, low-tech fridge, root-cellars, do-it-yourself composting toilets, pedal powered appliances, etc. would be excellent especially if some plans could be provided.

Also, could you please let me know where I can get *Keeping Warm with an Axe: A Woodcutter's Manual* by Dudley Cook? The review in your magazine did not say where to get it and I really need it. Thank you,

Clifton Schooley
#258-1857 W. Fourth Ave.
Vancouver, British Columbia V6J 1M4 Canada

Ed.: Thanks for the suggestions. Our reviewer gave no more information about Mr. Cook's book than we published, I regret to say, and is at last report travelling and not reachable. With a 1981 publishing date, the title's probably out of print. Might we suggest Inter-library loan?

New Forestry Sought for Southern Illinois

Dear Editor,

I thoroughly appreciate the quality work that you provide in the form of *The Permaculture Activist.* Although I am tardy with this compliment, I especially liked #40 - New Forestry.

I am the non-resident owner of land in Illinois—seven miles north of the confluence of the Mississippi and Missouri rivers. This land includes a timber stand that I would like to manage via the "uneven-aged Natural Selection Forestry" techniques of Orville Camp and using "light-footprint" log removal techniques such as horses.

I would like to know of any person who provides or knows of such services in that area. Thank you.

G. Frank Humiston
8835 Tamberley Way, Apt. A
Santee, California 92071-4264

Vegan Lifestyle Demands Mindfulness

Dear Friends,

Here is our renewal, as well as money for a gift subscription. Thanks for putting together a great publication. I'm always inspired and recharged after *The Activist* comes.

Thank you, too, for printing the letter from Skye. I am a vegan, and it initially upset me, but as I read the second part, I realized I basically agree with him. Veganism as a lifestyle (vs. a "diet") must encompass compassion for all animals, including humans. We should all strive to eat bioregionally, organically, and in season. We need to respect Mama Earth and lessen our footprint as much as we can.

To me part of being a vegan is actively avoiding exploitation, as Skye mentioned. We cannot buy from WalMarts or stuff made in sweatshops and pretend we are not fostering animal (human) cruelty.

Veganism is often a diet of affluence. But it is my hope that by eating low on the food chain and as simply as I can, I might be less of a strain on those who aren't affluent.

Skye is right about the bananas, margarine, etc. But eating meat or dairy doesn't preclude the use of non-local products. I won't pretending that I only use local goods—but I'm trying to do better. And that's what I hope we all do, no matter what our path.

Thank you, Skye, for inspiring me to speak up!

Aimee Dewar
Nashville, Indiana

New Lighting Technology

Dear Activists:

There is a company selling "full spectrum" digital lighting. It consists of red, green, blue (RGB) LEDs (light-emitting diodes), low voltage, switched on and off at very high rates to produce any color or colors you desire—16.7 million RGB colors continuously variable intensity output range. Power draw is very low. Life expectancy is 100,000 hours—11.4 years continuous! Perfect for off the grid!

Contact Color Kinetics, 50 Milk St., 17th flr., Boston, MA 02109. (888)-FULL-RGB or 617-423-999, xtn 287; fax /-9998. <www.colorkinetics.com> J. Derek Holte, Distribution Sales Manager, <JDH@colorkinetics.com>

To give an example of the efficiency of LED's: I bought my father a flashlight that uses three bright white LEDs. It produces a very bright soft unfocused light and runs 25-50 hours on one set of three AA alkaline batteries. That is over 10 times as efficient as conventional lighting!

Dave Springer
Newark, Delaware

Community Values

Dear Peter & Toby,

Ano ai kealoha.

Thank you for your issue on community-building. We greatly enjoyed the short article on the "Dark Side of Lost Valley," and laughed (from sympathy and comparable personal experience) at the trials and foibles of community building in our individualistic culture.

For a number of years, I lived in and wrote about communities in the U.S. and Japan, for magazines such as the *Modern Utopian*. Though their number was immense and their outlook extremely variable, communities in Japan had at least a common ideal or common cultural thread—Japanese were taught at an early age to work together, that each part, however humble, helped build and maintain the whole. Short of communities founded upon shared religious or spiritual beliefs, or often unhappily on charismatic personalities, communities in the US have been most often short-lived, or eventually stagnant.

Truthfully, for us, as a small Permaculture teaching and demonstration farm on Maui, our major problem has been the clash of ideals and simply the lack of intention on the part of our apprentices and co-workers. Too often, even with considerable "educational" background, there was a seeming lack of caring and consistency, not being able (or wanting) to follow through, or even to put tools away! Through the years, I felt pushed into a polarity where we would be hesitant about new interns and somewhat harsh in our reaction to what we perceived as carelessness and lack of concern.

What seems heartening (and deeply promising) about Earthaven, is the process of self-discovery and personal initiative on the part of the newer and younger participants in the community, the ability to take chances and to learn from their experiences.

Good on ya, mates.

Michael Howden
Kula, Maui, HI

Next *PCA* Issue #44: Earthworks & Energy

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Portable Dwelling Info-letter, about living in tents, yurts, domes, trailers, boats, remote cabins, other mobile or quickly-made shelters plus plans for simple low-cost, low-impact comforts and conveniences. Sample $1. 6/$5. Box 190-pa, Philomath OR 97370 -99

Apprenticeships

Back Issues of *The Permaculture Activist*

I, 1 July '85 Permaculture In Oz
I, 2 Nov. '85 Fruit & Nut Trees
II, 1 Feb. '86 Garden Design
II, 2 May '86 IPC 2 & PC Design Courses
II, 3 Aug. '86 Int'l PC Conference Program
II, 4 Nov. '86 Fukuoka; Keyline; Genetic Cons'vn; City Farms; Oceanic PC
III, 1 Feb. '87 Networking; Natural Farming; D-Q Univ.; Children's PC
III, 2 May '87 PC Restoration of Wild Lands; Design for Sacramento Farm
III, 3 Aug. '87 Annual Planting Cycle
III, 4 Nov. '87 Trees for Life
IV, 1 Feb. '88 Marketing PC Products; Bamboo; Home Wastewater Treatment
IV, 2 May '88 **Urban-Rural Links:** Economics & Community Development
IV, 3 Aug. '88 Social Forestry; Gabions; Jap. Org. Ag.; Prodc/Cons. Coops
IV, 4 Nov. '88 Multi-Story Tree Crops; Greening Dom. Repb; Runoff Gardens
V, 1 Feb. '89 Permaculture: A Designer's Manual; Tree Bank; Water in PC
V, 2 May '89 Plant Guilds; Roof Gardens; Small Livestock
V, 3 Aug. '89 Rainforest Conservation in Ecuador; Gaia; Weed Gardens
V, 4 Nov. '89 PC Def's; Water Conservation; Small Dams; Ponds; Keyline
VI, 1 Feb. '90 Household Greywater Systems; Soil Imprinting
VI, 2 May. '90 **Insectary Plants;** more Greywater; Land Use for People
VI, 3 Aug. '90 **Water:** Forests & Atmosphere; Catchment; Nepal; Pond Design
VI, 4 Nov. '90 **Urban Permaculture:** Ecocity Conf, Soil Detox, Suburbs & PC
#23† May '91 **Politics of Diversity;** Greenhouse Mkt Gdn; PC in Nepal
#24 Oct. '91 **Creativity in Design:** Examples; **Index Issues #1-23;**
#25 Dec. '91 **Design for Community:** CSAs, Restoring Forest; Garden Ecol.
#26 May '92 **Soil:** Our Past, Our Future: Fertility, Worms, Cover Crops
#27 Aug '92 **Integrating Pc:** Deconstructing Utopia; Grassroots Organizing; Garden Polyculture; Pattern Learning; Living Fences
#28* Feb. '93 **Structures:** Comm'ty Dsgn; LETS; Industry; Strawbale/Timber-frame Bldgs.
#29/30* July '93 **Networks:** Special Media Rvw; Rural Reconstr'n; Leaf Conc.; Comm'ty Food Initiatives; Pc in Palestine; Do-Nothing Ed'n; *Feng Shui;* Companion Gdng; Nature Spirits; Wilderness; Biogeog.; Network Theory; Pc Acad.
#31* May '94 **Forest Gdng:** Energy & Pc; Mushrm Cultn; Robt.Hart's F.G., Spp for N. Cal.; Alders; Agroforestry in Belize, China; Honeylocust; N-fixers
#32 April '95 **Animals & Aquaculture:** Rare Breeds; Animal Polyculture; Small-scale Cattle; Goat Dairy; Keyline; Ramial Woodchips; Feral Chickens; Bee Plants; Constructed Wetlands; Reed Bed Sewage Treatment
#33 Dec. '95 **Cities & Their Regions:** Green Cities; Independent Regions; LA Eco-Village; MAGIC Gardens; CoHousing; City Markets; City Animals; Micro-Enterprise Lending; Suburban conversion; Rails-to-Trails
#34 June '96 **Useful Plants:** Bamboo Polyculture; Medicinals; Pest Control; Root Crops; Oaks; R. Hart's For Gdn; Russian Plants; Regl. Plants; Sources
#35 Nov. '96 **Village Design:** Pattern Language; Consensus Democracy; Conflict; Historic & New Villages; Planning for Tribe; Earthaven, NC; Design for Catastrophe; Youth; Vill. Economics; EcoForestry; Natural Bldg.
#36 Mar. '97 **Climate & Microclimate:** Climate Change; Microclimate Primer; Weather; Windbreaks; Low-Tech Sun Locator; Drylands; Cool Slopes; Subtropic Forest Gdn; Straw-Clay Bldg.; Round Beehive; Water Catch.
#37† Sept. '97 **Tools & Appropriate Technology:** Dowsing; Workbikes; New Energy Scythes; Japanese Saws; Start a Nursery; Ferrocement; Greywater; A-frame & Bunyip Levels; Ram Pump; Solar Moldering Toilet; Log Yoke; Green Woodworking; Cookstoves...
#38† Feb. '98 **Economic Transformation:** The Speculative Economy; No Middle Class Pc?; Worker-Owned Coops; WWOOF; No Money!; Global Warm-What Profits?; Holistic Financial Planning; Land Use; Adopt-A-Hive
#39† July '98 **Knowledge, Pattern & Design:** Pc: A Way of Seeing; Sand Dunes; Native Conservation.; Language, Worldview & Gender; Pattern, illus.; Patterning as Process; Land-Use Planning; Teaching Pc; Vietnam; Tree Sculpture; DC Youth Design; Holmgren on Pc Movement
#40† Dec. '98 **New Forestry:** Regl. Devlpmt., Horselogging; Menominee Resv'n; Forest Investing; Restoration; Old Growth; Homestead Tenure; Forest Soils; Forest Farming; Woody Agric.; Rainforests; Windbreaks; Coppice
#41* May. '99 **Natural Building:** Oregon Cob; Cordwood; Bamboo; Thatch; Ethics; High Winds; Origins of Conflict; Greenhouses; Ponds; Adobe; Road-Building; MicroHydro; Bldgs. That Live; Under $20K Houses; Dreams
#42† Dec. '99 **Self-Reliance & Community Cooperation:** Co-Intelligence & Self-Orgn.; Archetype Design; Sovereignty; Samoa; Mondragon; Natural Housing; Comm. Gdns.; Zone Zero; Solar Electric Tractor; Beekeeping

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Apprenticeships available at our biodynamic family farm. Features: small CSA, hens, bees, reforestation. Help needed April-October. Robin Mallor, Three Roods Farm, 4281 Our Acres Dr, Columbiaville, MI 48421. Or email: robin@blclinks.net -43

Education

Accredited Permaculture Design Course. Brian J. Weston BSc. Ag., PDC, host of the weekly Permaculture radio program is now offering a full PDC by correspondence. Special emphasis on small properties. Economically priced! Contact: Brian J. Weston, Box 125, Takaka, New Zealand. E-mail: bweston@ihug.co.nz Homepage for detailed info: http://homepages.ihug.co.nz/usersdirs/bweston/public_html/permaculture.html -43

Help Wanted

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Small monthly stipend. Plant trees with us, that they may enjoy the winds blowing at Kawaiholehole, our farm on the Hamakua Coast, Island of Hawaii. Deep ecology/permaculture atmosphere. Design, plant, and restore with us? Please write Kawaiholehole, c/o Wild & Holy, PO Box 1863, Honoka'a, HI 96727. -43a

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Orchard Manager, passionate about plants, sustainable agriculture, hard working, satisfied with modest income. Semi-communal, peaceful scenicarea. H. Black, 170 Hidden Springs Ln. Cookeville, TN 38501. Phone 931-268-9889. hblack@twlakes.net -43

Situations Wanted

Seeking land for living-learning center. Reasonably priced, conducive for organic gardening. amhansen2@hotmail.com, 917 Jefferson, Farmington NM 87401 -43a

Business Opportunities

Wanted: Contributors and Investors. 120-acres former dairy farm is going to permaculture. Call Don (612) 825-2114, Elsie's Farm. -43

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Communities

Multi-dimensional opportunity to explore skills in sustainable development. Located in White Mtns., New Hampshire. Contact: dacres@cyberportal.net PO Box 98, Rumney NH 93266 for more info. -43

Ecovillage seeks members. Contact River Hayven, POBox 70 Wheeler, WI 54772 or sjfreund@win.bright.net -43a

The hunter-gatherer returns! Permaculture community forming around updated model of our ancestral lifestyle. Tread softly on the Earth. Designers needed. D. Devoe, RR 1, Box 529KF, Bonners Ferry, ID 83805. (208)267-1311. -43a

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CALENDAR

June 5-29. Fairfield, IA. Permaculture Design Course @ Maharishi Univ. of Management. Michael Lockman, PO Box 45472, Seattle, WA 98145. 206-459-7022.

June 9-11. Dexter, OR. Pond Construction Workshop. Lost Valley Educational Center, 81868 Lost Valley Ln., Dexter, OR 97431. 541-937-3351. permaculture@lostvalley.org www.lostvalley.org.

June 9-11. Arlington, WA. Women's Introduction to Permaculture. Jude Hobbs, 541/342-1160. hobbsj@efn.org.

June 9-18. Bloomington, IN. Permaculture Fundamentals. Beverly Skinner, Turtle Island Ctr., 1916 Arden Dr., Bloomington, IN 47401. 812-330-9010. blessbe@aol.com.

June 11-16. Summertown, TN. Japanese Bamboo Basket Making. Earth Advocates Research Farm, 30 Myers Rd., Summertown, TN 38483. 931-964-4151.

June 16-18. Madison, WI. Midwest Renewable Energy Fair. Midwest Renewable Energy Assn., 7558 Deer Rd, Custer, WI 54423. 715-592-6595, fx/-6596. mreainfo@wi-net.com, www.the-mrea.org

June 18-24. Dexter, OR. Practical Permaculture Intensive. Lost Valley Educ. Ctr. 541-937-3351. permaculture@lostvalley.org www.lostvalley.org

June 23-25. Traverse City, MI. Building Sustainable Community. Jane Leatherman-Walker, 10277 E. Bingham Rd, Traverse City, MI 49684. 231-620-4775.

June 23-July 21. Plainfield, VT. Ecology and Community Intensive. Institute for Social Ecology, 1118 Maple Hill Rd., Plainfield, VT 05667. 802-454-8493. ise@sover.net, http://ise.rootmedia.org/

June 25-July 2. Taos County, NM. "Build Here Now" Natural Building and Permaculture Convergence. Lama Foundation, PO Box 240, San Cristobal, NM 87564. 505-586-1269, fx/-1964.

July 5-August 19. Black Mountain, NC. Permaculture Residency. Culture's Edge, 1025 Camp Elliott Rd, Black Mountain, NC 28711. 828-669-3937. culturesedge@earthaven.org www.earthaven.org

July 7-15. Black Mountain, NC. Permaculture Fundamentals. Culture's Edge. 828-669-3937. culturesedge@earthaven.org www.earthaven.org

July 7-9, 29-30, August 26-27 , September 23-24. Seattle, WA. 4-weekends Permaculture Design Course. Michael Lockman, Box 45472, Seattle, WA 98145. 206-459-7022. michaellockman@juno.com

July 9-13. Summertown, TN. Bamboo Artifacts for Home and Garden. Earth Advocates Research. 931-964-4151, fx/-4228.

July 14-16. Orcas Island, WA. Permaculture Rendezvous & Bog-Toss. Michael Lockman, 206-459-7022. michaellockman@juno.com

July 23-August 5. Tlaxcala, MEXICO. Sustainable Rural Development & Building. Zopilote, Box 128, Cottage Grove, OR 97424. 541-942-2005. www.deatech.com/cobcottage

July 24-28. Marshall, NC. Toolmaking for Woodworkers. Country Workshops, 990 Black Pine Ridge Rd., Marshall, NC 28753. 828-656-2280. langsner@countryworkshops.org

August 3-6. nr. Taos, NM. Archetype Design. Box 2049, Taos, NM 87571. 505-758-9702, fx/-751-0038.

August 3-6. Celo, NC. 7th Annl. Southeastern Permaculture Gathering. Tony Kleese, 919-929-5900, or Chuck Marsh 828-254-5454.

August 3-20. Orcas Island, WA. Permaculture Design Course/Skills Intensive. Michael Lockman, 206-459-7022. michaellockman@juno.com

August 6-20. Sandy Lake, PA. PErmaculture Design Course. Darrell Frey, Three Sisters Permaculture Design, 134 Obitz Rd, Sandy Lake, PA 16145. 724-376-2797. defrey@bioshelter.com. www.bioshelter.com

August 7-11. Occidental, CA. Starting Community Watershed Groups. Occidental Arts & Ecology, 15290 Coleman Valley Rd., Occidental, CA 95465. 707-874-1557, fx/-1558. oaec@oaec.org www.oaec.org

August 11-19. Black Mountain, NC. Village Design Permaculture Practicum. Culture's Edge, 828-669-3937. culturesedge@earthaven.org www.earthaven.org

August 19-27. Traverse City, MI. Permaculture Fundam'ls. Jane Leatherman-Walker, 231-620-4775.

August 19-29. Basalt, CO. Permaculture Design Course. Central Rocky Mountain Permaculture Institute, PO Box 631, Basalt, CO 81621. 970-927-4158. jerome@permaculture.net, www.crmpi.org

August 21-25. Occidental, CA. Intentional Communities Course. Occidental Arts & Ecology Ctr. 707-874-1557, fx/-1558. oaec@oaec.org, www.oaec.org

August 26-28. Traverse City, MI. Permaculture Design Concepts. Jane Leatherman-Walker, 231-620-4775.

September 8. Tiptonville, TN Permaculture Design Course for Farmers. Keith Johnson, Patterns for Abundance, PO Box 1209, Black Mountain, NC 28711. 828-669-6336, fx/-5068. keithdj@mindspring.com

September 1-3. Louisa, VA. Twin Oaks Communities Conference. Twin Oaks Community, 138 Twin Oaks Rd, Louisa, VA 23093. 540-894-5126. conference@twinoaks.org.

September 16. Smiths Grove, KY. Cold-Frame Growing Workshop. Alison Wiediger, Au Naturel Farm, 3298 Fairview Church Rd., Smiths Grove, KY 42171. www.aunaturelfarm.homestead.com

September 16-29. Occidental, CA. Permaculture Design Course. Occidental Arts & Ecology Ctr. 707-874-1557, fx/-1558. oaec@oaec.org www.oaec.org

September 17-22. Dexter, OR. Practical Permaculture Intensive. Lost Valley Educational Ctr. 541-937-3351. permaculture@lostvalley.org

September 22-24. Dexter, OR. 4th Annual Oregon Permaculture Gathering. Lost Valley Educational Ctr. 541-937-3351. permaculture@lostvalley.org

October 6-14. Summertown, TN. Permaculture Design Practicum. Ecovillage Training Center, PO Box 90, Summertown, TN 38483. 931-964-4474 or -4324. ecovillage@thefarm.org

October 6-14. Dripping Springs, TX. Permaculture Practicum. Mary Talbot, 100 Hill Cover, Dripping Spgs, TX 78620-3533. 512-894-3605. peacefulhill@earthlink.com.

October 14. Whitwell, TN. Ginseng Workshop. Jeannette Matthews, Appalachian Ginseng Fdn. 606-256-0077, fx/-2779 aspi@kih.net

October 14-15, November 4-5, & addl. dates. Tucson, AZ. Permaculture Design Course. Joelee Joyce, DAWN /Out On Bale By Mail 6570 W. Illinois St., Tucson, AZ 85735 520-624-1673. dawnaz@earthlink.net www.greenbuilder.com/dawn

October 16-21. Summertown, TN. Ecovillage Design. Ecovillage Training Center. 931-964-4474 or -4324. ecovillage@thefarm.org

November 26-December 9. Dexter, OR. Permaculture Design Course. LVEC, 541-937-3351. permaculture @lostvalley.org.

February 15-28. Anihue, CHILE. Permaculture Design Course. CRMPI, 970-927-4158. jerome@permaculture.net. www.crmpi.org

Feb., 2001. Golden Bay, NEW ZEALAND. Community Design. Robina McCurdy, Tui Community, RD 1, Takaka, New Zealand. robina@win.co.nz

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