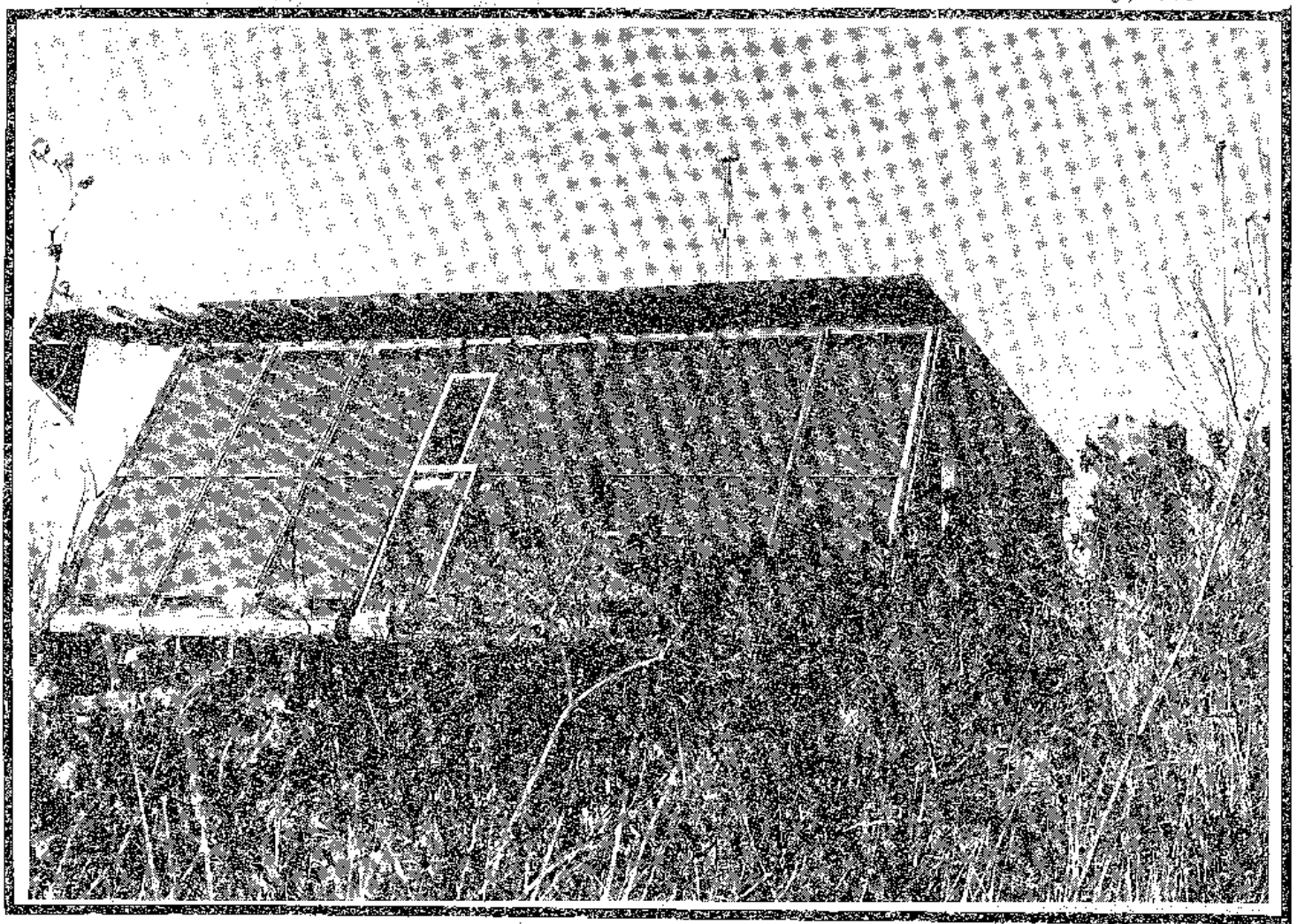
THE LAND REPORT

Number 4 February, 1978



"Doings" Building Number 2 *Terry Evans*

Inside:

At The Land . . .

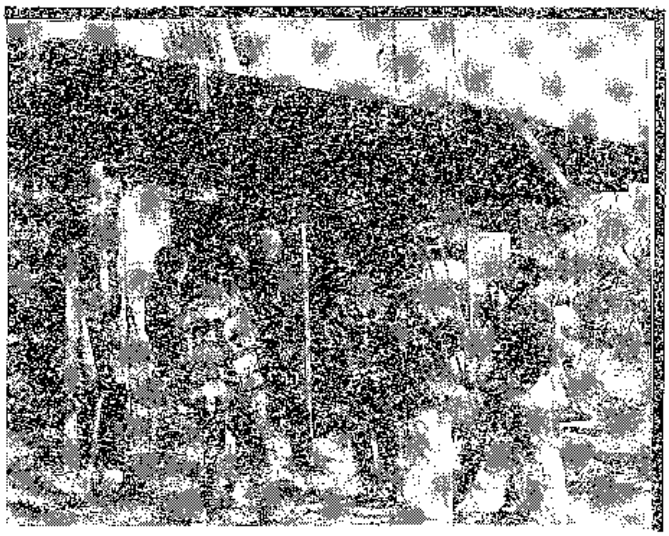
Third Term Completed

The fall term officially began on September 12, although students arrived Sunday evening, September 11 for a welcoming dinner. Dave Kearns, Dayton, Ohio; Mel Stampe, Cincinnati, Ohio; Jim Peterson, Salina, Kansas; Carol Craft, Hillsboro, Kansas; Michele Adams, Dallas, Texas; Maureen Hosey, Old Hickory, Tennessee; Bill Elliott, Providence, Rhode Island and student/research associates Marty Peters, Salina, Kansas, and John Craft, Hillsboro, Kansas participated in an orientation session on the first day and began the regular schedule on Tuesday, September 13.

The daily schedule required students to be at The Land from 8:30 A.M. until 3:00 P.M. Each morning the group discussed assigned readings or topics presented by guests and conferred on projects. After lunch they worked on individual or group projects. For several days early in the session, everyone helped plaster the newspaper house with a second layer of concrete. Weather conditions sometimes altered the schedule.

By the end of the second week, individual projects were chosen. Bill Elliott decided to work with John Craft and Marty Peters on wind energy. Mel Stampe chose to study solar energy and build a hot water system for eventual use in the first story kitchen. Michele Adams started a gardening project by building cold frames out of straw & hay bales and covering the top with patio doors. Jim Peterson prepared an area of ground for a spring planting of sorghum to make molasses and also worked on the Prairie Project. Dave Kearns decided to experiment with tamped earth and build walls for the Indian House. Maureen Hosey and Carol Craft chose to work on the Prairie Project with Wes and Jim. All of these projects are described in this REPORT.

The routine was broken occasionally by a special visitor who made a presentation and answered questions. Students heard H. O. Wright, retired labor official, talk about labor and the environment, and Rev. Cassell, religion professor, talk about the nature of evil in man and how it relates to environmental problems. Tom Durkin talked about Rousseau and his philosophy. Terry Evans shared her photographs and discussed the value of photography in developing and expressing the holistic view of the earth. Allen Edgar, student in architecture at K. State, came over one afternoon to explain the potential for construction out of sulphur ash, a by-product in oil refining. Roy Yost, an 85 year old friend, gave some special advice the day he was our guest: "Don't buy on installments, and keep moving." Dr. Paul Sears spent two mornings at The Land, and Malcom Wells, an afternoon (described in more detail elsewhere in this REPORT). Charles and



Carol, Mel, Leland, Jim, Wes, Maureen and Bill

Marty Jenner from the University of North Carolina at Chapel Hill joined the circle near the wood-burning stove on December 16, and Marty led a discussion about the American food industry and the way the consumer and the producer are victimized by monopolistic food profiteers.

Some of our visitors to The Land were here for a shorter time and did not make presentations but talked informally with students. Diane Simpson, Robert Riordan and James Hall of the Salina City Energy Use Committee came to The Land with Steven D. Harris, new Director of the Kansas Energy Office. Kansas Speaker of the House of Representatives, John Carlin, who lives nearby in Smolan, dropped by one afternoon for a look around and a chat by the stove.

Students from The Land also traveled to other places and met with interesting people. Early in the fall, they visited the Sand Prairie near Newton, Kansas, and later, the Konza Prairie and the Plant Materials Center near Manhattan, Kansas. They went to Kansas State University to see a film about the New Alchemists and then on to Home City, Kansas, to tour the organic farms of John Vogelsberg and Al Ketter where they feasted on watermelon. They examined the alternative shelters built by Leland Lorenzon near New Gottland and John & Carol Craft near Hillsboro. Marilyn Jones of Peabody, Kansas, graciously received them one day and shared her knowledge about growing sheep, shearing wool, and spinning and dying yarn.

We judged this to be a highly successful semester. There were individual accomplishments and some failures, but students learned from these experiences. As they shared in the discussions and in the physical work, a community spirit of warmth and helpfulness evolved. The semester ended with a joyous Christmas party on December 17.

Contents

The Land Report

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The Land Institute is a non-profit educational-research organization devoted to a search for alternatives in agriculture, energy, shelter and waste.

New Directions on the Prairie: The Land Summer Program

Beginning this year, The Land will offer short summer sessions on alternatives, one week workshops which focus on specialized areas such as wind energy, solar energy, ecological shelter design, or construction with waste materials.

In June, 1978, there will be two workshops, one on solar energy, June 6-10, and one on wind energy June 13-17. The programs run from 9:00 A.M. to 5:00 P.M. Monday through Thursday, 9:00 to noon on Friday and include two evening sessions on Tuesday and Thursday.

Staff for the workshops will include Wes Jackson and research associates at The Land: John Craft, Marty Peters and Mel Stampe. Ted Landers of New Life Farm, Drury, Missouri will assist with the solar workshop. Wind energy experts will be present for certain sections of the wind workshop. Instructional materials will be provided.

For further information, write to The Land for a brochure. The Land Institute admits students of any race, color and national or ethnic origin.

Community Programs

The main educational endeavor at The Land is a program for eight to ten college-age students who spend all day at The Land. However, during the fall semester and into January, special programs open to anyone in the community were offered in the evening and on Saturday.

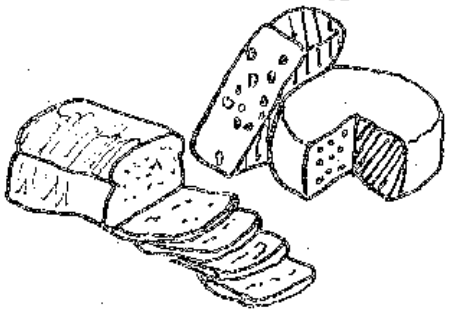
Two sets of discussion evenings engaged participants in the ideas of The Genesis Strategy by Stephen Schneider and Should Trees Have Standing? Towards Legal Rights for Natural Objects by Christopher Stone. Dana Jackson led the first discussion about world climate and how it affects food supply. Karen Black, Salina attorney and member of the board of directors of The Land Institute, and Wes Jackson guided the consideration of Stone's proposal.

A Saturday workshop on solar collectors for do-it-yourselfers attracted a group of capable people who spent the day discussing basic principles of solar energy as well as practical aspects of solar heating. Wes Jackson and Mel Stampe were assisted by Jack DeBacker of DeBacker Sheet Metal in Topeka who shared his expertise in the installation and maintenance of heating and cooling systems.

Three lectures on famous naturalists were well-attended in January in spite of some ice and snow. Wes Jackson opened the series with a lecture on John Muir, founder of the Sierra Club. Steve Burr, a wildlife biologist and member of the board of directors, talked about Aldo Leopold in the second. The third lecture on John James Audubon was given by Dr. Albert Robinson, former biology professor at Kansas Wesleyan and now an ecological specialist with the Kansas Weed and Pesticide Division of the state Department of Agriculture.

See the Special Events calendar on the back page for announcements of spring programs.

Prairieland Food Cooperative



Prairieland Food Co-op Organized

On January 13, approximately fifty people attended a general meeting of the Prairieland Food Cooperative at The Land Institute. Steve Palmer explained the objectives and advantages of a food co-op; Jan Peters conducted an orientation session on group ordering and distributed order sheets. After the meeting there was a get-acquainted time with refreshments provided by the steering committee.

A volunteer steering committee began meeting in the fall to organize the food co-op after a study and survey by Jan Peters revealed that there was sufficient interest in the Salina area. Members of the steering committee are Tom & Janet Renich, Fred & Ruth Elliott, Tom Pilarzyk, Andrea Hartenberger, Barb McKenzie, Sue Leikam, Garnet Zamboni, Jan Peters, Steve Palmer, Diane Simpson and Dana Jackson. At the October 26th meeting, the steering committee adopted the name "Prairieland Food Cooperative" and appointed Steve Palmer chairman, and Jan Peters secretary/treasurer. They established guidelines for membership and work requirements and drew up a tentative budget.

The committee set a goal to open a storefront by January 1, 1978. The members began to look for a possible store site with adequate parking and a minimum of building repairs needed. Several sites have been investigated, but so far none has been found suitable. The committee is still actively searching and would appreciate receiving information about available buildings from anyone.

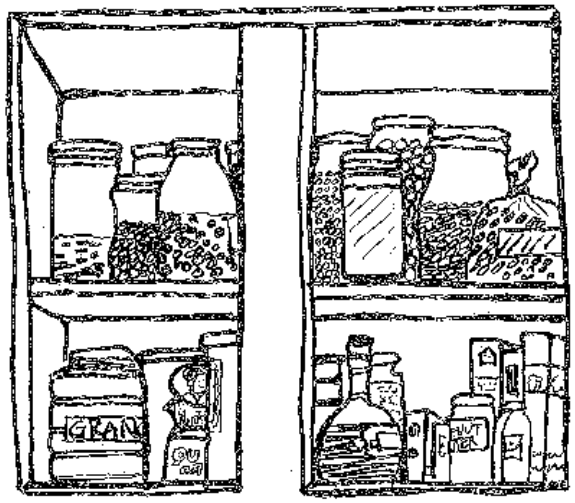
Until a good store site is found, the food co-op will be doing group ordering on a monthly basis. Food will be obtained from local producers whenever possible (e. g., cheese from Tescott) and will also be trucked in by the New Destiny Federation of Co-ops Warehouse in Fayetteville, Arkansas. The first order must be in by January 28 for delivery February 9 and distribution on February 11. Anyone can order once before we are in the store without paying the membership fee, but thereafter must join to order food. Those not interested in group ordering, but wanting to patronize the store, are encouraged to pay their $10/$5 now and help us be able to purchase equipment, make repairs, or whatever is needed to get the store going.

The lifetime membership fee is $10 a household, $5 single, or $3 for persons sixty-two years or older. Members will be owners of the co-op and their opinions will be important to the ongoing decisions and business of the co-op. Working members, those who put in about two hours a month, will pay a 25% mark-up over the cost of the food. Non-working members will pay a 75% mark-up, and non-members will pay 100% (walk-in customers at the storefront). The mark-up will be used to pay the expenses of the co-op, such as the price of a scales, paper sacks, order sheets, etc. Extra money after expenses will be accumulated as start-up capital for the store. In most cases, purchasing in bulk through the co-op will afford lower-than-supermarket prices for items of comparable quality to working members. The co-op will always try to get the best food (organic whenever possible) at the lowest price.

To obtain order sheets or more information, contact the Prairieland Food Cooperative at Box 425, Salina, or call Jan Peters at 827-9943.

Some items available at this time through group ordering are organically-grown raisins and currants, sunflower seeds and grains. Flours, garbanzo, lima, mung and soy beans, Knudsen's fruit juices, carob powder, yeast, dry milk and honey can also be purchased.

Jan Peters



Land Associates are Resource People

During the winter months, Land Institute associates will be participating as resource people in various workshops and seminars.

John Craft and Marty Peters will attend the Wind Energy Workshop organized by Dennis Keim in Lincoln, Nebraska on February 21 and 22. They will report on their wind study for the National Center for Appropriate Technology.

Jim Peterson will attend a seminar for farmers entitled "The Earth is the Lord's," on February 17 and 18. He will conduct a workshop on February 18 called "Conservation of the Farmer's Natural Resources." This program is sponsored by the Mennonite Central Committee and will be held in the Alexander Wole Church, near Goessel, Kansas, one of the oldest Mennonite churches in Kansas.

On February 18, Wes and Dana Jackson will participate in a seminar on food and world hunger at the First Presbyterian Church in Salina. During February, Wes will also be talking to local civic groups and the Audubon Society in Manhattan. On March 2 he will give the opening speech for the environmental law seminar at the Washburn School of Law in Topeka, Kansas.

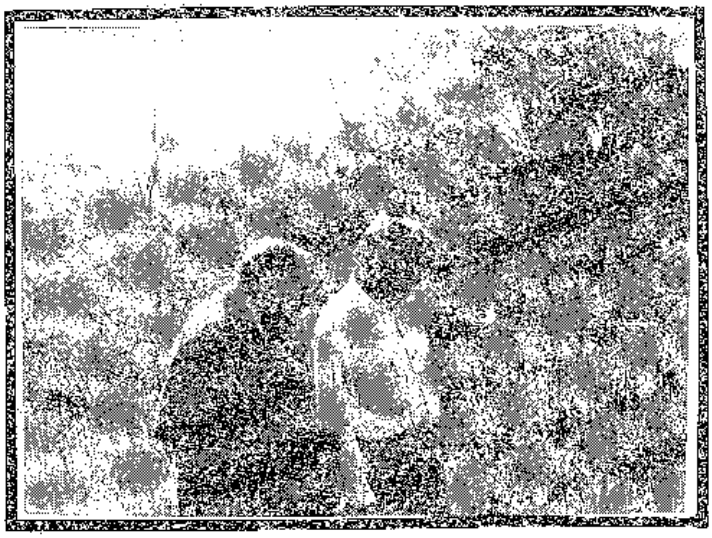
Adventures in Conservation with Paul Sears

The first hard freeze had not occurred when Professor Paul Sears visited The Land on October 11. We showed him the experimental village area, then walked through what was left of the garden. Dr. Sears enjoyed eating tomatoes and green peppers picked during the tour. The sharp wind that morning signaled the demise of summer gardens, however, and before dawn on October 12, the tomato and pepper plants were black from the frost.

Professor Sears generously shared his wisdom and wit with Salinans. In addition to talking to students during a soup lunch, he met with local biologists for dinner before his public address at the Salina Community Theatre the evening of October 11.

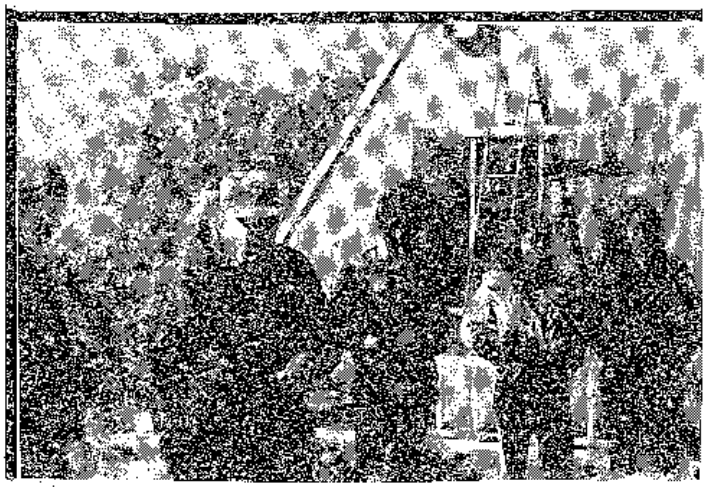
The topic of Professor Sears' address was "Adventures in Conservation." During his distinguished career as a botanist-ecologist and conservationist, Dr. Sears served on the faculties of Ohio State University, the Universities of Oklahoma and Nebraska and Oberlin College, and was chairman of the conservation program at Yale prior to his retirement. His most famous book, Deserts on the March, was first published in 1935 and has appeared in several editions.

In his speech, Dr. Sears traced the development of the conservation movement as he had observed and participated in it. Of special interest was his description of the Friends of the Land, a group organized in 1940 to help promote soil conservation and aid the new U. S. Soil Conservation Agency. Through a gift from Dr. Wendell Nickell, The Land Institute now owns a



good collection of the Land Quarterly. To prepare for Professor Sears' visit to The Land, students studied several articles by Paul Sears which were published in the Land Quarterly.

Everyone at The Land had an opportunity to learn from Dr. Sears again during the morning session on October 12. The discussion covered a wide range of topics, from the importance of precise language, to the mining of fossil water, to the extravagance of space exploration. "The human race has a positive genius for learning the hard way," he said, and then went on to express his opinion that although Americans are capable of being generous, probably no substantial change in our pattern of environmental destruction will occur unless forced.



Michelle, Paul Sears, Mel, Maureen and Carol looking at the cold frame garden.

"...We have modern technology at our service. But our bodies are stone-age bodies, if as good, our minds no better than the Greek, and our morals the patchy product of a long and checkered past. Above all, we must eat, a vulgar necessity whose rules were in operation a billion years ago." (From "Darwin and the Living Landscape" in The Land, Autumn, 1950.)

Alternatives in Agriculture

A Cold Frame Garden

After the garden at The Land had succumbed to insects, neglect and frost this fall, there was still one bright, green spot remaining, the garden under glass.

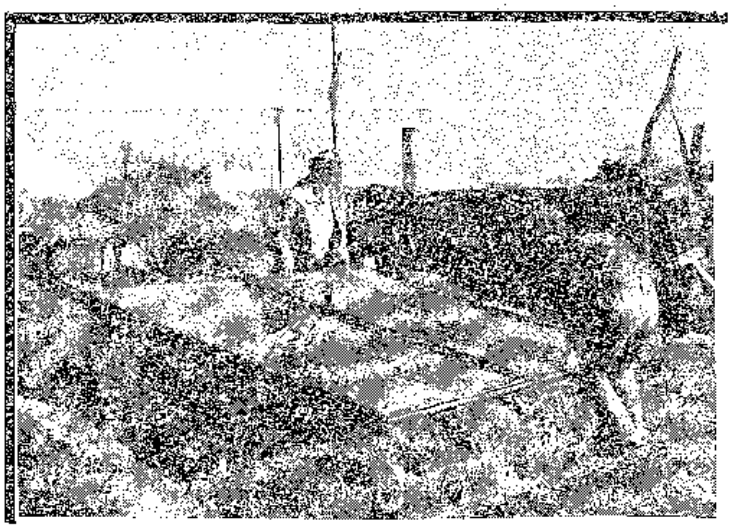
I came to The Land Institute hoping to gain some garden "know-how" while pursuing my major in nutrition. The best place to start in studying nutrition is from the beginning, where food is produced. I arrived at The Land too late to plant a full-scale garden, so my project became a cold-frame garden.

Many frames that I read about were made from new or recycled lumber and old window panes. At The Land though, there was an abundance of straw and hay bales and glass patio doors, so I adhered to the general philosophy at The Land and used the materials at hand.

The patio doors measured 4' X 6½'. I used three side by side, which determined the size of the frame and gardening area. Approximately seventeen bales, each about 3' X 1' X 15", were used. I stacked them two bales high and four bales long for the back north wall, and one bale high, four bales long for the south front wall. The east and west sides were built up as needed. Stakes were driven inside the frame against the back wall for supporting the stacked bales. The finished planting area measured 12' X 5' 8".

The frame was built on fertile garden soil, just east of the "Doings" building, so soil preparation was simple. We roto-tilled the area, then added sand for improved drainage and composted manure for fertilizer. The area was roto-tilled again before the frame was set up.

On September 22, I planted three rows of cool-weather vegetables: Black-seeded Simpson leaf lettuce, Detroit Dark Red beets, Sparkler radishes and Dwarf Grey Sugar peas. The glass was placed over the frame, which was oriented towards the sun exactly like the "Doings" building.



I attached a soaker to the hose and arranged it inside the frame around the plants. With the soaker I could water without taking the patio door covers off the frame.

As the days grew colder, I placed eight, one gallon plastic jugs, painted black and filled with water, inside the frame between the rows. The jugs functioned as heat sinks to hold the sun's warmth longer inside the frame. In late November, just before Thanksgiving, another layer of doors was placed on the top, and the original seventeen bales were supplemented with more hay to provide extra insulation.

On December 6, the temperature dropped to 5° overnight outside the frame. By mid-morning, the temperature had reached 24° F in the sun, while the temperature inside the frame had risen to 32° F. The freezing temperatures did little damage to the sugar peas and lettuce. The ground did not freeze inside the cold frame; therefore, the beets and radishes were not affected.

A warm spell the following week brought the temperatures up into the 40-50° range and warmed the soil considerably. On December 13, I transplanted five broccoli and five cabbage seedlings into the cold frame. The seedlings had been started in seed flats placed in the south window of the Jackson's living room.

We harvested some delightful crisp lettuce and some radishes in November. Although the lettuce stayed alive during the very cold weather, it did not grow much and the harvest was sparse. I suspect the daylight exposure was too brief and the weather too cold.

There were some drawbacks in using the hay bale structure for a cold frame. The bales did settle quite a bit and spaces and cracks needed to be filled in with extra hay now and then. The front wall cast a longer shadow than anticipated, and decreased the amount of direct sunlight on the plants. The patio doors were too heavy and awkward for one person to handle. They had to be completely removed before any work could be done in the cold-frame.

There were few problems with insects, except for a few long-lived grasshoppers early in the fall. However, another critter, either a rat, mole or perhaps a gopher, found the cold frame to be a convenient winter refuge. He burrowed beneath the bales and came up into the cold frame, causing damage to the roots of the sugar peas, which soon wilted.

In spite of the drawbacks of this cold-frame structure, it was economical and quick to build. The bales held up surprisingly well, and the patio doors were large enough to cover an area of convenient size. With certain improvements, this cold-frame could enable a gardener to extend the growing season in the fall, and begin cultivation very early in the spring easily and successfully.

Michele Adams

Companion Planting — a Help or a Hoax ?

In explaining the prairie project to visitors at The Land, I've heard Wes describe it as an experiment in companion planting. To find out more about how this subject applies to what we are doing on the prairie plots, I have gone through most of the issues of Organic Gardening and Farming from 1964 through 1977 to see what's been tried, what objectives were being sought, and what kinds of results people have been having. No doubt, companion planting has been a popular subject and gardeners have been eager to share successful attempts with readers.

By far the majority of articles I found on companion planting were relatively short, written by home gardeners who had tried a certain plant combination and had obtained some positive results. Almost all of the articles dealt with alternatives to chemical pest control that the writer had discovered in companion planting. Of course, many articles repeated plant combinations that had been successful as pest repellents. Some of the more common ones fell into three categories: 1) herbs protecting vegetables; 2) flowers protecting vegetables; and 3) two kinds of vegetables protecting each other. Examples from the first category include basil with tomatoes, savory with beans, and mint with cabbage. Flowers which are general pest repellents for any neighboring vegetables include nasturtiums, petunias, coreopsis, and asters. Some mutually beneficial vegetable combinations are radishes and any vining crops, potatoes and snap beans, tomatoes and asparagus. And, of course, a number of articles were devoted entirely to the pest repellent qualities of either marigolds or garlic. Marigolds are most noted for their ability to control nematodes. Garlic was portrayed as the most effective and generally applicable of all companion pest repellents. It was most often claimed to be a good chaser of aphids, but also as a protector of any neighboring vegetable.

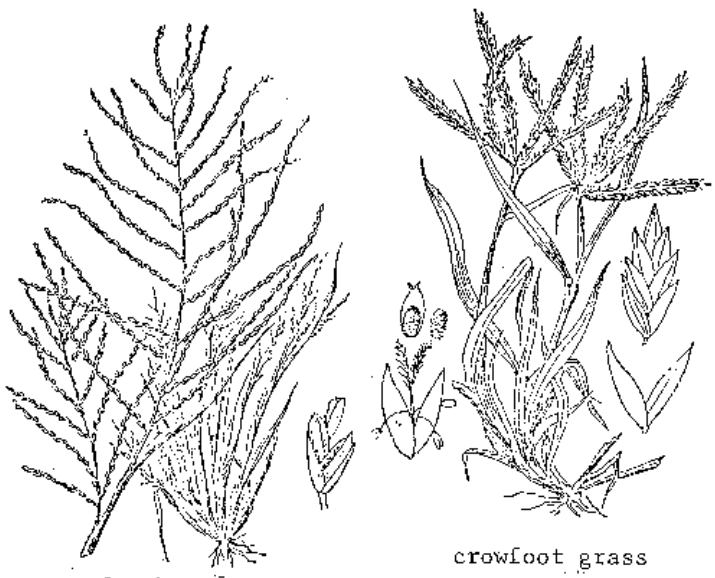
There are a few things about the nature of the articles which left me questioning the validity of the writer's conclusions. I don't question the fact that what they are reporting actually happened as they are telling it. I'm only questioning whether or not they have done enough experimenting to be encouraging widespread use of their methods. My contention is that there are variables which were not discussed in any of the articles that might have a bearing on the conclusions that were drawn.

One of these variables is the weather. Few of the writers even identified exactly where in the United States they were. And hardly any described the weather trends where they were gardening, the length of the growing season, when it occurs, and what effect these might have on certain plant combinations that would be less applicable in other parts of the country where weather and growing season may be quite different. The weather would also have a bearing on insect population, another variable. An extreme in wetness or dryness might have an influence on the population of insects that are predators of insects that are garden pests. A drastic change in population of predator insects would certainly have an influence on the success or failure of certain plant combinations in a given year. One other variable to be considered is the use of pesticides. Even if the gardener herself does not use them, they are being used so universally that their effect on insect populations should be taken into account, especially if one gardens in an area surrounded by fields on which pesticides have been applied.

There were, however, a few other articles that dealt with the subject in a more scientific and experimental manner. Instead of starting with the assumption that certain plants like some plants and dislike others, these writers took the approach that certain plant combinations are mutually beneficial because the demands the two plants make on the environment are complementary rather than competitive. An example of this is some research being done in Cuba, reported in the January, 1971 issue of Organic Gardening. It was found that the lygus bug, which is a threat to cotton crops, has a fondness for sweet tastes and is therefore attracted to alfalfa. So alfalfa interplanted with cotton turned out to be a good control. In addition to attracting the lygus bug away from cotton, they were being attracted to a crop which also attracts natural predators of the lygus bugs, namely ladybugs and lacewings. Another example of complementary needs beneficial to two plants is varying root depths. A deep-rooted plant can bring sub-surface nutrients closer to the surface for a nearby shallow rooted plant. By breaking through lower soil strata, one plant enlarges the feeding area of the other without competing for the same nutrients.

Robert Rodale describes some experiments designed to show possible benefits which weeds might have for our gardens in the February, 1977 issue of Organic Gardening. Nine field experiments and two lab tests conducted at an agricultural center in Cali, Colombia have shown that

weeds have a surprising amount of insect-controlling power. In one of the lab tests, leafhoppers were offered bean leaves alone and bean leaves mixed with grassy weeds. Eighty per cent of the insects moved away from the bean and weed mixture. If small amounts of weeds are allowed to grow in the fields, experiments show that insects will be repelled. In a planting of corn and beans together, there was a forty to fifty-three per cent reduction in leafhoppers. The weeds were controlled carefully, never being allowed to reduce yields of corn or beans. Another experimental planting showed that the presence of grassy weeds in a cornfield reduced cutworm damage by sixty-eight per cent. The grassy weeds Leptochloa filiformis (feather grass) and Elcusine indica (crowfoot grass) have shown the most insect-repelling abilities. They also seem to be most effective in interplanting situations. When beans or corn were planted separately, the presence of some weeds was not as effective an insect control as when weeds were allowed to grow in a field interplanted with both corn and beans. Rodale explains that through the process of domestication, the ability to repel insects was not a characteristic people were worried about breeding into plants. Because the ability to repel insects has not been bred out of weeds, they should be logical choices for protectors of our domestic crops.



feather grass

crowfoot grass

A survey was taken of 1000 readers to determine what their real feelings about companion planting are. (Organic Gardening, February, 1977) The majority of people surveyed practice companion planting because of practical reasons, and not because they really believe there are likes and dislikes among plants. The authors pointed out that herbs, which are planted because of assumed insect-repelling traits, very likely are plants which attract bees, which then do a good job of pollinating neighboring vegetable plants. Also, if they seem to chase insects away, it could be that the interplanting simply confuses the insects and forces them to spend their energies looking for the plant they are used to feeding on.

As was pointed out in an article by Jack Coggins in the January, 1972, issue, we would do well to take a closer look at nature to see how she does her "gardening." In nature, there are seldom wide, unplanted, unmulched areas between plants. Usually, plants grow very close together. Different varieties are usually not isolated from one another because they need each other for shade, climbing support, mulch, soil conditioning, and occasionally, repelling of insects.

Essentially, this is the concern behind us as we work on the prairie project. Our agricultural practices have for too long ignored the example nature sets forth in her own planting methods. Because relationships between plants aren't established accidentally, an understanding of their interrelatedness is necessary in patterning a domestic prairie after what we observe in the natural prairie.

Carol Craft

"Microbes to Man: The Story of a Prairie Farm"

Tom Putnam of Palo Alto, California, has produced a film called "Microbes to Man: The Story of a Prairie Farm." We reviewed it at The Land and highly recommend it.

The film deals with the efforts of a Missouri farmer named Gene Poirot to restore the fertility of a worn-out prairie farm, and to learn to farm in accordance with ecological laws learned by nearly sixty years of observation of the virgin prairie which adjoined his farmland. Poirot talks about establishing diversity, about the need to restore minerals to the soil through fertilizer, about appropriate technology (he doesn't call it this though) and about his efforts to nurture habitat for wildlife. He describes his catfish pond, his quail feeder, and his experiments in planting corn in an unplowed field all with enthusiasm and charm.

Gene Poirot proudly points out that his farming methods make money for him. He is on the board of directors of a local bank where deposits in the farming community have increased because the farmers followed Poirot's advice.

The film has many lovely scenes, such as fields of wild prairie flowers, close-ups of insects on plants, strutting prairie chickens and the family fishing on the pond. It is an inspiring film, as Gene Poirot is an inspiring man. In his humbleness before nature, he has become a successful farmer, quite in contrast to the conventional successful farmer, the conqueror of nature.

"Microbes to Man: The Story of a Prairie Farm" (35 minutes, color, sound) can be rented for $40 from Tom Putnam, 2344 Columbia St., Palo Alto, California, 94306.

First Efforts Toward Establishing a Prairie

The idea of re-establishing a prairie brings to mind all sorts of ideas as to what the end results will be. However, there is more work than one may realize in making these ideas a reality.

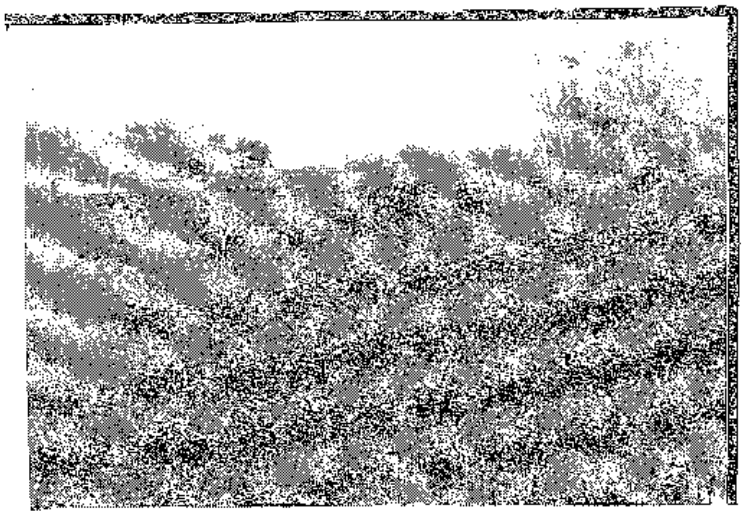
We began this project by first dividing part of the fifteen acre field east of the Doings Building into twenty-one quadrants, each thirty meters square. Then seven quadrants, randomly selected, were planted to native prairie.

During October, Carol, Michele and I collected seed from Indian grass (Sorghastrum nutans) and big bluestem (Andropogon gerardi). We began by simply gathering the heads of each grass. Although it was enjoyable, it proved to be time-consuming and already much of the seed had been dispersed by the wind. We finally mowed and baled a field of Indian grass and big bluestem and hauled the bales to the quadrants. The quadrants were disked and the seed was sown. With the wind blowing, Mother Nature did her share in aiding us disperse the seed. We have wondered if we were too late in gathering seed and are curious about how many seeds will germinate.

Carol and I also gathered seed from a few native species of forbs and legumes, which Wes had planted in rows last spring, and planted them in the quads with the grasses. The seeds were taken from compass plant (Silphium laciniatum), star thistle (Centaurea americana), Heliopsis (Heliopsis helianthoides), sunflower (Helianthus maximilian), and partridge pea (Cassia fasciculata).

On December 1st, Carol, Jim, Michele and I visited the Plant Materials Center near Manhattan, Kansas, to obtain seed. This center, which serves Kansas, Nebraska and part of Oklahoma, is one of twenty-two such facilities in the U. S. operated by the Soil Conservation Service. Various types of native grasses, forbs, shrubs and trees are grown, tested and released for such purposes as erosion control, windbreaks and roadside beautification. Plant materials are brought to the center from nature as well as from commercial enterprises. Those plants which are judged superior are increased and then put out in the field to be tested for performance. Select plants are harvested and seed is made available to commercial growers who will maintain the seed stock. Seed is also made available through the local soil conservation offices.

Michelle, Jim, Maureen and Carol planting seeds from the Plant Materials Center.



Indian grass and bluestem near the Jackson house.

We spent the morning gathering seed and visiting with Edie Hadle and Bill Wester who work at the Plant Materials Center. They aided us on identification and suggested plants which might best suit our purposes. Seeds were gathered from black Sampson (Echinacea augustifolia), three species of Monarda, Missouri primrose (Oenothera missouriensis), Petalostemum villosus, Penstemon cobea, common gayfeather (Liatris punctata), Illinois bundle flower (Desmanthus illinoinsis), and lespedeza (Lespedeza capitata). The majority of these seeds are from Kansas. Since many of them require a hard freeze for germination, we planted them outside in rows early in December.

Although we've done quite a bit of work and research, there is still much ahead. Whether it be gathering seed, planting, reading, or internalizing on the lessons of the day, there is a deeper consideration. What we are about is not merely re-establishing a prairie, but rather allowing Nature to unfold her secrets before us, incorporating what we learn with everyday life, and enhancing our relationship to the earth.

Maureen Hosey

"Some day we may need this prairie flora not only to look at but to rebuild the wasting soil of prairie farms. Many species may then be missing. We have our hearts in the right place, but we do not yet recognize the small cogs and wheels." (Aldo Leopold in Round River)

Soil Loss and the Search for a Permanent Agriculture

WES JACKSON

The Human-Nature Split

Nowhere is the human-nature split more dramatic than the manner in which land is covered by vegetation. To maintain the "ever-normal" granary, agricultural man's pull historically has been toward the monoculture of annuals. Nature's pull is toward a polyculture of perennials. This is not to say that we humans exclude perennials from our agricultural endeavors, just as nature does not exclude the annual plant as part of her strategy to keep vegetation on the ground. Certainly the numerous nut and citrus trees, grapes and berries (be they blue, black, rasp or straw), along with other perennial plants, are important to this agricultural species of ours. As for nature, no naturalist need remind us that her annuals are widely dispersed in natural ecosystems.

The main purpose of this paper is to consider the implications of these opposite tendencies on our earth with an eye to the serious work involved in healing the split. Nature is at once uncompromising and forgiving, but we do not precisely know the degree of her compromise and the extent of her forgiveness. I frankly doubt that we ever will. But we can say with a rather high degree of certainty that if we are to heal the split, it is the human agricultural system which must grow more toward the ways of nature rather than the other way around.[1]

Bills Must Be Paid

Nature rewards enterprise on a limited scale. A weedy annual is enterprising. Not only will it cover bare ground quickly, but it will yield an excess of potential energy besides. The main reason our most important crops originated as weedy annuals becomes immediately obvious when we examine the natural history of an annual plant. An annual, by definition, must complete a life cycle within a year. In contrast to most perennials, the annual carries more genes for fitness than for flexibility. A small amount of annual vegetative biomass promotes the production and survival of a rather large number of seeds during a growing season. This is usually assured by one of three ways or even a combination of all three: (1) the storage of plenty of food in the seed, (2) the set on of many seeds and (3) the ability to colonize a disturbed area. Many perennials may have these three characteristics, but it is less critical for them to come through in a particular season, for there is always another year. For that matter, there is always another year for many annuals too, as their seed will remain viable for more than one year. But overall the colonizing annual has had to rely on enterprise. The ancestors of our current crops may well have been camp followers, that is, colonizers of the disturbed ground around the campsite. They were obvious candidates for selection by humans because of their availability and their inherent ability to produce an excess of potential energy. They are the enterprisers of the higher plants.

We don't know whether the early agriculturists were faced with famine or not. But when they began to plant annuals in fields, they were beginning to reward enterprise. The monoculture of annuals, the enslavement of enterprising species, was a big new thing in the history of the earth. The face of the earth was changed. Is it possible that enterprising plant species taught humans enterprise?

By and large, the patient earth has rewarded patient ecosystems, but it would seem that enterprise has probably always been rewarded too, though on a very limited scale. It would seem to be a good strategy for an ecosystem to have enterprising species present, for these quick colonizers could rapidly cover the ground made naked by a migrating buffalo which had wallowed and dusted himself, or an excessive flood or an insistent wind. The ecological capital which had been sucked from parent rock material or stolen from the air could be retained to promote more life for future generations of all species in the system.

The selection of enterprising plant species has rewarded all humans bent on enterprise in food production. But there is a second consideration. Humanity also has long been armed with a psyche to take without thinking. After all, life and sustenance itself have forever been gifts of nature. It was the juxtaposition of these two psychological characteristics, however, enterprise and the taking without thought, which resulted in a rub which is yet to be reckoned with in the four hundred generations since humanity started seed time and harvest. The problem is this: to maintain any system, agricultural or natural, bills must be paid eventually. In nature's prairie, the bills are paid automatically and with amazing regularity. The wild forms have evolved methods for dispersing seed, recycling minerals, building soil, maintaining chemical diversity, promoting new varieties and even controlling weeds, e. g. through a shading system. The prairie has been successful because close attention has been paid to seeing that these jobs get done. Most biologists believe that natural selection alone was up to these tasks, and that purpose was not necessary.

This "no-free-lunch law" applies just as much to man's culture as it does to the biotic cultures of nature. For when agricultural man substitutes his annual monoculture on this prairie land, be it corn, wheat, milo sorghum, rye, oats or barley, the same bills have to be paid or

failure is inevitable. Mechanical and commercial preparation of the seed and planting, the application of fertilizer, chemical and power weeding, mechanical soil preparation, pesticides and fungicides and plant breeding are all the clumsy inventions we have devised for paying the same bills nature pays.

In contrast to the system of nature which relies solely on the daily allocation of solar energy, in the industrialized world our inventions for the successful monoculture of the annuals require the stored light of the Carboniferous. Efficiency in energy use is the way of nature, not of industrialized man.

I mentioned at the beginning that the human-nature split was the most dramatic in the manner in which land is covered with vegetation. Aside from nuclear war, there is no greater environmental problem than the loss of our soils. If soil loss were not such a reality, it would be much more difficult to argue that the way of nature is inherently better than the way of agricultural man in the developed world. Energy use is not the major consideration.[2]

We are back again to an examination of the consequences of the human-nature split. I have mentioned that the monoculture of annuals leads to soil erosion. The methods almost inherent in the monoculture of annuals require that ground be devoid of vegetation for too long a time, often during critical periods of the year. The forces of wind and rain can now rapidly move soil seaward. Even during the growing season, especially for the row crops, the loss is substantial. Crops such as corn, cotton and soybeans have much of their holding power destroyed between the rows as the farmer loosens the earth to cultivate. For this reason, J. Russell Smith called corn, "the killer of continents...and one of the worst enemies of the human future."[3]

The polyculture of perennials is another matter, however. The more elaborate root system is an excellent soil binder. It has been estimated that before the white man, fires were sufficiently common and any given area became burned at least once in a decade. Though the top organic matter may have been absent for brief periods, the roots at least were alive and binding the soil.

What Will Nature Require of Us?

It seems doubtful that nature will uncompromisingly insist that the polyculture of perennials is the only way humans can peacefully co-exist with her. As I mentioned earlier, she employs some annuals in her own strategy. One might begin a limited systematic inquiry into the nature of a high-yielding and permanent agriculture by asking whether it is the annual versus perennial condition of the plant or monoculture versus polyculture we need to investigate first.

In a more thorough-going systematic study, we may have to contrast, not just annual versus perennial, or monoculture versus polyculture, but the woody versus the herbaceous condition and whether the human interest is in the fruit/seed product or the vegetative part of the plant. When we consider these four contrasting considerations, in all possible combinations, we have sixteen categories for assessment.

We can eliminate four of these sixteen categories listed in Table 1 for they involve woody annuals, a rare phenomenon in nature. This leaves us with twelve categories for consideration. Eleven of these remaining combinations are currently employed in the human enterprise. But there is one, category seven, which involves the polyculture of the herbaceous perennials for seed/fruit production. This category is almost opposite of our current high-yielding monoculture of annual cereals and legumes.

Fruit/seed material is the most important plant food humans ingest. This is so because of the readily storable, easily handled, highly nutritious nature of the seeds we call grains. Unfortunately, none of our important grains are perennial. If a few of them had been, we might not have so thoroughly plowed from the edge of the eastern deciduous forest to the Rockies. Where we

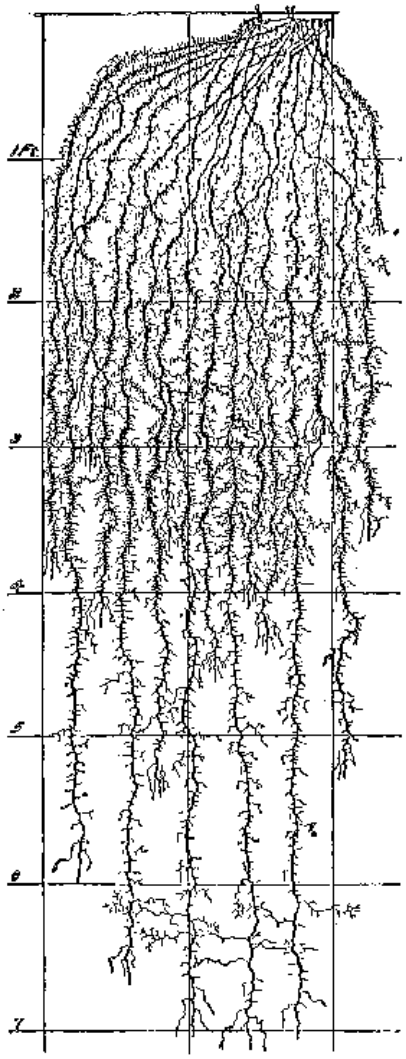


Fig. 1. Root system of sand hill bluestem with roots reaching more than 7 feet deep. From Plant Ecology by Weaver and Clements.

TABLE I

	Poly vs. monoculture	Woody vs. Herbaceous	Annual vs. Perennial	Fruit/Seed vs. Vegetative	Current Status
1.	Polyculture	Woody	Annual	Fruit/Seed	Not Applicable
2.	Polyculture	Woody	Annual	Vegetative	Not Applicable
3.	Polyculture	Woody	Perennial	Fruit/Seed	Mixed Orchard
4.	Polyculture	Woody	Perennial	Vegetative	Mixed Wood Lot
5.	Polyculture	Herbaceous	Annual	Fruit/Seed	Dump Heap Garden,* Companion Planting
6.	Polyculture	Herbaceous	Annual	Vegetative	
7.	Polyculture	Herbaceous	Perennial	Fruit/Seed	
8.	Polyculture	Herbaceous	Perennial	Vegetative	Pasture & hay (Native or Domestic)
9.	Monoculture	Woody	Annual	Fruit/Seed	Not Applicable
10.	Monoculture	Woody	Annual	Vegetative	Not Applicable
11.	Monoculture	Woody	Perennial	Fruit/Seed	Orchard
12.	Monoculture	Woody	Perennial	Vegetative	Managed Forest or Woodlot
13.	Monoculture	Herbaceous	Annual	Fruit/Seed	High-Producing Agriculture
14.	Monoculture	Herbaceous	Annual	Vegetative	Ensilage for Livestock
15.	Monoculture	Herbaceous	Perennial	Fruit/Seed	Seed Crops for Category 16
16.	Monoculture	Herbaceous	Perennial	Vegetative	Hay Crops (Legumes & Grasses) & grazing

*See Plants, Man & Life by Edgar Anderson for the splendid chapter on Dump Heap Agriculture.

did not plow or where we did plant back nature's herbaceous perennials in polyculture, our livestock have become fat on the leaf and seed products. Throughout this entire expanse, the mixed herbaceous perennials have not been cultured for the purpose of harvesting the seed except for the rare times when collections were made to plant more mixed pasture.

In the eastern tall grass region, the white settler substituted the domestic tall grass- corn. In the middle or mixed grass region, he substituted a domestic middle-sized grass- wheat. Part of the problem of the dust bowl is that we tried to substitute the middle-sized grass wheat in what was short grass prairie.

The Dust Bowl followed the great plowing of the teens and twenties. When the dry winds blew in the thirties, the bad reputation for the region became firmly implanted on the American mind. We have had other severe droughts in the area since, and the wind has blown just as strong. All the work done by the Soil Conservation Service and others to prevent this major loss of our ecological capital should be applauded. It is truly the work of thousands of diligent and dedicated people who have spent most of their productive lives thinking and working on the problem, but a most sober fact can not be ignored. The soil is going fast. On some flat land there may be very little loss, but on rolling land the loss can be as high as sixty tons per acre per year. According to the Soil Conservation Service, the average yearly loss is nine tons per acre. Based on a random sample conducted by the General Accounting Office, eighty-five percent of the farms are losing more than five tons of soil per acre each year.[4] Furthermore, there is little difference between farms participating in USDA programs and those which do not.

Unless the pattern of agriculture is changed, our cities of this region will stand as mute as those near the Great Wall of China, along the fertile crescent or the region of Egypt which once hosted grain fields that supplied the empire of ancient Rome.

If we are serious in our intentions to negotiate with nature while there is still time for the American to heal the split, are we not being forced to ask if nature will uncompromisingly require us to put vegetation back on the ground with a promise that we are never to plow again? If that is nature's answer from the corn belt to the Rockies, will it require that we develop an agriculture based on the polyculture of herbaceous perennials which will yield us seeds not too unlike our cereals or legumes? This category, so glaringly blank in our table, needs filling desperately; and yet to contemplate the research, breeding, establishment of the crops, the harvest and separation of seeds is mind boggling. All this effort must go hand in hand with the transportation, milling and ultimately, the eating of this "instant granola in the field."

Is it too much to expect plant scientists to come up with such perennials, either through some inter-generic crossing of our high-producing annuals with some perennial relatives, or by selecting some wild perennial relatives which show promise of a high yield of a product that is at once abundant and tasty? Any scenario surrounding such an agriculture does seem to be truly in a fantasy world. For mechanized agriculture it would mean either a minimum amount or a complete absence of plowing, disking, chiseling and mechanical power weeding. There would be only harvest, fertilizing, pest control, genetic selection and the occasional replanting.

Where Do We Begin?

As the result of this analysis, I can see four lines of investigation which we might pursue, though not in equal intensity. I will present them here beginning with the most difficult and ranging to the easiest to implement. It turns out that the first two of these lines mostly involve our agriculture. The third is more relevant for the gardener, and the fourth would be shared by both gardener and agriculturist. For the first two, we begin with the assumption that for the Prairie-Plains Region, the seed/fruit producing, herbaceous, perennial grasses and legumes are the very best plants for saving our soils and giving us food directly.

(1) One line of research would involve the conversion of the current high-producing annual cereals and legumes into perennials through some inter-generic crosses with close, wild relatives. This will be discouraging work, for in most cases it will involve tedious manipulations such as embryo culture and the breakdown of cytogenetic and biochemical fertility barriers. Nevertheless, some of these techniques have been developed.

(2) We have the technical and scientific know-how necessary to begin an ambitious breeding program to increase the size and nutritional quality of the seeds or fruits of many of the herbaceous legume and grass perennials. Some of the legume candidates which come to mind include the large-podded, ground plum milk vetch, the scurf pea and some species of Baptisia. Of the grasses, we might try "improving" switch grass, Indian grass, eastern gama and some of the Panicums. But like our first consideration, the results will be a long time in the making.

There is another haunting consideration. The late Dr. Edgar Anderson, geneticist at the Missouri Botanical Garden, once posed the generalization that crops tend to be the highest producers outside the region in which they had their evolution. Large seed production in one region of the globe is the result of the centuries of pressure from its pests in the region of its evolution. For example, our sunflowers will thrive locally, in the place they evolved, but to obtain a crop with almost one hundred percent of the achenes fully inflated, a massive spraying of pesticides will be necessary. Sunflowers will probably do better with less spraying in the Soviet Union where they are, incidentally, a more important crop than in the U. S.

Anderson's axiom can not be dismissed lightly. We may be forced to consider the adoption of some European, but mostly Asiatic species, perhaps of the same genera as our prairie grass and legume perennials. These relatives, which were once somewhat contiguous through a circumboreal connection on a warmer earth, have evolved separate gene pools since the beginning of the Ice Age, well over two million years ago.

(3) Patches of native prairie have become few and far between, but their importance has increased. One of the most practical activities of professional and amateur alike would be to preserve the existing native prairie and work to re-establish, wherever possible, these prairie patches throughout the region. We desperately need them now so that we might have a standard against which to judge our agricultural and garden practices. The efforts of the organization, Save The Tallgrass Prairie, are justified on these practical grounds alone.

We live in a time when the conscientious organic gardener has developed an interest in companion planting. The native prairie had companion planting and still does where it exists. While diseases and pests do take their toll, the chemical diversity prevents the epidemic from ravaging the entire system.[5]

Many maps of the spatial relationships of the wild prairie species are needed. Once mapped, we can then select the domestic annual relatives to plant in the garden in the same spatial relationship we found the wild relatives in the field. These domestic analogs would collectively form a "domestic prairie" of edible annuals. We could then conduct some controlled experiments to investigate whether this type of "companion planting" has any previously undiscovered inherent virtue for reducing the impact of pathogens and other pests, including weeds which these individual garden crops experience in monoculture.

TABLE II

Wild Perennials	Family	Domestic Annuals
Big Blue Stem, Little Blue Stem, Indian Grass, Switch Grass	Grass	Sweet or Field Corn, Wheat, Rye, Barley, Oats
Buffalo Gourd	Cucurbit	Cucumber, Squash, Pumpkins, Melons
Petalostemon, Dalea, Psoralea, Baptisia, Vetch	Legume	Beans, Peanut, Peas
Physalis, Nightshade species	Nightshade	Potato, Tomato, Eggplant
Poppy Mallow, False Mallow	Mallow	Okra
Onion, Garlic, Leek	Lily	Onion, Garlic, Leek

On the left in Table II are some of the wild plants whose ecology we might study. For example, around some clusters of wild onion we might discover a relationship with some species that is unique to these "onion patches" on the prairie. Near the buffalo gourd may be another ensemble of plants which affords a measure of protection for this cucurbit. Perhaps squash bugs or cucumber beetles would be less of a garden problem if the buffalo gourd has a secret and we were to learn it.

Here I can not resist developing a scenario. Imagine a garden in the future in which a winter wheat and/or rye had been sown in the fall. This has provided ground cover through the winter and early spring. The cereal grains are not planted for harvest. They are more substitutes for their perennial relatives, the wild perennial grasses. The rest of the garden is planted in this grain field, but in spatial relationships which generally resemble a vegetation map of their wild relatives of the prairie.

Any naturalist, amateur or professional, looking for a chance to do some meaningful research could begin this micro-mapping of the native prairie vegetation. The number one problems in our garden at The Land are the cucumber beetle and squash bug. How well do the wild cucurbits fare on the prairie, and if they do better than their garden relatives, what plants are surrounding them and in what type of soil? The cabbage moth is another pest most exasperating to many an organic gardener who likes cauliflower, cabbage and broccoli. What happens to the wild species of the Brassicaceae in the prairie? We need to make this information more widespread.

(4) When we inspect Table I to find the closest reasonable category to our ideal (number 7), we have to make some decisions. It seems reasonable to favor polyculture over monoculture, perennial over annual, and probably fruit/seed over vegetative since what we seek are substitutes for annual grain crops. All of this assumed, we are left to select woody over herbaceous. Result: the mixed orchard.

Two questions now come to mind. What kind of food value do the various nuts and fruits have and how does their production compare to one of our major crops, such as wheat? A more thorough-going literature review and analysis of data pertaining to these questions will begin in February, 1978 at The Land, and I expect the results to be reported in the next issue of The Land Report.

On the question of comparative production, a cursory survey and analysis suggest that both the economics and the biological feasibility are there to support an agricultural shift. I have not looked at the alternative machinery for harvest, storage, milling etc.

The advantages of tree culture have been enthusiastically spelled out by the late J. Russell Smith in his splendid book, Tree Crops.

> For experiments in breeding, the tree has one great advantage over most of the annuals. We propagate trees by twig or bud, by grafting or budding. Therefore, any wild, unstable (though useful) freak, any helpless malformation like the navel orange which cannot reproduce itself, can be made into a million trees by the nurseryman. The parent tree of the Red Delicious variety of apple grew, by chance, in an Iowa fence row. A representative of the Stark Nursery Company saw the apple at a fair and raced with all speed to the tree, bought it, and reproduced it by the million, an easy process if you really need a million trees. With corn, oats, or alfalfa, the breeder must produce a type true to seed before the farmer can use it.
>
> Not only is the tree the great engine of production, but its present triumphant agricultural rivals, the grains, are really weaklings.
>
> All plants require heat, light, moisture, and fertility. Give these things and the tree raises its head triumphantly and grows. But in addition to these requirements the weakling grains must have the plow. A given area may have rich soil and good climatic conditions, but be unsuitable for grain if the land happens to be rocky. Nor are steep lands good farm lands for grains. Trees are the natural crop plants for all such places.
>
> Moreover the grains are annual plants. They must build themselves anew for each harvest. They may, therefore, become victims of the climatic peculiarities of a certain short season. It is rain in July that is so vital to the American corn crop. The rains of June cannot bring a good crop though. Also, if most of the rain due to fall in July happens to come in August, it comes too late. The corn has shot its bolt; it cannot be revived. Trees are much better able than the cereals to use rain when it comes. They can store moisture much better than the annuals can store it, because they thrust their roots deep into the earth, seeking moisture far below the surface. They are able to survive drought better than the annual crops that grow beside them. For example, a drought that blasts corn or hay or potatoes may have little influence on the adjacent apple orchard. Trees living from year to year are a permanent institution, a going concern, ready to produce when their producing time comes.
>
> Therefore, the crop-yielding tree offers the best medium for extending agriculture to hills, to steep places, to rocky places, and to the lands where rainfall is deficient. New trees yielding annual crops need to be created for use on these four types of land.

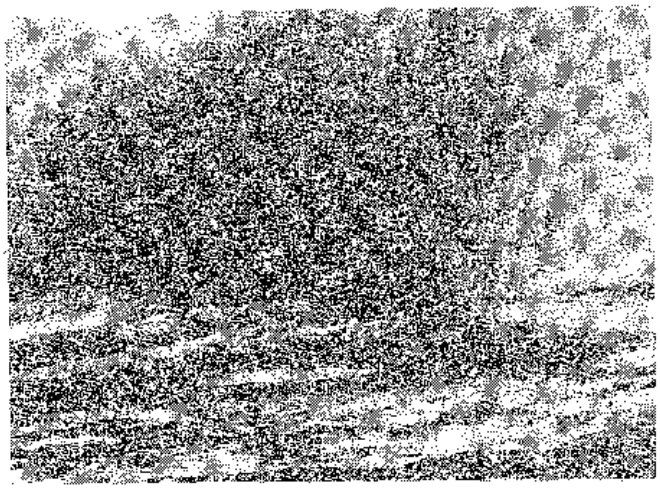
When E. F. Schumacher spoke on tree planting, he spoke from an intuitive understanding of the tree as "soft" technology, as a source of food, as a holder of soil, as a way of dealing with the global food and energy problems all at once. Though he spoke from his religious "center," he was also aware of the historical record of the devastation caused by man due to the neglect of trees in the Mediterranean, all of Asia Minor, much of India and in many parts of Asia. I doubt that Schumacher constructed anything like Table I of this paper, nor did he need to in order to see that the closest category to our ideal for the great prairies and plains agriculture which is blank on the table is the mixed orchard. Happily, Schumacher believed we can all do something about these problems by reminding us that

> "We can better prepare by taking seriously the possibility of growing a lot of food on trees of various kinds, including carob, honey locust, and all sorts of extremely useful trees. It takes some time if you embark on a long journey, and the only advice that one can give is that you should get up early. We have all been sitting under trees planted by our ancestors, so let us plant

trees so that our children and grandchildren can sit under them and possibly get the harvest. The interesting thing about this which now becomes more understandable is that the tree is a three-dimensional solar collector and is of such miraculous powers that only people that have done the grafting and breeding work fully realize. The first thing to do is for people to really get busy in a popular democratic movement everywhere to establish a tree that is potentially useful, a tree that can produce food, not only timber. Once we have the stock established, then there will be sufficient interest to do the work of selection and even plant breeding to make the best of it."

The shelter belt program, started in 1934 by President Franklin D. Roosevelt, by 1943 consisted of 19,000 miles on approximately 33,000 farms.[7] Many large and beautiful shelter belts still march east-west across our countryside. Though these trees were not planted for their fruit/seed bearing qualities, these local survivors tell us something about the potential of trees in the area. The late botanist, W. H. Horr of the University of Kansas, watched and studied these shelters for more than thirty years, always comparing them to the surrounding vegetation. Several years ago he told me that during certain periods of extreme drought, he had observed numerous deciduous trees in western Kansas cutting their leaves as early as July. In the spring, these trees would leaf out again, thus demonstrating that the leaf loss was a remarkable mechanism for reducing transpiration and additional drought stress.

We need to caution ourselves about completely relying on survival and productivity information gained from studies of shelter belt trees. The shelter belt really stands as an island in a field. For more than thirty-five years now, top soil has been trapped by the dense growth, thus affording a rich supply of nutrients. Furthermore, they serve as snow fences accumulating large drifts and therefore a disproportinate amount of moisture available for plant growth compared to the surrounding fields. (see photograph). Nevertheless, because of the planting records and the few follow-up studies which were done, these trees may provide the best base-line information available for exploring the feasibility of woody perennial polyculture in the Great Plains.



An island of hedge. Note where dozer has leveled the ground to grade at right. Photo by Harry Mason

In the next Land Report I hope we can present a list of the more promising trees for the Great Plains area, along with an assessment of their use, likelihood of success, most promising varieties and how they might be integrated with herbaceous vegetation on the ground. I suspect we will be advocating honey locust grown for sugar, and perhaps persimmon, acorns and mulberry for livestock, and several other tree products for direct human consumption. Those who wish to get started this spring, however, could plant the honey locust, Gleditsia triancanthos. I suggest this tree, because in a 1944 survey of the plantings in the shelter belts, the highest percentage of survival was with the honey locust at seventy-nine percent. In 1942 some five year old trees of the Milwood variety produced an average of 58.3 pounds of pods per tree. At forty-eight trees per acre, this would equal 2,798 pounds of pods.[8] Furthermore, this Milwood variety has produced as much as thirty-six percent sugar.[3]

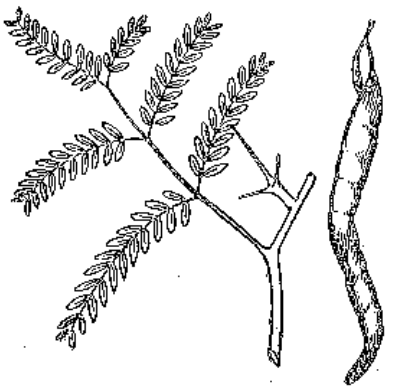


Fig. 3 Honey locust branch, leaf and pod. The Milwood is a high sugar, thornless relative of this species.

In Conclusion

The depth of the human-nature split, symbolized by the depth of the hillside gullies, as far away as the Great Wall of China, or maybe as near as our closest field at home, is not highly visible in modern agriculture. The chemotherapy treatments to the land promote a temporary vigor more impressive than these fields have ever known. Though the physician may rejoice with his cancer patient that he is feeling better in response to the treatment, he is also careful to monitor the telltale systems of the body. Similarly, those interested in the long-term health of the land need only stand on the edge of a stream after a rain and watch its plasma boil and turn in the powerful current below and then realize that the vigorous production of our fields is, unfortunately, temporary. Since we initiated the split with nature some 10,000 years ago by embracing enterprise in food production, we have yet to develop an agriculture as permanent as the nature we destroy.

Rcferences and Notes

[1]This discussion on the human-nature split about the ways of humanity versus the ways of nature is merely a convenient mode for discussing one of the earth's problems. Of course we are all aware that Homo sapiens is a product of nature and that it can be argued that anything which is, is natural, etc. Philosophers have fun with this type of discussion. I do too, sometimes, but I have not chosen to spin it out here for I think most readers would be weary long before we reached our main point of the discussion.

[2]On the basis of a paper, "Energy Use in the U. S. Food System" by John and Carol Steinhart from Food: Politics, Economics, Nutrition and Research edited by Philip H. Abelson, 1975, I have estimated that from four to eight percent of U. S. energy is spent in agriculture at what we might call the "production level." Given this low percentage, it would seem that in a decade or less we could convert to fuels made out of several forms of now-wasted biomass to yield such products as alcohol and methane.

[3]Tree Crops by J. Russell Smith, The Devin-Adair Company, New York, 1953.

[4]National Wildlife, February-March, 1978, page 28.

[5]I personally believe that most of the gain from companion planting methods is due less to some chemical exuded by a neighboring plant than to presenting the pests with the mathematical problem which could best be understood through vector analysis (no pun intended). If a different species is growing next to one which an insect has an enzyme system to handle, then respiratory energy must be spent to find another plant. Less of the pest's energy budget is available for reproduction. Exponential growth is more likely where the food supply is contiguous, as on a petri dish, than when it is not.

[6]Intermediate Technology Report 4/5, Summer, 1977.

[7]The Journal of Forestry, April, 1946, pages 237-257.

[8]53rd Annual Report (1942) Alabama Agricultural Experiment Station, page 54.

[9]I thank O. S. Fent for his helpful critique of this paper.

[10]I thank Ted Landers of New Life Farm, Drury, Missouri, for first calling to my attention the numerous merits of the honey locust.

Kansas Organic Producers' Annual Meeting

William Lockeretz, principal investigator with the Center for the Biology of Natural Systems at Washington University in St. Louis, Missouri, will be the featured speaker for the KOP Annual Meeting on February 11 at the University Methodist Church in Salina. Lockeretz will explain the purpose and range of interest of the Center as well as report on the research project that is studying organic farms in the Midwest. This study, the first of its kind, caused a stir in some quarters when it revealed that the per acre net income on organic farms is essentially the same as that on conventional farms.

The report that brought the CBNS and Washington University to the attention of the organic farming community came out in 1975. It compared the crop production, profitability and energy consumption of sixteen organic and sixteen matching conventional Corn Belt farms. According to that report, not only did the organic farmers produce about as much per acre and earn as good an income as the conventional farmers, they used only about a third as much energy to do the job. The Center is currently trying to broaden the base of their study and hopes to learn more about organic farming all across the Midwest.

Mr. Lockeretz will speak at 1:30 P.M. He will be followed by a slide-viewing tour of Kansas Organic Producer farms presented by Nancy Vogelsberg, former student at The Land Institute. The KOP business meeting will take place in the morning at 10:00 A.M. The mid-day meal will be pot-luck. Everyone is invited.

The possibilities of the future are boundless. Until now we have destroyed as much as we have constructed and we are beginning at last to pay for that destruction in terms of reduced living standards and health and intelligence, in subsidies and all manner of politico-social-economic short cuts, tricks and panaceas. There is a tremendous job ahead of reconstruction and restoration, a job quite as big and infinitely more complicated than the job of subduing the wilderness by the first settlers. What we need is a new courage and a new race of pioneers, as sturdy as the original pioneers, but wiser than they--a race of pioneers concerned with the physical, economic, and social paradise which this country could be, if there were fewer exploiters, fewer selfish minorities, fewer self-seeking, vain-glorious politicians, fewer social and economic panaceas and fanatics. When there is no more soil, there will be no more nation, and the American civilization, even in its crude materialistic manifestations, will wither and pass away. (From the last chapter of Pleasant Valley by Louis Bromfield, Harper & Brothers, New York, 1945)

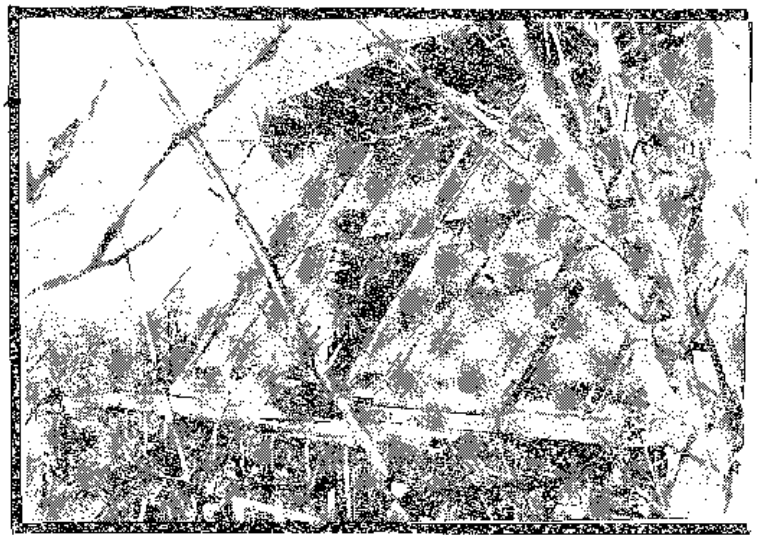
Alternatives in Energy

Building a Solar Hot Water Heater

Since one of my long-range goals is to build a house that is as energy self-sufficient as possible, I came to The Land with an interest in doing a project that would give me some practical knowledge about energy alternatives. This desire found a good match with the needs of The Land in the form of a solar hot water heater. There is a kitchen in the lower level of the "Doings" building that will eventually be used in preserving the food grown in the garden. As of the beginning of this session, nothing had been done to provide a supply of hot water to this area. In the middle of the roof on which are mounted the collectors for heating the building, was an area of about seven square feet that was not being used, so Wes and I decided that we could take advantage of that for heating water. Since the supporting structure was already in place, this seemed to be a good choice for a project.

I decided to build a passive system; that is, one that does not require a pump to move the water through the system, but lets the sun do that job. Such a system uses the principle of a thermosiphon which takes advantage of the fact that as water is heated, its density decreases and it then tends to rise to the highest point of its container. Thus, by putting the storage tank above the collector, and connecting the top of the collector to the top of the tank, and the bottom of the collector to the bottom of the tank, and making sure the connecting pipes are always sloping upward, the water heated in the collector should rise to the top of the tank. As this happens, the cooler water at the bottom of the tank will be drawn down to the collector. This arrangement is shown in Figure 1.

The collector, illustrated in Figure 2, was built mostly from materials that were on hand from the "junk" piles. The copper tubing was chosen because of its excellent thermal conductivity,



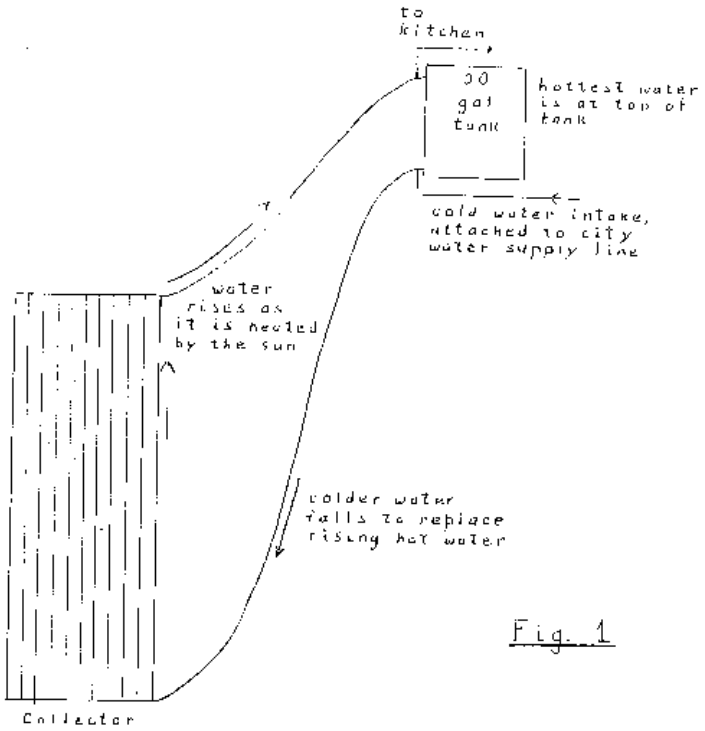


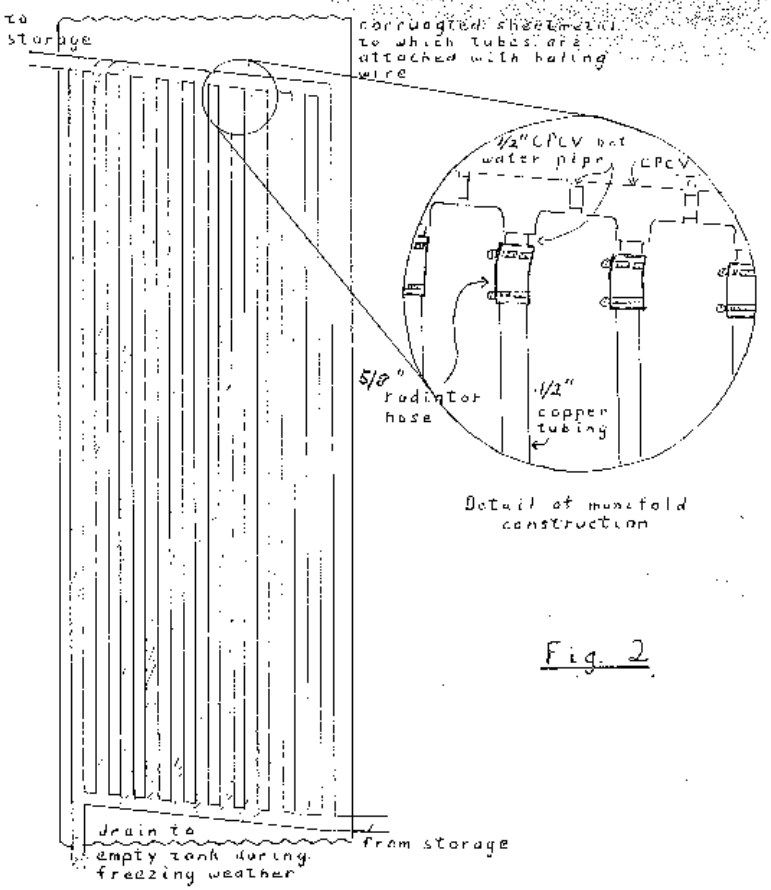
Fig. 1

plus the fact that it was "in stock" at The Land. If it had been necessary to purchase it, I might have chosen an alternative because of the expense. The corrugated sheet metal and plastic pipe were also salvaged from the "junk" pile. The radiator hose, hose clamps and plastic T's were purchased at a local hardware store, as were the elbows and valves for the rest of the plumbing in the system. The plastic plumbing was chosen because it is somewhat easier to work with, and I had not done any plumbing before.

The method of connecting the plastic manifold or header to the copper tubes with hose was chosen to give some flexibility and allow for the different rates of expansion of the two materials. In addition to the hose clamps, these joints were sealed with a liquid gasket sealer.

I decided to use the manifold technique rather than a continuous series of elongated "S" loops running up and down the collector, because in that type of arrangement, half the tubes would carry water up and half would carry water down the other side of the "S." This would oppose the natural thermosiphoning action in which the water rises in all the tubes.

The storage tank is a twenty gallon electric hot water heater from Sears. This will serve not only for storage, but also as a backup system when the sun is not shining or more hot water is needed than the solar system can supply. This backup will be operated manually rather than by the built-in thermostat. The reason for this is that as hot water is drawn off at the kitchen sink, cold water will enter the tank to replace it faster than the



Detail of manifold construction

Fig. 2

collector can heat it. But if less than the full twenty gallons of hot water is used, the electric heater is not needed. However, if the thermostat were in control, it would not sense this and would begin to heat the water right away, even if the collector were operating.

The system is almost finished, but at this point the thermosiphoning action has not been tested because sub-freezing temperatures blocked the cold water intake line. Hopefully there will be a warming trend which will allow me to fill up the system and see if it is going to work. The next LAND REPORT will probably contain an account of just how well the system works.

Mel Stampe

Early 1900 Southern California newspaper ad.

Lighting the Path with a Six Volt Wind Generator

During my first few weeks at The Land, I spent a good deal of time "tailing" along with John Craft and Marty Peters, the resident wind experts, asking questions. I also read Wind Power Digest, Windustries and The Energy Primer. After that initial apprenticeship, and with a little prodding from Wes, I began my own project, the repair of a battered six volt Windcharger. Its tower had blown over in a wind storm.

The propeller had broken, so I needed to make a new one. I used redwood because of its lightness and resiliency. The wood was shaped with a draw knife, then planed and sanded. Balancing the blade was the most tedious part of the process. Not only is it necessary to get equal weight throughout the blade, but a relatively consistent shape must be maintained.

After completing the blade, it was necessary to heat and straighten out a few pieces on the braking mechanism bent from the crash and to repaint the machine. I welded a stronger bond between the two sections of the tower where it had broken in the storm and was then ready to put the generator back up on the tower.

We mounted the generator and checked the wires for current. The blades were turning, and everything seemed to be OK. However, nothing was happening to the needles on the ammeter used to check current. The tower and the generator came down again. Marty and I tested the generator to see if it were putting out power. That test proved positive, so we knew the problem wasn't in the generator, but maybe in the wire connection. We put the generator back on the tower and erected the whole kit and kaboodle again. Even though all electrical connections were clean and secure, there was still no reading on the ammeter. Maybe there were not enough revolutions per minute, another of Marty's theories to prove or disprove.

Down came the generator again. By this time, it was becoming a ritual to put up and take down the generator. In the meantime, I built a small box to hold the two six volt batteries that were to be used for storage. A parallel connection was used to increase storage capacity but maintain six volt current.

Before connecting the generator for the third time, John suggested that I directly connect the wires from the generator to the batteries, rather than go through the slip rings. The Craft connection worked.

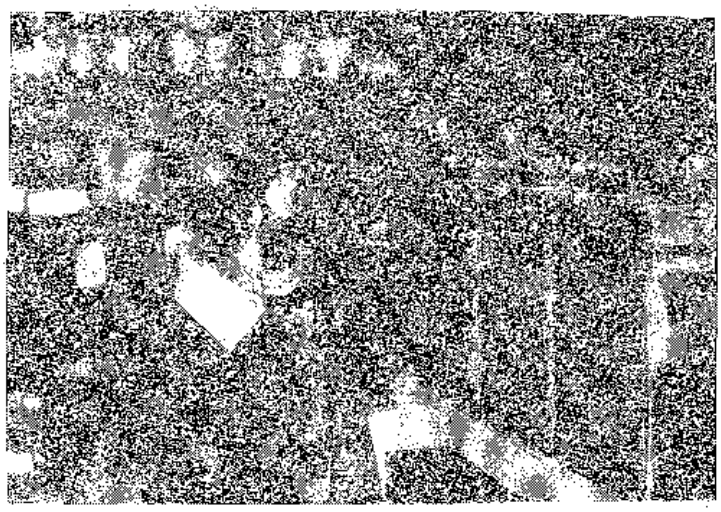
The machine is now putting out a maximum of twenty-five amps or 200 watts. The electricity is used to illuminate three lights made out of six

Consumer-Utility Conference

The Land Institute was well represented November 21-22 at a conference in Topeka entitled "The Utility and the Consumer." The two day event was sponsored by the League of Women Voters of Kansas in cooperation with the Kansas Corporation Commission and the gas and electric utilities of Kansas. The stated purpose of the conference was to provide a forum for discussion so that utility companies and consumers could better understand each other's problems, since such an understanding must precede finding answers to the larger questions: "What are the future sources of energy?" "Where will they come from?" and "How will we pay?"

Twelve speakers presented different perspectives on the energy situation, and the topics included the utility perspective, the consumer perspective, the utility dollar, the natural gas perspective, the cost of energy, the need for energy, rate structure and innovative rate design, and the role of the regulatory commission in rate reform. The program included two informal discussion sessions, and a "firing line" panel to field questions from conference participants.

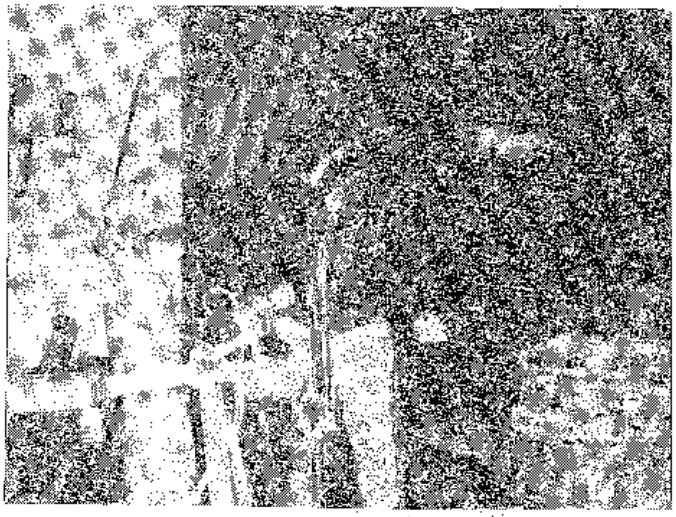
It was discouraging to us that the discussion could not break away from what Wes termed "fine tuning of the system." Over and over the discussion belied the underlying question: "How can we maintain our energy "habit" and still keep the cost down?" No one wanted to think about how to get unhooked. No one wanted to recognize that



the best and least costly means of reducing our energy vulnerability and the concomitant problems is to use less energy.

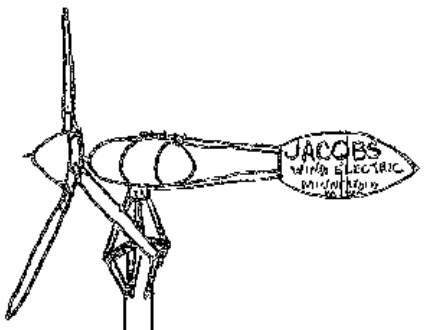
Through this conference, The Land Institute students and I became acquainted with many Kansans concerned about energy and gained experience in discussing energy issues. Our attempts to put forth convincingly our ideas regarding energy were sometimes feeble. However, as we continue to become better informed, we can participate more confidently in such forums in the future.

Marty Peters



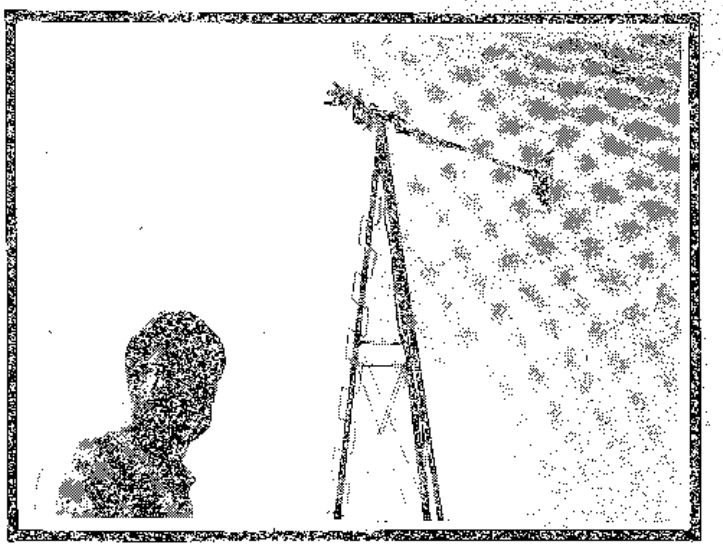
volt tail lights from junked automobiles. We spaced these three lights along the path leading to the north door of our building. Each light is covered with a fruit jar for weather protection. The Land Institute does not have a tall pole with a bright light that comes on at dusk. However, our "wind lights" on the outside of the building and along the path make the approach to the building safe, without obfuscating the light of the stars and the moon.

Bill Elliott



The wind doesn't lightly give up
The gift from the sun.
The sleek, sturdy silvery tower's bracing
Must resolutely clutch the Earth
To affirm Jacobs' insistence that he, not the wind,
Is executor of the sun's legacy.
And Jacobs not only passes that
Gift on to me, but he
Concentrates it, packs it with green fire,
Charges it with lightning, so that I,
Helpless to use the wind's power in the raw
May receive a custom-tailored tool.

Marty Peters



Energy Notes

LEARNING BY DOING

In September, two reconditioned Jacobs wind electric plants were installed on guyed steel pipe towers at The Land. The 2000 watt, 32 volt plant was put to work charging the 1680 amp hour battery bank from which the upper floor of the "Doings" building draws its power for lights and motors. The practical experience gained in wiring, adjustin the controls and day to day monitoring of the system has given us an appreciation of all that's involved in a wind energy system. It has also shown us weaknesses and strengths in the Jacobs plant and low voltage D C current from lead-acid batteries.

The second Jacobs, a 2500 watt, 32 volt unit, will also be tied into this battery bank as soon as some new aluminum castings are made to secure the propellor blades to the governor shafts.

NEED VERSUS CREED

Henry David Thoreau may have solved our energy crisis in his simple directive to "Simplify, simplify, simplify!" I propose that to ask how our nation can meet its energy appetite in the future, regardless of the source of energy, is a totally inappropriate question. To ask how to simplify the nation's energy demands is a more fitting inquiry.

The most obvious way to simplify energy demand is to reduce energy demand. Thermodynamic matching and technical fixes, such as home insulation, smaller cars, etc. will aid in reduction. However, the area most needing fixed is the human mind, the mind that assumes a higher standard of living means a higher quality of life, that desires the luxurious car, the large house, and the mechanical gadgets to fill the rooms in that house. And more. The fact that Americans "get off" on material goods may well have more serious long term environmental effects than overpopulation or wars.

What does it take to get us to question the life-long assumption that "things" can make us happy, or happier? We're willing to be bored and frustrated for forty hours a week to be almost able to afford "things" which the ad propaganda leads us to believe would make us feel good.

I believe if our nation were to consume one fourth the energy we now use that the number of meaningful jobs would double or triple, community life would improve, and the harmful environmental impact would lessen. In short, our quality of life would improve.

LOOKING.....and STILL LOOKING

The grant from the National Center for Appropriate Technology to conduct a survey of components commercially available with potential applications in wind electric systems has been an excellent springboard in our attempts to locate these components that could be assembled into a successful wind machine. The most difficult problem to date has been finding an alternator or generator suitable in both price and specifications. The majority of modern commercial generators or alternators are high speed units which would require a gearbox for a suitable hookup to a wind-driven propeller. This increases maintenance (in the form of annual oil changes) and reduces life expectancy (because of the high rpm) and overall efficiency (because of increased friction).

Only recently have slow speed machines become available--and these are still either in the development stage or in early production runs. However, the indicated prices and performances appear to insure a promising future for reasonably-priced, well-engineered wind energy machinery.

John Craft

Wind Power Research Project

The wind power research project that has been conducted since last July has focused primarily on an analysis of system design and the determination of a machine design that is within the capability of local manufacturing resources. Because of the latter, our main interest and data-gathering has concerned those systems with peak ratings of no more than ten kw and which are applicable to individual residences. The potential market for small wind systems consists of rural, single-family, owner-occupied, permanent, year-round residences.

In areas such as ours with almost universal availability of utility electricity, greater cost effectiveness is yielded by supplemental power systems than by independent systems. Although still not competitive with utility rates, a system to provide electric water heating with a power company backup presently is the most economical way of utilizing wind energy in our area. The major advantage of this system is that it does not require expensive power conditioning and electrical storage equipment. The economics of wind electric systems hinges upon the electric utility rates, and present trends indicate that wind electric systems could achieve economical status within a few years.

The complete analysis and conclusions of the study will be published by The Land Institute as a separate circular, available for a nominal fee upon request after March 1.

Marty Peters

Alternatives in Shelter

Earth Walls on the Indian House

To promote regional self-sufficiency, a shelter should be constructed mostly of local materials, thus eliminating the transportation costs in terms of dollars and energy, and reliance upon other regions.

Earth lodges were built by the regionally self-sufficient Indians of the Central Kansas area. Nancy Vogelsberg and Sue Leikam, previous students at The Land, began to construct a log frame house modeled after the excavated remains of an Indian house two miles south of The Land. The original Indian houses were constructed of local timber: hackberry, cottonwood, or burr oak. Loose earth was piled against the logs, thus creating a thick-walled structure, a large thermomass.

The Land's Indian house is a round building, twenty-five feet in diameter, framed in hedge. Pallets, discarded by a hardware store, were nailed to the frame to compose rough walls. The original plans were to use adobe material for the walls, but upon my arrival at The Land, Wes suggested that perhaps tamped earth might be more appropriate.

The tamped earth process first involves mixing earth with another material to give it stability. This mixture is placed in a three to six inch layer inside forms and tamped, or rammed down to form a hard, compact surface.

After researching rammed earth and running soil analyses, I determined that the sub-soil at The Land would be excellent if it could be stabilized with lime at the ratio of ten parts earth to one part lime. A tamped earth structure requires a large amount of soil. We considered how much we needed for the Indian house and decided to use a bulldozer to remove the top soil, scrape three to four inches of sub-soil into a pile for construction purposes, then replace the topsoil over the stripped area.

Dave, Maureen, Jim, Carol and Bill mixing lime with earth.

After this was done, I began wall construction with the help of all the students. We tacked polyurethane to the outside walls to prevent the earth from falling through the pallets. Concrete forms were set up to hold the eight to ten inch walls we planned to construct.

Utilizing the "good junk" from the scrap metal pile, we built three tampers. I began the tamping process by myself and found that it went very slowly. Nearing the end of the semester with a very small portion of wall built, I decided to change my method. We rented two air tampers and a one hundred cubic feet per minute air compressor and tried the industrial tamping method.

Before we rented the tampers, the other students helped me mix large quantities of earth and lime with hoes and shovels and make piles of the mixture around the building. After tamping began, we tried combining the earth and lime within the forms. However, this method failed to yield a homogenous mixture, and we returned to mixing it on the ground.

After eight hours of work (the amount of time we rented the equipment), the first level of the wall was completed. A tamped earth wall about three and a half feet high extends nearly all the way around the Indian house.

During the process, many unforseen complications arose. For example, the tamping forced the concrete forms outward, opening cracks in the outer walls. The polyurethane ripped, and small boards had to be placed over the rips to prevent loss of the earth-lime mixture.

The biggest drawbacks to the industrial tamping method we used were the expense and the consumption of fossil fuel. The process consumed fifteen gallons of gasoline to run the air compressor and tampers for eight hours.

The tamped earth walls will be kept under observation to discover how they hold up in low freezing temperatures or heavy rains. It will be up to someone else during another term to continue building the walls on the Indian house.

Dave Kearns

A Talk With Malcom Wells about Underground Houses

The Land Institute has benefited immensely from its association with the College of Architecture and Design at Kansas State University. Dean Bernd Foerster is a valuable member of our board of directors. Assistant Professors Gary Coates and Bruce Snead are concerned about ecologically-appropriate buildings and have been interested in our shelter experiments at The Land.

MALCOM WELLS contd.

On November 10, some of our K. State friends brought Malcom Wells, prominent designer of underground houses and a guest lecturer at the College of Architecture, to spend an afternoon at The Land. After looking at the newspaper house, the adobe building and the Indian house with rammed earth walls in the Experimental Village, and eating a soup lunch which our students had prepared, Mr. Wells sat down in the classroom to answer questions about the structures he designs.

The underground houses are not buildings bermed on two or three sides, but houses with dirt on the roof and plants growing there. His office in Cherry Hill, New Jersey, is built underground on a tiny lot close to a freeway and a sewer. The office is totally shielded from freeway noise by being underground. Light pours through the doors opening into a courtyard and the hillside windows.

"There is still a tremendous prejudice against the word 'underground,' but it's so delightful to see people turn around when they experience it that I like to call it that."

When asked if building codes prevented people from building underground, Mr. Wells replied that although some states do have an absolute prohibition against underground houses, in most states, as long as the houses have daylight and proper ventilation, there is no problem. He pointed out that underground houses must look nice to be saleable; eye appeal has much to do with their acceptance. However, to some people, an attractive house under a hill doesn't look like an attractive house, but an attractive hill.

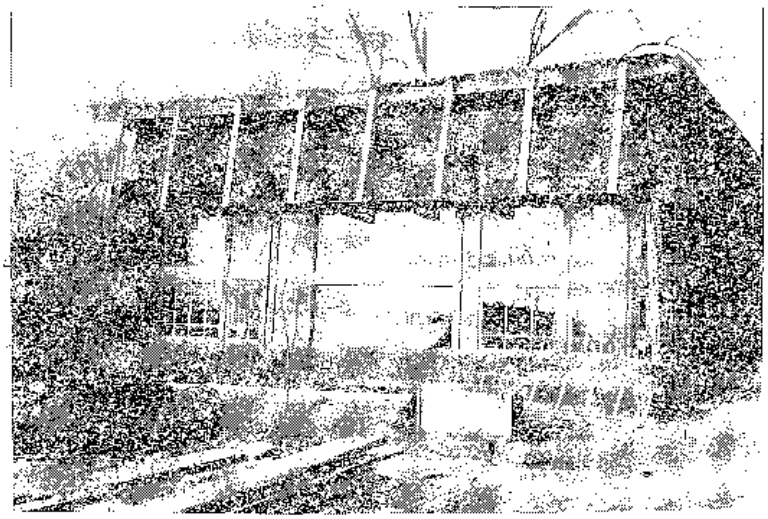
The cost of underground houses was discussed. Energy savings make them economical in the long run; but since they are initially more expensive, generally only upper income people can afford them, unless, as Leland Lorenzon remarked, "a man builds his own house, cheaply." (Leland lives in a house with dirt on the roof which he built himself.) One compensating factor in the cost of underground houses is that they can be built on low-cost lots deemed unsuitable for conventional housing.

"Do you all know what oceans and big rivers are? Heard of them?" Malcom Wells asked his midwestern audience. "Anyway, where I come from, everybody who has a lot of money, and that's millions of them, immediately buy a boat and every weekend and every vacation they spend on this boat. They live in the most cramped quarters with great pride...I think somehow we've got to make that jump toward small, tiny houses being appropriate and patriotic and successful...but we can't have that. If you live in a small house, you're a failure; if you live in a boat with small rooms, you're a success."

Gary Coates commented, "What we need is the high status people to go for small houses, so the other people will know that's how you keep up with the Joneses."

After driving through the rolling hill country between Manhattan and Salina, Malcom Wells was thinking about building a house in Kansas and moving here. "Today, it's Kansas," he said.

Editor's Note: There is a good article with illustrations about Malcom Wells and his designs in the CoEvolution Quarterly, Fall 1976, pages 84-93, available in The Land library.



In an effort to live out a lifestyle which would make less of an impact upon the environment, John and I decided to experiment with living in a structure made mostly of prairie grass hay bales. We wanted to use hay bales because of our belief that buildings should be constructed primarily from locally-available materials.

Lumber for construction of this building was obtained by tearing down a nearby abandoned farm house. After setting up a 12' X 22' pole frame (using old telephone poles) and framing out for windows and the door, we covered all remaining outside wall space with plastic to serve as a vapor barrier. Then we stacked hay bales on edge outside the plastic. The pole frame had been set up leaning in, so the haybales stacked easily. The north and south walls measure 22' in length. The heighth of the south wall is 10½' and the north wall is 7½' high. Windows cover about one half of the south-facing wall to allow the sun to heat the house during the day. We constructed rafters for the roof to accommodate rows of hay bales for insulation in the ceiling. Corrugated steel roofing was used.

The work on the inside of the house consisted mostly of building shelves, setting a kitchen sink in a counter, installing a small wood-burning stove, digging a hole to serve as a refrigerator, and doing a minimal amount of wiring. The electricity we use to run lights, a radio and a sewing machine is supplied by the wind generator John made from junked car parts. Our goal was to start out with only enough conveniences to keep us warm and fed. So as of now, we are bucketing our water in and carrying it out again when it's been used.

We're also cooking and heating with one small wood-burning stove located in the center of the house.

So far, we have been happily surprised at how easy it has been to adjust to life without even some of the most commonly used modern conveniences. Although we were concerned that not having these conveniences would necessitate spending more time with daily tasks, we find that they require less time because the tasks themselves have been simplified.

Carol Craft

The "Doings" Building Number 2

When the first building was under construction at The Land, Sara Jackson, then eight years old, would ask, "What's Daddy doing?" The reply always seemed to be, "He's out at the building." So Sara named it the "Doings" building. We accepted her logic and began calling it the "Doings" building. When it burned to the ground on October 17, 1976, destroying all the tools, Wes's extensive personal library, and several student projects, we realized how apt the name was. Suddenly, there was no place to "do" anything.

By the start of the spring term, which was delayed a month, Wes and friends had constructed the skeleton of the present building. There was a shop area on the first floor, and a classroom walled off and insulated from the shop. The spring term students used this first floor.

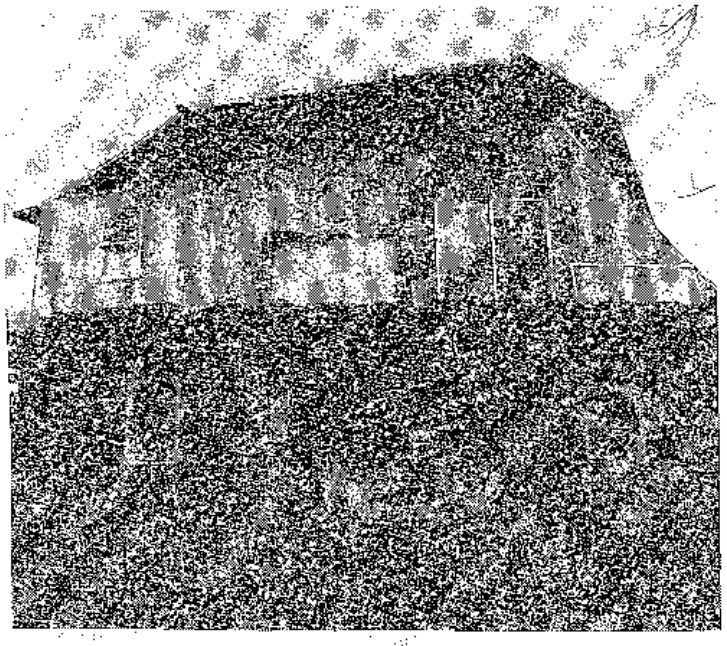
During the summer, Wes hired some help and began to close in the second floor. They installed doors and windows, insulated and sheetrocked the walls, and built part of the solar collector system. It was ready for students when the fall, 1977 semester began, and in the early months, the room could be warmed enough by the wood-burning stove on cool mornings to hold class discussions there. However, it would not have been usable in late December and January as winter really began to set in if we had not worked very hard. Our goal was to have it ready by the Audubon bird count on December 18, so the pot-luck supper could be held there afterwards. We put up doors at the stairs and the entry way which cut out much cold air, and trimmed, painted and varnished. Wes finished laying carpet the afternoon of December 18, just in time.

Now we have a place to "do" things again at The Land in "Doings" Building Number 2. It is not completely finished by any means, but we do have the classroom-library area and office fairly comfortable. The only obstacle to accomplishing something in the office is the delightful view out the window down the ravine. It's sometimes a birdwatcher's paradise, but not a place for a typist to concentrate.

The Jacobs wind electric plant lights the building, but the solar heating system has not been completed. The collectors are in place on the roof covered with two layers of glass, and the upstairs ducts are in. However, the ducts under the floor have not been built, and the rock pile storage area downstairs is yet to be installed. On sunny days, we can tell the collectors are working when we open a door in the duct system and warm air pours out into the room.

The two wood burning stoves upstairs enable us to meet and work in comfort. We have been using the classroom-library for various events, such as solar/wind workshops, discussion groups, and our Famous American Naturalist lecture series. We can squeeze in a group of fifty people, but twenty-five is a more ideal number. There are three organizations with whom we share the meeting room from time to time: the Smoky Hills Audubon Society (and its library), the Prairieland Food Cooperative, and the Kansas Organic Producers. They held committee meetings here when the conditions were primitive, and now that conditions are pleasant, we expect them to find The Land an even more convenient place to meet.

The fire which destroyed the first "Doings" building set us back about fourteen months, or even more when we consider the projects neglected while we were intensely into construction and without an office. It is really gratifying to have reached the point once again where we have a place to "do" things.



Unfinished, but in use. With different roof braces and a balcony railing, the logs chinked, a door on the shop, the construction mess removed, and some landscaping with native plants, the "Doings" building will be attractive as well as functional.

"The subject at hand is life. To kill living land for 50 or 100 years by covering it with dead boxes and asphalt can in no way be favorably compared with building in such a way as to let the land not only survive but thrive for a century or two." (Malcom Wells in CoEvolution Quarterly, Fall 1976)

The Land Institute and Third World Technology

DANA JACKSON

Occasionally we are asked if the work we are doing at The Land Institute is applicable to the third world. This is a difficult question to answer.

When The Land Institute was organized, we recognized a need in the United States for a different approach to meeting human needs. The mass production system, promoting a high consumption of people's wants, not needs, not only wastefully depletes natural resources and pollutes air and water, but it dehumanizes people. Those who wish to live with more quality and less quantity must learn how to do more for themselves, to take a larger measure of control over their own lives, and to touch the earth lightly. They need to know about alternative shelters, alternative materials for construction, alternative heating and cooling systems, and how to grow their own food successfully.

More importantly, our children and grandchildren, faced with a growing scarcity of metal, mineral, soil and energy resources, will need to know about technology they can afford and maintain. The Land Institute is devoted to a search for alternatives in agriculture, energy, shelter and waste to help those in the present who desire a lifestyle more gentle to the earth, and those in the future who must live differently by necessity.

The types of projects with which our students and research associates experiment fall into the Schumacher category of "intermediate" technology, and we hope into the category of "appropriate" technology. The term "intermediate" implies technology which is halfway between small-scale, primitive, and large-scale, complex. But as Ken Darrow and Rick Pam of Volunteers in Asia point out in the Appropriate Technology Sourcebook, "'Intermediate' says nothing about the process by which the technology is to be developed, who is to control it, how it relates to social and cultural factors, and what effects it will have on the natural environment. 'Appropriate' seems to include a concern for all of these." It is "appropriate" technology that is most needed in the third world.

THE TRANSNATIONAL DIALOGUE TO SOUTH ASIA

This last fall I had the opportunity to travel in India and Sri Lanka and learn about some of their problems of development. I was a participant in a program called the Transnational Dialogue to South Asia, sponsored by the Overseas Development Council and the Charles F. Kettering Foundation. The purpose was to help a group of Americans from diverse backgrounds and diverse constituencies better understand the social and economic aspects of world food and development problems by communicating directly with the people in third world countries. We talked to national government officials, village leaders, poor and prosperous farmers, shopkeepers, businessmen, teachers, social workers and researchers. Just as important as the dialogue with Indians and Sri Lankans was the dialogue carried on among the eighteen Americans. As we traveled and talked, we often noted what tools, machines or techniques were used, especially in agriculture, and discussed whether they were "appropriate" technology or not. During the trip I thought a great deal about the nature of appropriate technology and the relationship of The Land to third world development.

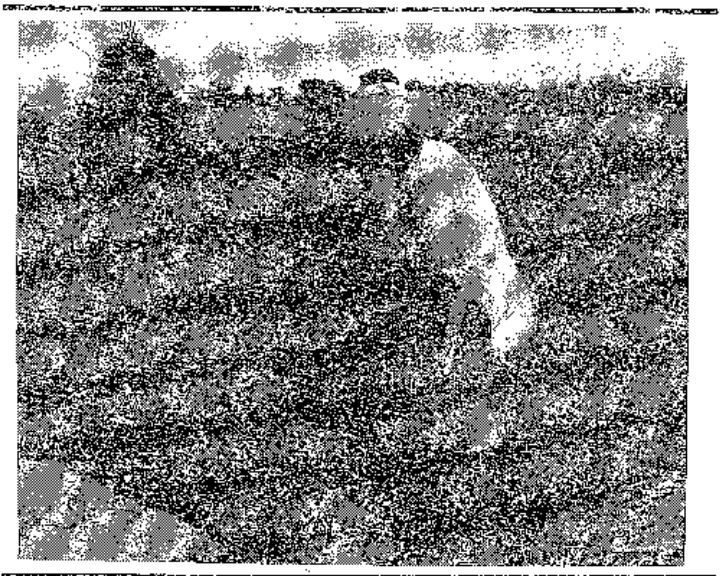
A main objective of the dialogue was to learn more about the problems of a developing country trying to feed its people. The day after we arrived in New Delhi, we went by bus to the state of Punjab which produces much of the wheat in India. Agricultural experts at the Punjab Agricultural University, established in 1960 and modeled after Ohio State University and other U.S. land grant colleges, showed us a film called "The Makers of the Green Revolution," which explained how P. A. U. developed the high-yielding varieties of wheat responsible for the doubling of production. But the Green Revolution did not happen because of improved seed alone. Irrigation and increased use of fertilizer also made it possible. The university experts were talking about another input, chemical weed control, when we were there, because the new dwarf varieties of wheat sometimes get overtaken by weeds.

The increase in wheat production has made Punjab farmers prosperous, relative to farmers in other parts of India, and ambitious to have machinery to become more prosperous. We talked to a thirty year-old farmer who plows with bullocks and asked him what would help him farm his nine acres more efficiently, and he replied, "A tractor-a Ford 3000." We asked the same question of a farmer who manages ninety-three acres (twenty are his own), who already has a tractor and several other small implements. He wanted a mechanical harvester. We asked the commissioner at the grain market what the U. S. could do to help the marketing process, and he replied, "Elevators."

Is the American tractor appropriate technology? Is the harvester? The elevator? Dr. Raj Khrishna of the Planning Commission of India uses employment as a criterion for deciding. He told us in a special meeting in New Delhi that he could accept tractors for tilling, but that he had recently stopped the importation of five hundred harvesters because the machines would replace people who needed jobs. American-type agriculture, promoted by American type agricultural universities, resulting in greatly increased yield, is not helpful unless people have jobs to buy the food produced. India has eighteen to twenty-one million tons of surplus grain stored now, not

because everyone is well fed, but because the poorest people have no money to purchase the grain.

Seventy percent of the population of India lives in the rural areas, and twenty-five percent of that population is landless, so rural employment is extremely important. The Punjab imports laborers from other states to work in their fields, and the use of combines would make these people unemployed. An example of intermediate technology, the pedal-powered thresher, would make harvesting more efficient and replace fewer workers than the mechanical threshers. But if the main criterion for appropriate technology is that it be labor-intensive, the pedal-powered thresher would not be as "appropriate" as traditional methods. Clearly, employment, by itself, is not an adequate measure of "appropriate" technology.



NEW GOVERNMENT DEVELOPMENT PLAN FOR INDIA

Dr. Raj Khrishna, an American-educated economist (doctorate at Chicago, post-doctorate at M. I. T.), told us about the new government's plans for development in India. Although India has a modern industrial sector (engineering products are its second largest item of exports), and recently had a 250 million dollar balance of trade surplus, this seemingly successful development strategy has failed to improve the living standards of most of the people. The new plan will stress rural employment, and the key to this employment is irrigation. Twenty-five percent of cropland in India is irrigated; fifty-two million hectares are irrigable, but not irrigated. Irrigated land can be double or triple-cropped, thus increasing production and employment.

NO WINDMILLS IN THE PUNJAB

Wheat yield increase in the Punjab is largely because seventy-six percent of the cropland is irrigated. In Mahadian, a Punjab village which we visited, the sixty farming families and forty non-farming families owned ninety-seven tubewells with electric or diesel pumps. I did not see any windmills or wind generators in the Punjab. The Indian experiments with wind energy in Madurai and Bangalore have been described in American magazines, so I expected to see windmills.

At our meeting at the Indian Planning Commission, I asked Dr. Raj Khrishna why there were no wind machines in the Punjab to pump water, especially in light of the increasing cost of energy. He said that "small technology" (his term) is needed, but that no one receives any status for research in small technology, and therefore, little is done. Indians have the ability to manufacture anything, but they need designs, without strings, without royalty payments. The U. S. could help by providing professional advice, not money. If the U. S. would develop and use small technology first, then the Indians would accept it. If the American National Academy of Science would offer ten prizes a year for development in small technology, much more research would be done.

This did not quite answer my question, but it led me to some other ideas. What he said is true about "small" technology, but not true of "appropriate" technology.

If an American company manufactured windmills and sold them in India, this would not be appropriate technology. If the U. S. gave designs to Indian industrialists who produced windmills and sold them in the villages, this still would not be appropriate technology. In either case, the villages would need money to buy the machines, and there would be an element of dependency either upon the U. S. or the Indian manufacturers. But if people in the villages could design, or adapt a design of a windmill and assemble it out of some locally-available materials and maintain it themselves, they would be developing appropriate technology.

John Craft, research associate at The Land Institute, designed and built a wind generator out of automobile parts. This is certainly an alternative technology for the production of electricity, but whether it is appropriate or not in its application depends upon many social and cultural factors. We first looked upon his wind machine as something which could be built cheaply out of scrap parts; therefore, it was useful technology for low-income people, and perhaps people in the third world. Now there is some doubt about low-income people accepting a wind generator built out of junked car parts, at least in the U. S. If the design were easily available, and it could be adapted to developing country conditions, then perhaps The Land Institute could make a contribution to third world development.

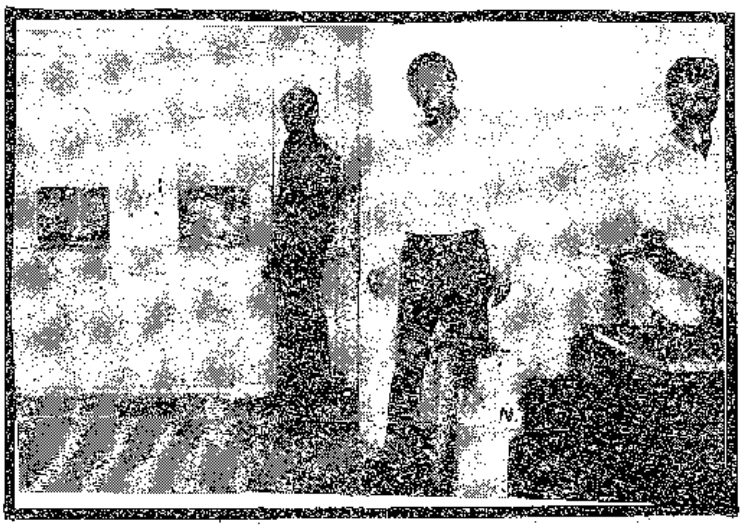
A design or an idea can be a catalyst for the evolution of appropriate technology within a particular region. This is why the Village Technology Handbook and the Appropriate Technology Sourcebook are extremely valuable publications, though their use depends upon literacy, or maybe an educated outsider, to bring the ideas to the villages.

TRADITIONAL TECHNOLOGY AND INDIGENOUS TECHNOLOGY

"Traditional" technology and "indigenous" technology are other expressions often used in

reference to "appropriate" technology. The terms sometimes are synonymous, e. g. when used in reference to adobe mud houses with thatched coconut leaf roofs in Sri Lanka. However, traditional technology can obstruct development. In India, I was enormously bothered by the sight of the sweepers, the untouchables, crouched down in the dusty streets, in the dairy stalls at the dairy research barns, on the pavement at the train station, using short bundles of straw for brooms. I could not understand why the sweepers did not work with long-handled brooms, instead of creeping around in the dirt and dust all day. Before leaving the U. S., I had read a proclamation by Prime Minister Desai about eliminating the caste system and giving the untouchables dignity. Why didn't he issue a proclamation that all sweepers must use brooms with long handles and stand up so they could look fellow humans in the eyes? But this type of change involves such deep social and cultural patterns that it is harder to bring about than the construction of new roads, or inappropriate technology such as nuclear power plants.

A good example of appropriate technology built upon traditional technology in India is the refrigerated automatic milk vending machine. At first, the idea of such a machine seemed incongruous with the one-cow-per-farmer milk production system. Actually, it makes great sense in India. The villagers near Anand take their milk in traditional brass containers to the village milk collection center and pour it into milk cans. From there it goes to the district cooperative dairy to be processed, and then to the city of Bombay and into the milk vending machines. Twice a day people drop coins in slots to receive measured amounts of milk into their individual brass containers. The entire energy-intensive process of bottling milk is by-passed. Since Indians always boil their milk before they use it, sterilized containers are unnecessary. We saw village women scouring their brass pots with sand and manure, and I was glad to know about the custom of boiling milk when I drank their tea, always served with cream and sugar.



Milk vending machine in Anand.

DEVELOPMENT IN SRI LANKA

The last part of the dialogue was in Sri Lanka, formerly Ceylon. This small, island country has followed a development pattern very different from India's. There has been little large-scale industrial development. Small-scale industrial cooperatives have been organized at the village level, and medium scale cooperatives manufacture products such as the two-wheeled tractor, widely used and appreciated in Sri Lanka. Government social programs such as free medical care and food subsidies have made the average Sri Lankan's standard of living much better than the average Indian's. Paying for these programs is a burden, especially with international lending agencies frowning upon their growing balance of trade deficit. Since food accounts for almost half of Sri Lanka's annual imports, there is now a big emphasis upon developing the rural areas to increase production of food within the country. The Mahawelli Dam Diversion Project is supposed to make this possible by opening up 100,000 acres in the dry area for agriculture.

Rice is the major food in Sri Lanka, and the small paddies are farmed with methods used for generations. Though most farmers still use bullocks to help prepare the land for planting, many of them have also adopted a modern technique, the application of commercial fertilizer.

"APPROPRIATE" RESEARCH

If water is the most important factor in increasing food production, fertilizer is the second most important. However, importation of fertilizer is not going to help Sri Lanka's balance of trade deficit. Some very interesting research is now being undertaken which may alleviate this problem. The water fern, Azolla, has a symbiotic relationship with a blue green alga, Anabaena, which can fix nitrogen. Sri Lankan researchers, as well as Americans at the University of California at Davis, are finding that the Azolla Anabaena can provide up to forty percent of the nitrogen needed in a rice field. The Vietnamese have grown one type of Azolla in the irrigation ditches of rice fields for centuries. The modern research is being built upon a traditional technology.

Two members of our O. D. C. Transnational Dialogue, Dr. Sylvan Wittwer, Director of the Agricultural Experiment Station at Michigan State University, and Dr. Marvin Lamborg of the Kettering Research Lab in Yellow Springs, Ohio, often talked about "mission-oriented basic research." They want more money and effort into research to understand photosynthesis and nitrogen fixation, for the purpose of developing plants which can make optimum use of their environment. Most research applied to agriculture in the past has focused on the additions to a plant's environment, such as water and chemicals, which increase the plant's growth. These inputs add to the energy and environmental costs of production, and make the farmer dependent upon companies or countries providing the inputs. The development of plants well-suited to their environment with greater genetic potential to use more of the sun's energy or to fix nitrogen would be

beneficial to third world countries. This seems to me to be "appropriate" research possibly leading to a more "appropriate" agriculture.

THE LAND INSTITUTE AND THIRD WORLD TECHNOLOGY

At The Land Institute we are interested in alternative methods of agriculture. We will be expanding our gardening activities and beginning the prairie project in this next year. Although we do not have the specialists or the equipment to do the kind of research mentioned in the above paragraph, we do believe there are areas in which we can experiment. Of course, we are aware that we cannot make direct transfers of our experiences to third world countries. But we share with them an interest in small-scale, self-sustaining agriculture and greater regional self-sufficiency.

The desire to achieve a greater measure of self-sufficiency at the village or national level is directly related to the development of appropriate technology. Sri Lanka wants to lessen its unfavorable balance of trade by importing less and producing more at home. India has a favorable balance of trade, but wants its production to benefit the poor in India more than it has. In these countries, and in other developing countries, there is a growing sensitivity to the foreign expert overselling Western technology. For too long the Western world assumed that all countries were on the same road destined to go the same direction, only the developing countries were behind. Now individual countries are choosing their own roads, looking to their own resources and endowments in planning development.

Private groups, rather than government agencies, seem able to incorporate appropriate technology into their programs. In Colombo, Sri Lanka, we visited Meth Medura, the headquarters for a private organization making significant contributions at the village level in Sri Lanka. The Sarvodaya movement, founded by Mr. A. T. Ariyaratne, a friend of E. F. Schumacher, has as one of its basic principles: "Development should start from the grass roots with locally-available human and material resources and using appropriate village technologies for the satisfaction of basic human needs of the village community." The Sarvodaya movement has trained leaders within the villages and has helped build roads, establish preschools and community kitchens, and develop safe water supplies and village manufacturing. Another organization doing similar work is the Mahilasmiti. Dr. De Mel at the CARE office in Colombo introduced us to Mrs. Soma Tannangara of this women's organization, which works in villages where there is no Sarvodaya program. Among many other things, they teach women to grow vegetable gardens.

In many respects, private groups in the U. S. can make a better contribution to the development of appropriate technology than can government agencies. An article in RAIN, January, 1978, called "Why Big Business Loves A. T." suggests that when the national government becomes really interested, then the major goals of decentralization and local application become co-opted as government seeks to make appropriate technology economically advantageous to big business.

At The Land, we shall continue to experiment with alternatives, trying to develop "appropriate" technologies which are not damaging to our life-support system. Some of our ideas may be applicable to the problems of developing countries; some of the third world technology may be applicable to solutions we are seeking. After my trip to South Asia, I have a better understanding of third world development and the meaning of "appropriate" technology.

Garrett Hardin's concept of "lifeboat ethics" has been accepted by many people. Hardin sees the developed countries in a lifeboat, surrounded by drowning third world countries. Allowing them in the boat would cause the boat to sink, and everyone would drown. Trying to come to the aid of the very poor, seemingly lost, countries would only cause the demise of the richer countries also. I prefer the image drawn by Russell Peterson, one of the participants in the Transnational dialogue. The day after we returned from Asia, he received the Audubon Medal at the Annual National Audubon Dinner in New York City. In his address that evening, he spoke of the commonalities between Asians and Americans, and the interdependence of all peoples with the other species of life on earth. The title of his speech was "All in the Boat Together."

In this spirit, the answer to the question of whether our work is applicable to third world development problems must be "Yes," although a cautious, qualified, "Yes."

Russell Peterson, Director of the Office of Technology Assessment, Washington D. C., Robert Benton, Superintendent of Public Instruction for the state of Iowa, and Dana Jackson of The Land Institute with children at Meth Medura, headquarters of the Sarvodaya movement near Columbo, Sri Lanka.

February 12-15, Dana Jackson will attend a follow-up workshop on global food and development issues in Racine, Wisconsin. Participants in the Transantional Dialogues to Africa and Latin America, as well as to S. Asia, will discuss U.S. policy related to these issues.

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Friends of The Land

The Friends of The Land have been extremely important to The Land Institute. Many helped collect materials to build the first building; many donated time and labor after that building burned to help start reconstructing the classroom-library-shop. Friends donated books and money to help develop another library. The Land needs these friends, and new friends too.

The Land Institute is a private, educational-research organization, financed by student tuitions and private gifts. Contributors receive THE LAND REPORT, any special publications, and notices of interesting events at The Land. The Land Institute is a non-profit organization, and all gifts are tax deductible.

Special Events at The Land

I. RURAL DEVELOPMENT IN INDIA AND SRI LANKA, a slide presentation by Dana Jackson.
February 28, 7:30 P.M. No fee.

II. HOME GARDENING THE ORGANIC WAY - WORKSHOP on techniques of organic gardening: planning the garden, preparing the soil, weed control, pest control, general rationale for the method.
March 11, 9:00 A.M. to 2:30 P.M. (Bring a sack lunch) Registration $5.00.
Register by March 8.

III. MUSHROOM WORKSHOP- March 31, April 1
Dr. Harold Keller, a mycologist at Wright State University, Dayton, Ohio, will conduct "fungi fun" days at The Land. On Friday, March 31, at 7:30 P.M., there will be an informal lecture by Dr. Keller, followed by a reception. Saturday morning (9:00 A.M.), participants will be instructed on how to identify, how to collect and how to prepare mushrooms. In the afternoon, Dr. Keller will lead a foray to nearby wooded areas to collect mushrooms. Specimens will be brought back to The Land for dissection and identification. An instruction packet will be provided for each participant. Bring a sack lunch.
Registration $5.00. Register by March 26.

IV. ARBOR DAY TREE PLANTING AND SERVICE IN MEMORY OF E. F. SCHUMACHER, honorary member of the board of directors of The Land Institute before his death on September 4, 1977. Ceremony followed by tour of projects and a reception.
Arbor Day, April 28, 1978, 4:30 P.M.

V. NATIONAL SUN DAY, May 3. Secondary school classes will be welcomed at prearranged times for an explanation of our solar heating and wind electric systems.

IV. SUMMER SOLSTICE CELEBRATION, June 21. 7:00 to 10:00 P.M. Food, games, music.

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