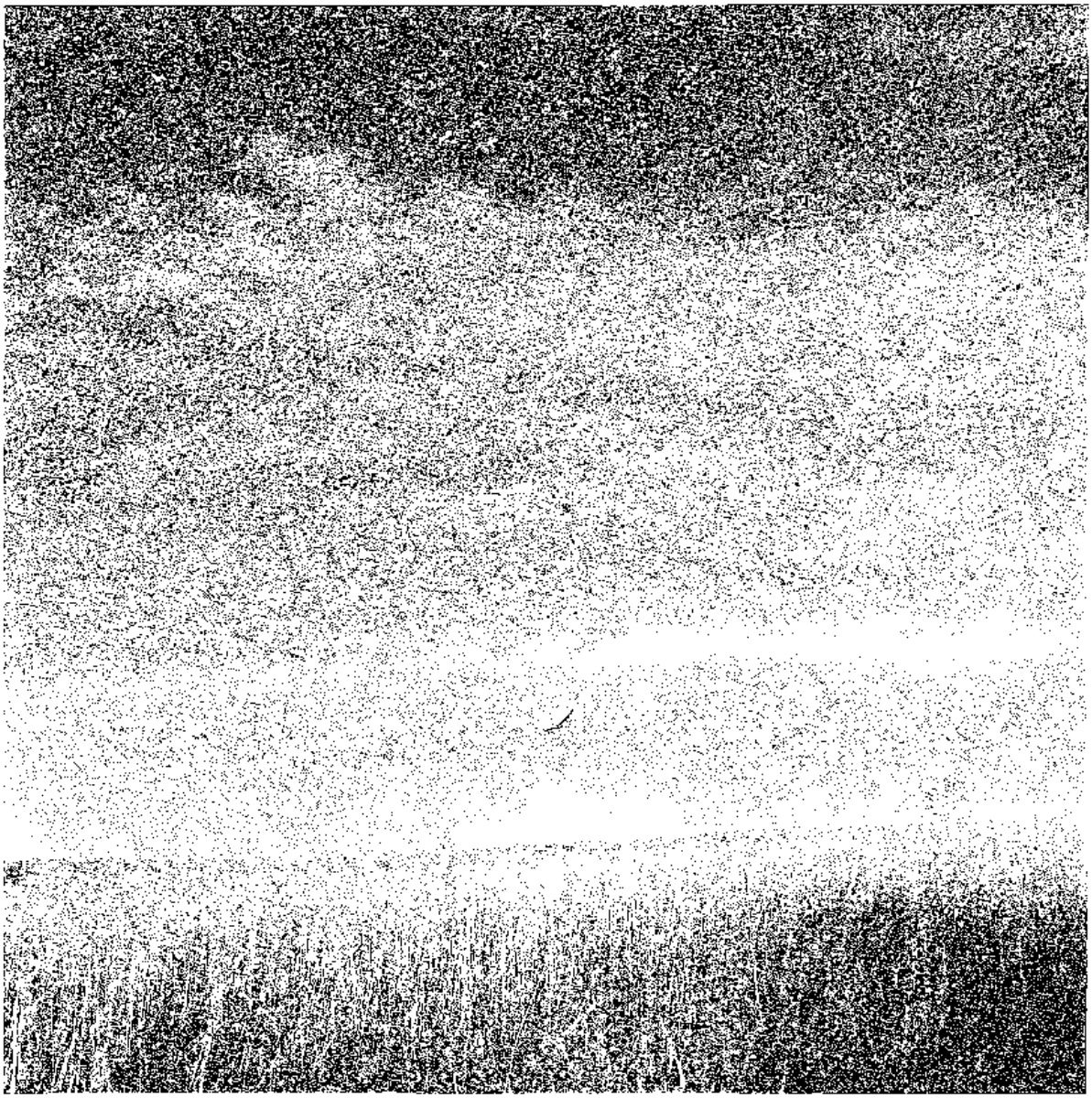

THE LAND REPORT

Number 17 Fall 1982

The Land Institute

Contents

Fall 1982

SKETCHES: Marie Rasch (24-30)
PHOTOGRAPHS: Denise Attwood, Ted Hale, Dana Jackson, Terry Evans
COVER: Terry Evans
(This photo is available in color on a poster. See back of cover for further information.)

At The Land

Working Together

Denise Attwood

The Fall semester began on September 2 with the usual introductions, and then, before we knew it, we found ourselves outside tearing out the porch east of the classroom building. When the bridge planks forming the porch floor were apart and stacked, and the foundation constructed, we shoveled a couple truckloads of dirt around the base of the building so that water would drain away from it.

According to Wes, there is no better way for a group of people to get acquainted than by working together, and his theory proved true. As the three new students (Curt Laub, Regina Grabovac and I) and the two interns (Barry Moir and Margo Thompson) shoveled, poured concrete and hammered, we talked; and the community bond began to grow. Another student, Alisa Coffin, arrived in early October and helped us finish the porch. Although Alisa started late, she too became involved in the project that enabled us to first get acquainted.

Since our group was small, and because there were many maintenance and agricultural research projects that needed to be done, the students chose to work together on these rather

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THE LAND INSTITUTE IS A NON-PROFIT EDUCATIONAL-RESEARCH ORGANIZATION DEVOTED TO A SEARCH FOR SUSTAINABLE ALTERNATIVES: AGRICULTURE, ENERGY, SHELTER, WASTE MANAGEMENT.

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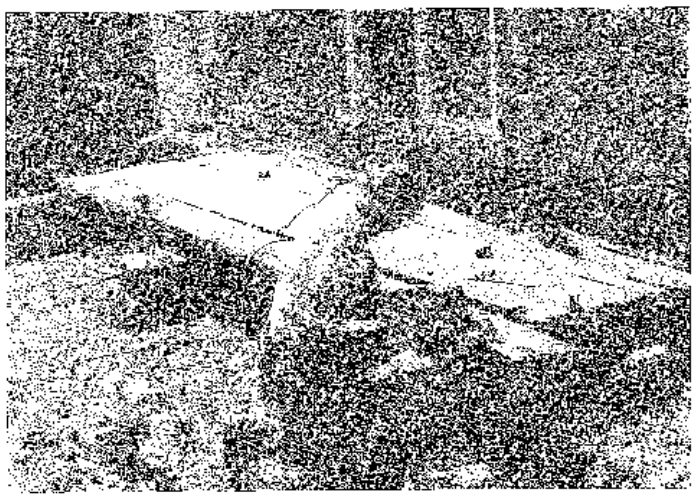
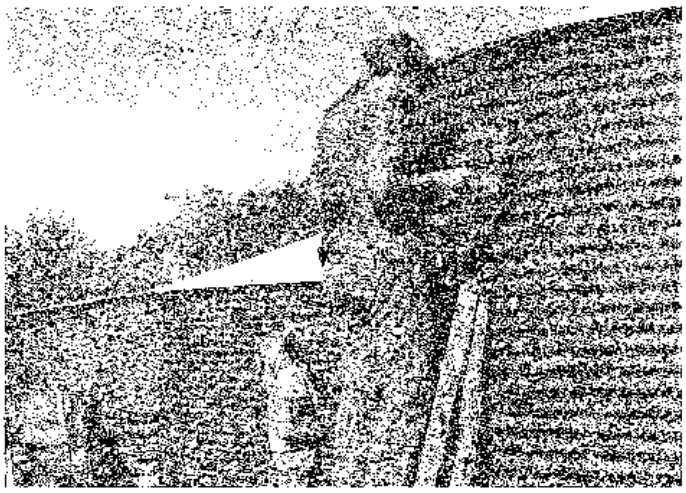


Alisa Coffin



Regina Grabrovac and Margo Thompson

than working on individual projects. This choice proved to be a wise one as we were kept continually busy in these pursuits.

Along with working on the porch there was much other maintenance work which needed to be done before the cold winter temperatures set in. Margo and Curt drained and flushed the solar hot water heating system (see Land Report #15) to check for leaks, and Regina, Alisa and I caulked the solar collecting panels in an attempt to minimize leakage in the solar heating system. All of the students worked on tarring the roofs of both the greenhouse and the main building in various places to insure against water leakage. Although these tasks seemed minor, they proved very significant when it became colder and we had warm water, a warm classroom and a dry building.

Along with these small projects there were two major maintenance jobs that we all worked on this fall: painting the granaries and moving the batteries.

This summer the Land acquired two small used metal granaries from an old farm down the road. The people who worked over the summer placed them to the south of the barn and poured concrete floors for them. However, the students this fall had to do more work to make them ready for winter. One of the granaries needed a door so we built a small hinged door out of scrap metal and wood. Then we all used wire brushes to remove the rust which had accumulated over the years. After many hours of scraping we primed and painted the granaries.

The second major project involved moving 76 2 volt Gould batteries out from under the bench in the sawshed. The batteries, which were used to store electricity generated by the Jacobs wind generator, had started going bad this summer. Many had cracked cases and some had reversed their polarities. Because they were going bad and were so heavy (350 pounds each) and hard to manuever, we decided to replace them. We found that we could get smaller, lighter 6 volt batteries for a reasonable price from a company in town. These were batteries that had been used in electric golf carts. So with strong backs and determination, we moved out the old batteries. These will be sold to a salvage yard and eventually the lead in them will be recycled. We then wired the new batteries into the Jacobs and have found that they work very well.

While we were doing the maintenance jobs, we also helped with agricultural research. In September all students took part in surveying and marking out contour lines on the quarter section. The lines were marked before any seed

Barry Moir, Margo Thompson, Curt Laub

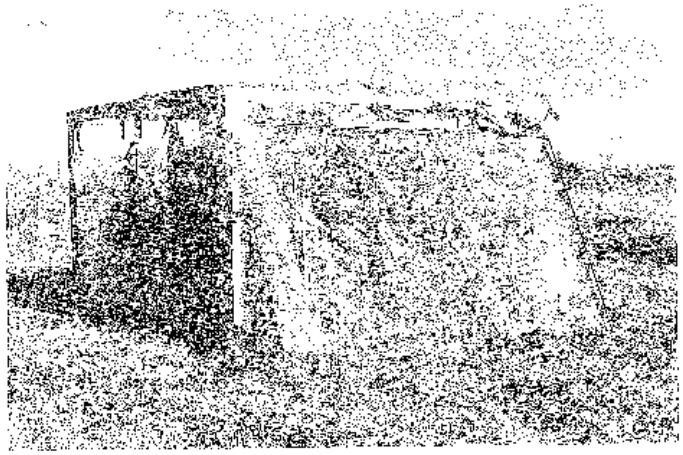
Curt Laub

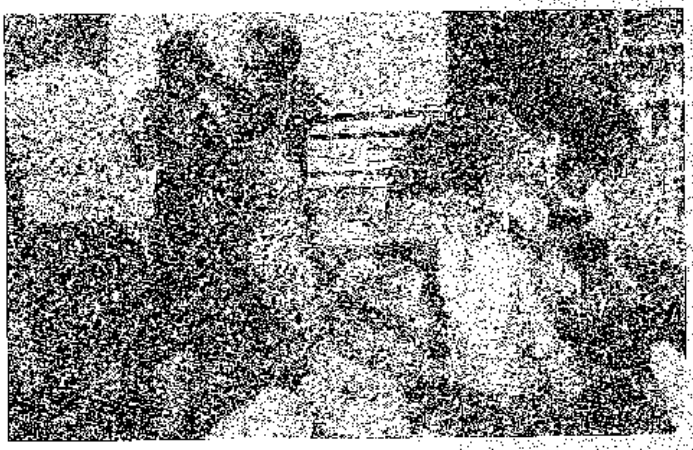
was planted so that we could follow the contours to prevent soil erosion.

In mid-October we began harvesting the experimental plots of Wild Senna. This required many hours since we picked the senna by hand and placed each of the 125 accessions in a separate marked bag. We hung the bags in the granary to dry but left the cleaning job until November since we could clean seed in the barn even if it were cold or wet outside.

We also spent time harvesting the herbary, the small plot of sunflowers, the plots of paired grasses and the Illinois Bundleflower and put this seed in the granaries for later cleaning.

With the first frosts of fall in early October, Walter Pickett became concerned that there would not be enough warm weather left for the plants which were a cross between domestic corn, Zia diploperennis and Eastern Gama Grass to mature and set seed. So Regina and I built a small, temporary, on-site greenhouse to protect the plants when the temperature dropped. With seven sliding glass door panels, duct tape and a small amount of plastic, we constructed the small greenhouse. We used one door for each side, taping them together at the corners, laid two on top and left a small gap at one end which we covered with plastic so that on warm days the greenhouse could be ventilated. The seventh door was used to cover up the last row, and we simply leaned it up against one side and taped it on. We covered the sides of the lean-to with plastic, and voila, we had a working greenhouse! The structure stood up amazingly well to the weather, needing only minor repairs on the plastic. We removed the greenhouse in early November after the plants had matured and set seed.





Curt, Margo, Barry, Regina and Denise.

Now that the colder weather has arrived, we have begun threshing and cleaning the Wild Senna that we harvested in October. Since each accession has to be kept separate from the others, we thresh and clean one bag at a time. First we put the bag of senna through a hammermill seed grinder to break up the stalks and the pods. Then we put it through a Clipper seed cleaner and collect and bag the seed for weighing. It is weighed to determine the yield per acre of each accession.

Our last project has been the construction of a 12' X 40' extension to the south side of the barn. The extra space is needed for seed cleaning equipment and tractors. This will be a pole structure with "strong barn" roofing metal on the roof. Our first task was to dig holes and set the four power poles in place, which required all of us working together. As the weather permits, we will continue to work on the barn until the end of the semester.

The physical work is usually done in the afternoons, as mornings are used for discussions of assigned readings. Needless to say, there have been plenty of jobs to keep us busy in the afternoons. But we can see the improvements we have made, and that is satisfying. It is also satisfying to know that we've helped with research towards a sustainable agriculture in the future.

1983 Calendar

The Land Institute is beginning a new calendar in 1983. There will be a spring Growing Session, a Summer Session, and a fall Harvest Session in The Land Term.

Grants from the Jessie Smith Noyes Foundation and the Joyce Foundation have made it possible to begin an agricultural intern program in February, 1983. The Land will accept applications for the six openings until December 15, 1982, and all candidates selected as agricultural interns will be notified by January 1. The interns will be expected to attend all three sessions in the 43 week term. All will receive full tuition scholarships, plus a stipend of approximately $80 a week.

In addition to the six interns, The Land will also accept up to six regular students. We originally announced in the summer Land Report that they would be required to attend both the spring and fall sessions, with a summer vacation in between. We are modifying this. Regular students will have the option of attending in the spring only.

Persons who wish to apply as regular students may do so until January 20. The tuition is $1000 a session, but partial scholarships are available. To apply, write a letter, in your best style, describing past academic and job experiences, any involvement in environmental issues, major interests and goals for the future.

The Land admits students of any race, color, national or ethnic origin. We recommend that applicants have completed at least one year of college. Agricultural interns should be upper level undergraduates or graduate students interested in sustainable agriculture.

Growing Session	
Feb. 14	- First Day
March 31-Ap. 3	- Easter Vacation
May 28-29	- Prairie Festival
Dec. 17	- Last Day
June 6-Aug. 31	- SUMMER WORK FOR INTERNS
Harvest Session	
Sept. 5	- First Day
Oct. 9	- Visitors' Day
Nov. 23-27	- Thanksgiving Vacation
Dec. 17	- END OF TERM

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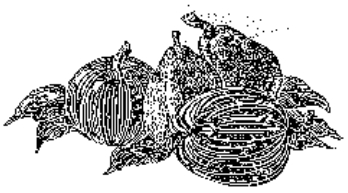
(flours, nuts, molasses, seeds, raisens, honey, carob, coconut, spices plus popcorn & granola)



Harvest Dinner

The buffet dinner began with a choice of pumpkin, onion-miso or split pea soups, tabouleh and lentil-spinach salads, and humus with bread and crackers. Sweet potato bread, oatmeal, herb sour cream and cranberry breads, as well as corn muffins and bagels accompanied the main course, which featured Rice Con Queso, Spinach Ricotta Pie and Empanadas, with Chinese vegetables and scalloped potatoes. The buffet also included desserts: Tangy Rice-Sesame Pudding, Winter Fruit Pie, and Tofu Cheesecake.

Students from The Land Institute transformed the Prairieland Food Co-op into an elegant dining room on November 19, with small tables covered with tablecloths, candles, flowers and borrowed china. After reading and discussing the new and revised Diet for a Small Planet and working at the food co-op this fall, they decided to prepare a special dinner to interest new people in the Co-op and demonstrate what gourmet delights could be created with co-op supplies. They sold tickets ahead of time, accepting reservations for 25 people.

Ingredients for the dishes came mostly from the Prairieland Food Co-op. Margo's fall garden supplied fresh spinach; and potatoes, onions and garlic came from The Land's summer harvest. The students chose the menu from an assortment of cookbooks, including Laurel's Kitchen, Diet for a Small Planet, More with Less and Moosewood. Each diner received a booklet designed by Alisa Coffin with recipes of dishes served at the buffet.

Since the food co-op does not have a cooking stove, the students prepared all the foods in their own kitchens. To make certain that the main dishes would be hot, they were taken out of the ovens and delivered to the co-op exactly at 7:30 P.M. and placed on warming trays for serving. Other students had earlier delivered the soups served with appetizers for the first course.

The entire project, from planning the menu, advertising and ticket sales, gathering ingredients, cooking and serving to eating the leftovers was a cooperative effort.

Since 1978, every group of Land Institute students has made some special contribution to the Prairieland Food Co-op. They have worked as managers, served on the Board of Directors, organized bake sales and constructed a walk-in cooler. Supporting the food co-op is a way of searching for sustainable alternatives in agriculture. Through the food co-op we can avoid some of the processing, packaging, and transportation costs of our American food system, while learning to prepare nutritious meals.

Walter Pickett guides tour of research plots.

Visitors' Day

Visitors are welcome at The Land Institute if they call ahead and make an appointment. However, it is easier for us if local people and friends around the state attend our annual Visitors' Day in the fall. We get the place spruced up, organize our tours better, present a special lecture or discussion, and even have refreshments.

The 1982 Visitors' Day was held on October 10. Students led tours at 1:00 and 2:00 P.M. to give visitors an overview of the physical facilities, student projects and agricultural research activities. In the middle of the afternoon, visitors were asked to choose one of three groups all discussing the same topic: "Surviving the 80's: Working for Saner Agricultural, Energy and Environmental Policies." Wes Jackson and Walter Pickett chaired the group primarily interested in agriculture; Barry Moir and Margo Thompson met with those interested in energy; and Dana Jackson directed a discussion on environmental issues and politics. Cold windy weather forced the groups to meet in the classroom building. Following the discussions, guests were invited to have tea and cookies in the classroom.

For many, this was a first visit to The Land. Our guests included an alternatives group from Olsburg, Kansas, students and a professor from Southwestern College in Winfield, Kansas, and persons from Manhattan who signed up to attend Visitors' Day through the University for Man. We also recognized familiar faces of Friends of The Land from Salina and other places around the state.

One special visitor, who could be seen busily taking notes during the tour, was Peggy Haas from the Rodale Research Farm in Emmaus, Pennsylvania. Peggy works on perennial crops, and Visitors' Day was just the first of a three day stay at The Land to consult with researchers.

Coordinating Legislative Environmental Action in Kansas

Thirty two people attended the third annual Statewide Environmental Lobbying Conference at The Land on Saturday, November 13. The conference was co-sponsored with the Kansas Natural Resource Council and organized by their acting executive director and former Land Institute Research Associate, Mari Peterson, and the President of KNRC, Ron Henricks.

The purpose of the conference was to bring together environmentalists from around the state to set priorities for the 1983 legislative session. Some of the organizations represented at the meeting included the Sierra Club, Kansas Audubon Council, the Salina and Lawrence Audubon Societies, Kansas Rural Center, Kansas Friends of the Earth, Kansas Farmers Union, Cross-Lines, Kansans for Safe Pest Control, the Kansas Corporation Commission Consumer Information Board, The Land Institute, the Harvey

County Citizens Energy Project, Sedgwick County Energy Advisory Board, and the Kansas Natural Resource Council.

During the morning session, guest speaker Ramon Powers of the Legislative Research Department spoke about the effect of last year's legislation, what the interim legislative committees had been working on, and possible upcoming legislation. Energy and water were predominant topics in the legislation he discussed.

After lunch, the participants identified other issues in addition to those which Ramon Powers had described. Then they began to determine common areas of interest, group issues together, and set priorities. Out of the approximately thirty issues mentioned, the group selected seven to be priorities for this legislative session as far as coordinated lobbying is concerned. Separate organizations are to continue to follow issues of particular concern to them and keep the KNRC informed, but the newsletter alerts and telephone tree will mostly be activated on the agreed upon issues.

An issue of major concern is one involving the electric utilities' right to charge ratepayers for construction work in progress. This was outlawed by the legislature in 1978, but KG&E and KCP&L, in such bad financial straits because of the construction of the Wolf Creek Nuclear Plant, are eager to have this restriction removed. Another area of major concern relates to the Kansas energy office. The last legislature greatly reduced its effectiveness by massive staff cuts and the elimination of its solar, wind, research and development programs, and grants for community energy management programs. Reinstating a research and development program and community energy management grants program with funds from the surcharge on utility bills was a priority at the conference. Other energy issues of major concern were renewal of the solar energy tax credit, funding for the low income energy assistance program (LIEAP), the adoption of conservation utility rates, and special natural gas prices for older people. Ramon Powers indicated that reorganization of the administration of Kansas water could be a major issue in the legislature this session, and the conference members agreed that this should be a top concern to everyone. The participants agreed to support a particular piece of legislation to be introduced this session which would lengthen the 60 day statute of limitations on individuals who file complaints after being illegally sprayed with chemical pesticides.

Marsha Marshall of DeSoto, Kansas, will again be lobbying for the Kansas Natural Resource Council during the legislative session, assisted by three or more volunteer, part-time lobbyists and two interns in Topeka to track legislation and research issues. KNRC will prepare biweekly legislative newsletters which anyone may receive by sending $10.00 to

Kansas Natural Resource Council
5130 Mission Road
Shawnee Mission, KS 66205

Kansas Energy Resource Manual

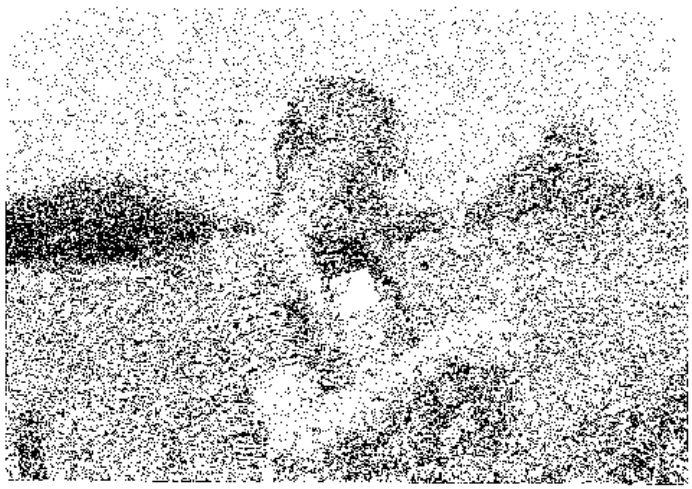
Mari Peterson, former research associate at The Land, has co-authored with Diane Tegtmeier a three volume energy resource guide for Kansas. Marie Rasch, a 1981-82 Land student, did the cover and lay-out. It was produced under the auspices of Energy for Rural Self Reliance and the Kansas Natural Resources Council (KNRC), with support from The Land, the Center for Renewable Resources, and the Noyes Foundation.

Vol. 1, The Energy Transition, contains information about energy extracted and used in Kansas; Vol. 2, The Kansas Energy Directory, lists energy agencies, organizations and businesses; Vol. 3, Community Workbook, tells how to organize citizen-based energy activities. A limited number of free copies are available from KNRC, 5130 Mission Rd., Shawnee Mission, Ks. 66502.

Office Becomes Lab

Marvin Pauls and Paul Krumm spent a week at The Land in August building cabinets for books and equipment in the first floor office adjoining the shop. In order to make the room more dustable and therefore safer for laboratory equipment, they put formica on the counter desk tops and vinyl on the floor. Becky Pickett, who has been training to become the lab technician, helped prepare the lab by staining and varnishing all the cabinets. Paul Krumm has been working one day a week during September and October, completing the ductwork for the solar heating system leading into the lab, putting slate under the woodburning stove, installing a new door leading into the room, etc.

The Rodale Publishing Company granted $5,000 to The Land to purchase a microscope and glassware so that researchers could look at chromosomes in plants involved in crosses. Becky Pickett will be working three days a week as a lab technician preparing slides as soon as the equipment is in place. This is an important next step in our developing research program.



Becky Pickett during summer seed harvest.

PEACE
THE KANSAS DREAM

Dana Jackson

Ecologists and environmental activists have long been concerned about the ecological effects of an arms build-up in the United States. They have fought the development of an MX missile system, challenged uranium mining operations in the West, and worried about the safety of cities when nuclear fuel and waste from weapons production is transported across the country. When Amory and Hunter Lovins and Leonard Ross made the connection between nuclear power and nuclear bombs (Foreign Affairs, Summer 1980), environmentalists learned that a nuclear arms build-up could also lead to a nuclear power plant build-up. These energy scholars suggested that the federal government was interested in subsidizing nuclear power plants in order to have a supply of spent fuel from which to extract plutonium to make bombs. Therefore, an arms race could lead to greater support and encouragement of the nuclear power industry, and proliferation of nuclear power plants around the world would lead to a proliferation of nuclear weapons. The chances for terrorist groups and smaller nations to build bombs would increase as the plutonium in spent fuel was dispersed around the world.

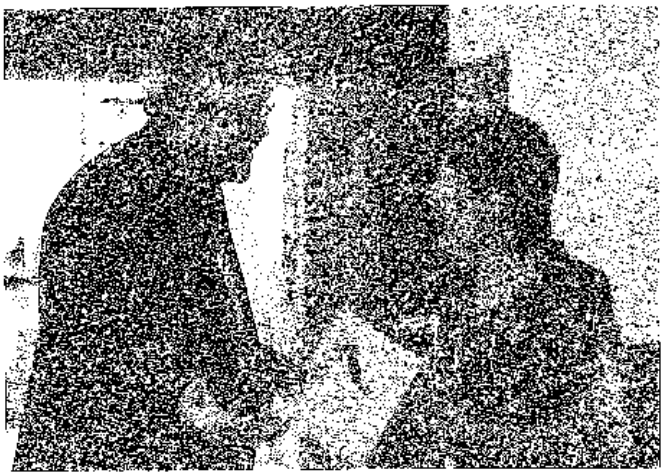
Until recently, people haven't thought much about the actual consequences of a nuclear war, because war has been considered unthinkable. That is, knowing that nuclear war meant mutually assured destruction was a deterrent to war. But the rhetoric of our national leadership and the military has changed. We now hear the expressions "limited war" and "preemptive strike." The government refers to the survivors of a nuclear war as it prepares civil defense plans for moving civilians out of cities after a nuclear attack. Suddenly, we realize that there are military leaders who believe we could "win," and all our preparations for nuclear war become more frightening.

The publication of Jonathan Schell's book, The Fate of the Earth, this year caused many people to think about the consequences of a nuclear war. Schell recounts the devastation of Hiroshima, then describes how a one-megaton bomb, eighty times the explosive power of a Hiroshima bomb, would affect New York City. (Except the Russians would more likely use a twenty megaton bomb.) "Like the people of Hiroshima, the people of New York would be burned, battered, crushed, and irradiated in every conceivable way." Then the fires would begin. In details agonizing to read, one learns how shock waves, fires, and radiation would affect humans, animals and plants after an attack on this country. Not since early geological times has there been a devastation of the natural environment as great as a nuclear war would cause. Schell examines the meaning of extinction in the second part of the book, causing the reader to think about the end of all life, the end of birth and the end of death. In the third part, "The Choice," he analyzes the doctrine of deterrence, pointing out the contradictions and irrationality of a world arrangement for security which is making us so insecure.

The Fate of the Earth is one of those pivotal books which change people's lives. Just as The Population Bomb caused Americans to think about the seriousness of overpopulation, and Silent Spring called our attention to the disastrous misuse of pesticides, and Soft Energy Paths awakened us to the potential of conservation and solar in meeting energy needs, this book has made us realize that nuclear war would be an ecological catastrophe so great that it could cause the extinction of humankind and other species. We must all do something to prevent it from happening.

The serialization of Jonathan Schell's book in the New Yorker magazine last February was a factor in the participation of so many people in Ground Zero Week. It motivated people, including conservationists and environmentalists, to work on the nuclear freeze campaign and join the peace march in New York City last June. In the process of these activities, the general public is becoming better acquainted with the facts of our enormous arms build-up. National environmental journals, as well as more popular magazines, include articles on issues surrounding the arms build-up and the increasing military budget. Peace activists are not well-meaning but naiive persons misled by Russian agents, as President Reagan has suggested. They are people who treasure the earth and its life, people who cannot accept the idea that it is worth risking extinction so that a particular political point of view can prevail over a scorched earth.

Americans are educating themselves about the nuclear arms race through conferences as



John McCormally, columnist with the Harris newspapers & keynote speaker, talks to Mineko Gillespie, Salina participant.

well as publications. In our city of Salina, a small, dedicated group of people who make up the Salina Peace Coalition, joined with Roman Catholics and Mennonites to organize a conference on the theme, "Peace: the Kansas Dream." The Land Institute was pleased to become a co-sponsor of the conference held at the First Presbyterian Church on October 15-16. Over 300 people came to learn more of the facts about nuclear weapons and the meaning of national security from speakers and panelists, and to think together in workshops about peacemaking and the draft, non-violent civil defense, and conservation as it relates to global security.

A few days later, Wes and I attended the conference "On the Fate of the Earth," at the Cathedral of St. John the Divine in New York City. David Brower, Chairman of the Board of Directors of Friends of the Earth (see pg. 35) was so moved by Jonathan Schell's book, that he organized the first biennial conference "On the Fate of the Earth." Nearly 800 people gathered for the sessions. Beginning with the keynote address by Russell Peterson, President of the National Audubon Society, many distinguished speakers and panelists described the cancerous U.S. arsenal which we pay for at the expense of human services. Retired Rear Admiral Gene La Rocque, Nobel prize-winners Linus Pauling and George Wald, Richard Barnet of the Institute for Policy Studies, Father Robert Drinan, President of Americans for Democratic Action, Stanford professor Paul Ehrlich, and many other speakers and panelists challenged the audience to accept personal responsibility for preventing a nuclear holocaust. After three days of what George Wald referred to as "eloquent manifestations of anxiety," the conference concluded on notes of joyful appreciation for the earth and humankind through the music of the Paul Winter Consort, Pete Seeger and Odetta. Participants left the Cathedral Synod House commited to work for peace.

The conference "On the Fate of the Earth" was an idea whose time had come, and David Brower put it together in just a few months with a great deal of daring and faith. Most of those on the program participated without honoraria. Environmentalists and peace activists came together with shared commitment.

The week before attending the Salina and New York conferences, we spent several days discussing the book, The Fate of the Earth, in the classroom with our students. The three events in sequence solidified our understanding that a nuclear holocaust would be the worst of all possible ecological disasters, and that The Land Institute must directly address itself to helping prevent it. We know that our search for sustainable alternatives in agriculture, energy, shelter and waste management can contribute to national security in a real way. But we at The Land will in the future be speaking and writing more about the particular issues of a nuclear freeze and the necessity of spending more money on national defense (soil conservation, schools, health care, environmental protection, energy conservation, etc.) by taking funds away from the bloated military budget.

> A nuclear holocaust, because of its unique combination of immensity and suddenness, is a threat without parallel; yet at the same time it is only one of countless threats that the human enterprise, grown mighty through knowledge, poses to the natural world. Our species is caught in the same tightening net of technical success that has already strangled so many other species. ...The peril of human extinction, which exists not because every single person in the world would be killed by the immediate explosive and radioactive effects of a holocaust---something that is exceedingly unlikely, even at present levels or armament--but because a holocaust might render the biosphere unfit for human survival, is, in a word, an ecological peril. The nuclear peril is usually seen in isolation from the threats to other forms of life and their ecosystems, but in fact it should be seen as the very center of the ecological crisis... Both the effort to preserve the environment and the effort to save the species from extinction by nuclear arms would be enriched and strengthened by this recognition. The nuclear question, which now stands in eerie seclusion from the rest of life, would gain a context, and the ecological movement, which, in its concern for plants and animals at times assumes an almost misanthropic posture, as though man were an unwanted intruder in an otherwise unblemished natural world, would gain the humanistic intent that should stand at the heart of its concern.
>
> -Jonathan Schell
> THE FATE OF THE EARTH

During the same weekend as the Salina Peace conference, General Bernard W. Rogers, supreme allied commander of the North Atlantic Treaty Organization (NATO) in Europe spoke at a NATO symposium in Abilene, Kansas. Rogers stated that conventional NATO forces are so weak that if Russia attacked Western Europe, NATO would have to use nuclear weapons to turn them back. NATO forces should be stronger, so strong, he argued, that then they could defeat initial attacks by the Russians, forcing the decision to use nuclear weapons on the Soviets. "Faced with that unpleasant and incredible prospect, I do not believe Soviet leaders would attack." he said. Wait a minute! Did he say that NATO would go ahead and use nuclear weapons, but Russia wouldn't? Yes. He went on to say that Western Europe should learn from the U.S. and sacrifice spending on social programs in order to increase military spending.

This kind of illogic abounds in the military mentality designing our "defense" policy. That's why at both conferences we heard so many speakers reduced to describing our nuclear arms strategy as "absurd," "insane," and "psychotic."

Ron Dellums, congressman from California, illustrated the U.S. defense posture in this way: Two men are standing up to their necks in a pool of gasoline. One of the men is holding seven matches; the other, ten. The one with ten says, "I'll talk about getting rid of my matches as soon as I have 15."

Today the U.S. can explode 12,000 weapons in the USSR, and they can explode 8,000 here, according to Rear Admiral Gene La Rocque. In the next ten years, the U.S. proposes to build 70,000 nuclear weapons (many to replace outdated technology). Randall Forsberg, the author of the nuclear freeze proposal and President of the Institute for Defense and Disarmament Studies, pointed out at the Salina conference that between 10 and 100 bombs would probably be enough to "obliterate culture," so talking about tens of thousands of bombs is meaningless. Yet the myth of who is ahead and who is behind keeps both Russia and the United States spending enormous sums on the arms race.

In 1971, the U.S. military budget was 76 billion; in 1981, 173 billion; and in 1982, 226.3 billion dollars. It is projected to be ½ trillion by 1989.

The 1982 budget and beyond are not <u>defense</u> budgets. Rear Admiral LaRocque told us at the Fate of the Earth Conference that we have entered a new phase geared to fighting and winning a war. In phase one of our military build-up, we had a retaliatory posture, when we had bombers all over the world in the air or ready to take off at any time to respond to an attack. Then we tried detente, which dissatisfied the military because their role has always been to fight and win wars, not to hold off. But the high ranking military is having its way in this administration. The 1982 budget message, according to Rear Admiral Gene LaRocque, stated clearly the posture of the U.S. in this new phase of arms build-up: "The U.S. defense policy insures our preparation to respond to and <u>successfully fight</u> either a conventional or a nuclear war." This is why this year's requests for military spending included offensive weapons systems such as the Trident submarine, the MX missile, the B-1 bomber, the cruise missile, the Pershing, the Titan, the neutron bomb and even binary weapons (nerve gasses). The U.S. policy seems to be to build a force which could attack all weapons on the other side before they could be used on us. This is called a preemptive strike, which means that we might be the first to drop the bombs. This policy could push both sides to the position regarding weapons of "use them or lose them," so there would be no motive for restraint once the hostilities began.

The military leadership has tried to lull the American public into thinking that striking at military targets would amount to a "limited war." The idea of "limiting" a nuclear war once it begins is ludicrous, as ludicrous as the plans to evacuate millions of people from large cities to small towns in the event of attack. Once a war has begun, who is in control? With 50,000 nuclear weapons around the world, there will be many officers unable to communicate with superiors before they decide whether or not to push buttons. Individuals will get scared and start pushing buttons all over the globe.

It might take only one nation to start war in Europe, but it would take several to stop a war. If Germany and France decide to stop, can they control Maggie Thatcher? The expression "limited war" is a hoax, and we are fools if we continue to allow the generals of the world to prepare for our extinction.

Faced with the reality of the United States/Russian arms build-up and the belligerent rhetoric tossed back and forth, the Kansas dream of peace seems to have little chance of coming true. Yet, to abandon the pursuit of peace is to acquiesce to the pursuit of disaster. We must keep dreaming--and acting--to make peace work. As Jonathan Schell wrote:

> "Evolution was slow to produce us, but our extinction will be swift; it will literally be over before we know it. We have to match swiftness with swiftness. Because everything we do and everything we are is in jeopardy, and because the peril is immediate and unremitting, every person is the right person to act, and every moment is the right moment to begin, starting with the present moment. For nothing underscores our common humanity as strongly as the peril of extinction does; in fact, on a practical and political plane it establishes that common humanity. The purpose of action, though, is not to replace life with politics. The point is not to turn life into a scene of protest; life is the point."

"Every person is the right person to act, every moment is the right moment to begin, starting with the present moment."

HAVE YOU EVER ASKED -- HOW MANY OF THE RESOURCES IN THIS COMMUNITY ARE GOING FOR ARMS?
(Betty Lall)

WE CANNOT FEED THE POOR WITH MX MISSILES. WE CANNOT HEAL THE SICK WITH B-1 BOMBERS.
(Ron Dellums)

FIFTEEN MILLION CHILDREN DIE OF STARVATION EACH YEAR WHILE THE WORLD'S MILITARY SPENDS TWO MILLION DOLLARS A DAY.
(John McCormally)

WE WON'T CHOOSE A WAR, BUT CHOOSE A PATH LEADING INEVITABLY TO WAR.
(Richard Barnet)

THERE ARE TWO MEN IN THE SENATE WHO HAVE PUBLICLY RECOMMENDED USE OF NUCLEAR WEAPONS, AND THEY ARE ACCEPTED AS SANE MEMBERS OF THE SOCIETY.
(Richard Barnet)

(AFTER A NUCLEAR ARMS LIMITATION AGREEMENT) NO DEGREE OF CHEATING WOULD GO UNDETECTED THAT COULD RESULT IN AS BAD AN EFFECT AS ALL OUT NUCLEAR WAR.
(John Holdren)

75% OF ALL GOODS AND SERVICES PURCHASED BY THE FEDERAL GOVERNMENT IS FOR MILITARY-RELATED ENDS. ONE-THIRD OF ALL RESEARCH AND DEVELOPMENT MONEY, BOTH PRIVATE AND PUBLIC IS FOR THE MILITARY.
(Betty Lall)

ON TREATIES WITH THE RUSSIANS... IT'S SAID WE CAN'T TRUST THEM ENOUGH TO MAKE TREATIES. IF YOU AVERAGE IN OUR INDIAN WARS, THEY ARE MORE TRUSTABLE THAN WE.
(Linus Pauling)

THE GOOD PEOPLE WHO STAND BY ON THE SIDELINES ARE ALSO AMONG THE CAUSES OF WAR.
(Alice Tepper Marlin)

WE ARE BASING OUR SECURITY ON A POLICY OF HOLDING HOSTAGE 90% OF THE WORLD THROUGH OUR NUCLEAR THREAT.
(Richard Barnet)

The Ecological Effects of Nuclear War

A scientific appraisal of the human and ecological consequences of a nuclear war, a project which took two years to complete, is the subject of the current issue of Ambio, the journal of the human environment published by the Royal Swedish Academy of Sciences. The Ambio study began with a reference scenario drawn from a precise set of assumptions--that a nuclear exchange, involving less than half of the weapons in the arsenals of the two superpowers, started on a weekday in mid-June, 1985--and asked a number of distinguished scientists in a wide range of specialties to assess the probably consequences in their various fields of expertise.

The following statements are abstracts of articles appearing in this special issue of Ambio.

* * * *

OF AN URBAN POPULATION OF NEARLY 1.3 BILLION IN THE NORTHERN HEMISPHERE, ABOUT 750 MILLION WOULD BE KILLED OUTRIGHT AND SOME 340 MILLION SERIOUSLY INJURED. FURTHERMORE, OF THE 200 MILLION INITIAL "SURVIVORS" MANY OF THEM WOULD PERISH FROM THE LATENT EFFECTS OF RADIATION AS WELL AS INFECTIOUS DISEASES LIKE CHOLERA, TUBERCULOSIS AND DYSENTERY.

* * * *

AT LEAST ONE THIRD OF THE SURVIVORS OF A NUCLEAR WAR WILL SUFFER FROM SEVERE MENTAL AND BEHAVIORAL DISTURBANCES. FOR THE VAST MAJORITY OF THESE PSYCHIATRIC CASUALTIES, NO ADEQUATE MEDICAL TREATMENT WILL BE POSSIBLE.

* * * *

IN ADDITION TO THE TREMENDOUS FIRES THAT WILL BURN FOR WEEKS IN CITIES AND INDUSTRIAL CENTERS, FIRES WILL ALSO RAGE ACROSS CROPLANDS, AND IT IS LIKELY THAT AT LEAST 1.5 BILLION TONS OF STORED FOSSIL FUEL (MOSTLY OIL AND GAS) WILL BE DESTROYED. THE FIRES WILL PRODUCE A THICK SMOKE LAYER THAT WILL DRASTICALLY REDUCE THE AMOUNT OF SUNLIGHT REACHING THE EARTH'S SURFACE. THIS DARKNESS WOULD PERSIST FOR MANY WEEKS, RENDERING ANY AGRICULTURAL ACTIVITY IN THE NORTHERN HEMISPHERE VIRTUALLY IMPOSSIBLE IF THE WAR TAKES PLACE DURING THE GROWING SEASON.

* * * *

THE FISSION PRODUCTS FROM A NUCLEAR WAR WOULD CAUSE WIDESPREAD CONTAMINATION OF FRESHWATER RESERVOIRS, AND THAT CONTAMINATION WOULD PERSIST FOR A NUMBER OF YEARS. RAINWATER WOULD BE A DEADLY POISON IN THE PERIOD IMMEDIATELY FOLLOWING THE WAR, AND GENETIC DAMAGE TO LARGE NUMBERS OF SURVIVORS WOULD BE UNAVOIDABLE.

* * * *

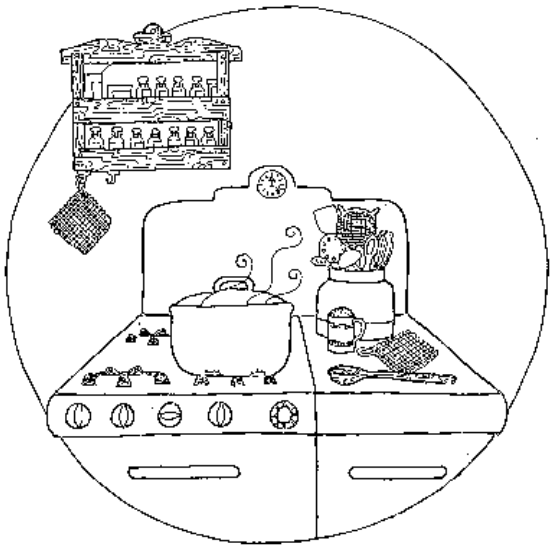
RADIOACTIVE CONTAMINATION OF CROPLANDS WOULD BE WIDESPREAD IN THE NORTHERN HEMISPHERE. AND DELAYED FALLOUT, IN AREAS NOT DIRECTLY INVOLVED IN THE WAR, WOULD RAISE RADIOACTIVITY LEVELS IN FOOD AND HUMAN TISSUES TO 20 TIMES THE LEVELS REPORTED DURING THE WEAPONS' TESTING PERIOD OF THE 1960's. AGRICULTURE WOULD REVERT TO A NON-MECHANIZED AGE AND MANY THIRD WORLD COUNTRIES DEPENDENT ON ENORMOUS IMPORTS OF FOOD FROM THE DEVELOPED COUNTRIES WOULD BE SEVERELY AFFECTED.

* * * *

EXPOSURE TO HIGH LEVELS OF IONIZING RADIATION WILL DEVASTATE THE NATURAL PLANT AND ANIMAL COMMUNITIES OF THE EARTH, ESPECIALLY FORESTS, LEAVING AN IMPOVERISHED RESIDUAL VEGETATION OF HARDY SUCCESSIONAL SPECIES. THE CIRCUMSTANCES LIKELY TO PREVAIL FOLLOWING A NUCLEAR WAR FAVOR SMALL-BODIED, RAPIDLY REPRODUCING ORGANISMS THAT ARE OFTEN IDENTIFIED AS PESTS.

Time to Live Lightly on the Earth

Mari Peterson



A schizophrenic feeling is developing for many people of good conscience who try to engage in more subsistence living while holding an eight to five job. Having been nurtured by the industrial era, cast in the proper molds, and taught its ways, we've discovered that it is extraordinarily difficult to loosen its tenacious grip on our lives. Recognizing the virtues of living lightly on the land, we still find it necessary to make rent or house payments, send children to college, and shore up for retirement. As much as we might wish to garden, preserve food, raise livestock, make bread and cheese, sew our own clothes, or build our own solar collector, we find ourselves fully wrapped up in the money economy, devoting the large chunk of requisite time needed to play the money game.

Ivan Illich spoke of this conflict in his essay "Shadow Work," an essay which several of us read and discussed this past spring. The subsistence economy has been pushed out by the industrial economy, and the rigid, institutionalized nature of the latter thwarts a resurgence of self-reliant living.

Illich warns against the weakness of desiring the subsistence/solar economy for merely sentimental reasons. A nostalgic longing for lower-priced, better quality goods, and a measure of independence gives the market economy grounds on which to compete. We should not be surprised by a return of real butter, wholewheat bread, and whole grain cereals. And what better way is there to gain more "independence" than through labor-saving devices which give you more time?

Sentimentality will pass when we understand how the industrial economy denies subsistence. When this becomes transparent to us, we will have substantial reasons for reorganizing our lives around subsistence, and we will begin to find the means to do so.

DIVIDE AND CONQUER

Nearly all basic social institutions have been disconnected or set in opposition to each other to facilitate the market economy. This subtle encroachment of apartheid in our society must be articulated and named. It then becomes a reality to counteract with more than sentimentality.

For the industrial economy to develop in Europe during the 1600s and 1700s, and in this country following the settlement of each region, there had to be an economic division of the sexes. Men's hands were to transform raw materials into useful products. Women's hands, which once did the same in the subsistence economy, were relegated to the task of organizing "compulsory consumption." Thus the two necessary phenomena of "labor" and "markets" were created.

This threw a rift between production and consumption. The term "work" would only apply when one produced goods or services through a job; women who organized consumption were therefore engaged in nonwork.

Ivan Illich gives the term "shadow work" to this role for women. As defined, it is "unpaid work which does not contribute to subsistence." It includes such things as housework and shopping.

The industrial society has discriminated against women in the work place, and has also prevented women from engaging in subsistence activities. Those things women once produced in the home are now produced by men in the factories and made competitively available on the market. Mass media and marketing efforts have made it clear that to provide these items for one's family at home is drudgery.

The tragedy is not just that women no longer engage in subsistence activities, but that they have been enclosed in the home without their husbands, apart from other women, to engage in shadow work. And in a most subtle development, the man at work has become a conspirator with his employer, the industrialist, in promoting economic expansion through the suppression of subsistence activities.

The industrial economy has also required that the family be viewed as an economic unit. The children are the future laborers who must be schooled and trained. The housewife organizes the economic activity of the family, which relates, of course, to consumption. And the man as head of the household brings home the money around which this economy revolves.

Though women have recently entered the labor market, this does not preclude the necessity of

shadow work--it has actually increased it. It further denies the potential for subsistence activities and increases the woman's responsibility of "organizing consumption." She finds the need for many more labor-saving goods and services for her home and family: automatic dryers and dishwashers, childcare services, frozen dinners, and another car. As the cycle fully develops, it seems there is never enough time nor money.

Since homes have become saturated with material goods, the post-industrial economists look to the service sector to boost economic growth and keep the economic monster from toppling over. So the shadow work piles higher and deeper to include, in Illich's words, not only "housework, shopping, homework, commuting, and the stress of forced consumption," but also "the tedious and regimented surrender to therapists, compliance with bureaucrats, the preparation for work to which one is compelled, and many activities usually labelled 'family life'."

This shadow work is made to appear as the satisfaction of our needs, not work. But in reality, shadow work "exacts time, toil, and loss of dignity."

Shadow work is essential to make the economy run. According to Illich, shadow work is more important to the post-industrial/service economy than wage labor. The profits for capitalists and the power of professionals and bureaucrats require "compulsory consumers" and "disciplined clients." "The creation of professionally supervised shadow work has become society's major business."

The industrial economy is enshrouded in abstraction. Its numerous components--labor and markets, goods and services, jobs and money--mask the true purpose of having an economic system. Essentially the purpose of any economic system is to have a means of providing for our basic needs: food, clothing, shelter, warmth, and perhaps happiness. To meet this purpose, it is not essential to have an economic division of the sexes, the family, and production and consumption.

Before exploring how we might meet our basic needs without the divisions inherent in industrialism, we must examine another basic shortcoming of the system.

GO FOR BROKE

Nearly 100 years after the discovery of the immutable laws of thermodynamics, the implications of these laws are becoming clear. In reality, human beings do not actually engage in production or consumption because neither matter nor energy can be created or destroyed. Human beings transform physical resources into physical goods and then into physical garbage. Human beings transform energy into useful work and waste heat. The second law of thermodynamics, entropy, makes clear that this transformation takes place in a one-way direction transforming matter and energy into "consumable" products. In fact, the system depends on ever increasing "consumption." But since matter and terrestrial energy are finite, we might suspect this system is operating on borrowed time.

The truly illuminating concept of the thermodynamic laws follows from their being the first and only physical laws to incorporate time into our understanding of the universe. The amazing truth is that when we "consume" matter and terrestrial energy in the form of industrial goods, we are really consuming planetary time. In piling up physical garbage and waste heat, we are reducing the life expectancy of the human species on this planet.

Kurt Vonnegut aptly describes the consumption of time in a story about the planet Vicuna in his book, Jailbird.

> "The tragedy of the planet was that its scientists found ways to extract time from topsoil and the oceans and the atmosphere--to heat their homes and power their speedboats and fertilize their crops with it; to eat it; to make clothes out of it; and so on. They served time at every meal, fed it to household pets, just to demonstrate how rich and clever they were."

Vicuna ran out of time. We, too, will run out of time if we do not find a way to build our economy on a sustainable base.

OUT OF OUTRAGE AND NECESSITY

The industrial society has fragmented the family to expedite production and consumption, while rapidly depleting the finite resources of the earth. To seek a reunification of the family and a reliance on renewable resources are substantial reasons for wanting a reformation to a sustainable, subsistence/solar economy. These are not sentimental reasons.

By closing the production/consumption process, there is the potential to restore unity within families and between people and the land. Furthermore, women will be liberated from the bondage of shadow work, which is a far greater reward than equal pay in the work place.

To move in this direction, though, we must break the bond between time and money.

THE TIME/MONEY BOND

"Time is money" is the wisdom that has been instilled in us. Laborers combine their time and skills to earn money, and bankers or investors watch interest rates which reflect the time-value of money.

This is the age-old wisdom of our old and aged industrial society. The second law of thermodynamics turns this wisdom inside out. Time becomes fundamentally more important than money.

To reduce confusion we must differentiate between personal time and planetary time. Most of us go to great lengths not to waste time--personal time. We might agree there are virtues in living a more simple, subsistence lifestyle, but conclude that we do not have the time to make such a transition.

Ivan Illich once drew the following connection between personal time and money. Many people know it is better to bicycle to work than to take a car, but claim they do not have the time. However, the wages earned during at least the first half-hour of work each day are needed for car payments and maintenance, gasoline and insurance. It would probably take most people less than one-half hour to bicycle to work.

Most time-saving devices for the home (which are really capital investments in shadow work) require time on the job to earn money to buy the time-saving technology and pay the associated electricity and maintenance costs. Many time-saving devices actually consume more of our personal time, and all consume resources and thus, planetary time.

The strength of the industrial economy is in equating time and money. This is done by

breaking apart the traditional bonds of society--family and community--to create labor and markets. The industrial economy abstracts time into labor, markets, and money, distracting us from looking closely at the production/consumption process. By devoting our time to acquiring money, we are distracted from considering what we are producing, and why. Those considerations are left to our employers who are mostly concerned with profits and expansion, creating a proliferation of material goods transformed from matter and energy. When time is equated with money, we find ourselves working for money, itself, rather than the goods and services we need. We are thus more easily tempted into consuming the superfluous, either goods or services, as suggested to us by advertising and "professional opinions."

Time is more valuable than money for people who wish to be more self-sufficient. Whereas money is the key to breaking the connection between production and consumption, time is the key to uniting it.

A FOOT IN BOTH WORLDS

The subsistence/solar economy is based on the assumption that our scarcest resource is time embodied in finite resources. The goal of such an economy is to minimize the use of non-renewable resources thereby extending the lifetime of the planet for human habitation. The connection between the sun and the earth and its renewing cycles is the source of information upon which this system operates.

The subsistence economy reunites men and women in the common task of providing for their basic needs. There may be a division of the sexes based on physical capabilities, but not the arbitrary economic division that began with men as producers and women as consumers that today continues to discriminate against women in the work place.

Work becomes something more fundamental than a job and money. It has a purpose relating directly to the needs of the household. The skills learned for this work are directly useful and meaningful for basic survival. Such a system is grounded and not abstract.

The need for community is seen more clearly as local markets for surplus goods are created that enable people to obtain those specialized, necessary services which they cannot provide for themselves. However, surplus goods are not produced for economic expansion as in our current system.

We cannot totally escape the industrial money economy should we want to. First of all, people are not on the land and do not own the land which is essential to a subsistence economy. Secondly, we do not have the infrastructure in place for a solar economy. Thirdly, many communities no longer have local markets for locally produced goods. And lastly, we are still bombarded, and our children are bombarded, by the mass media indoctrination of the industrial/service economy. We will still need some money.

What I wish to suggest is that we can have a foot in both worlds. When we can provide for ourselves, we should attempt to do so; but realizing the need for those things which must be purchased, we hold money-making jobs.

Without a change in the structure of the job market, this will quickly turn us into frenzied people. Currently there are women who try to hold a job, raise a family, unwittingly engage in shadow work, and out of good conscience are trying to grow a garden, bake bread, and sew. This is not what I have in mind.

In the 1930s, Bertrand Russell wrote an essay about Adam Smith's pin factory. Though he was trying to illustrate a different point, the essence of his story is this:

> A certain number of people were employed in the manufacture of pins when a method was discovered which doubled the number of pins these people could make during a day. However, the world did not need twice as many pins. The logical response would be to have the people each work four-hour days rather than eight. Instead, everyone continued to work, making surplus pins until half the factories were forced to close and half the people were laid off.

Separating cream.

There has always been resistance to part-time work, both from employers and employees. But if we recognize that our time can be more valuable than our money, and attempt to do more things for ourselves, then part-time work is really all that is needed to meet our monetary requirements.

By shifting to more part-time work, the number of available jobs will increase. This certainly is a wise move in recessionary times.

There recently was a newspaper story of a man in Plymouth, Michigan, who was laid off from his job as a truck driver and laborer in Plymouth's Department of Public Works due to the recession. His coworkers responded by each volunteering to take a week off without pay so that the city would have funds to rehire this man. The fact this story made it into the papers shows how rigid our work schedules have been.

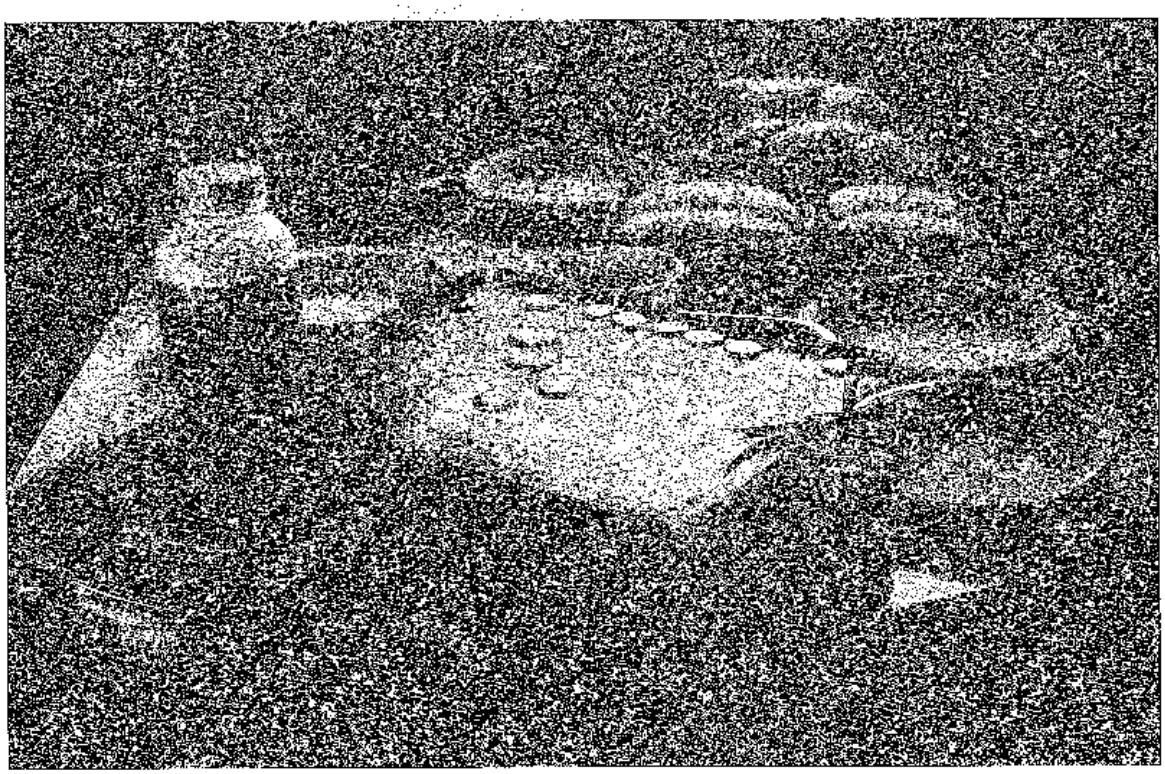
Another possible reform is to have shared jobs whereby two people are responsible for the same job, each working four hours of the day. Some husbands and wives who own small businesses or law firms, for example, have already begun to do this.

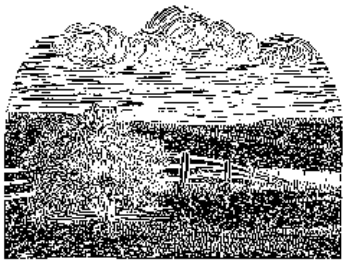
Aside from the benefit of being able to engage in more subsistence activities, and the benefit of more jobs being available during recessionary times, people who engage in part-time work find their share of shadow work reduced. For example, parents who arrange their work so that one or the other parent is home throughout the day will not need to turn their children into clients of day care centers. This restores unity to the family, with both parents raising the children. Day care centers sprang up because women reacted against the ungratifying shadow work they did alone in their homes. With the restructuring I am suggesting, a woman would be able to go out and work half a day, experiencing the satisfaction that brings. And her time at home could be spent with the children in activities which directly provide for the needs of the family.

There is a caveat, however, for people who begin to provide for their own needs. These activities must be done for noneconomic reasons, because the "economic reasons" are dictated by an archaic industrial/service economy which steals time (personal and planetary) to create bondage (shadow work and jobs). If you make cheese, do so because you want to be home with the family, are opposed to the resources consumed in the industrial processing of cheese, and because you like the quality of the cheese you produce. But do not hope to save money with cheesemaking or other subsistence activities, especially if you give your time a wage value. You are spending your time in a qualitatively different way than if you were to be working on a job, and it is impossible to give a price to qualitative benefits such as being home with family and knowing a useful skill.

To move beyond sentimentality, we must demand changes in our work places that allow for part-time and shared jobs. We must recognize the value of the family unit and break the industrial system as we try to live lightly on the earth. First, we must see the value of our personal time and reclaim it.

(PHOTOGRAPHS WITH THIS ARTICLE ARE ALL BY TERRY EVANS.)





Essays on Sustainable Agriculture

Wes Jackson

Choosing an Appropriate Tradition

Production agriculture has drawn much of its strength from the assumption that agriculture can be understood in its own terms. It has operated on the basis that we have enough knowledge to act with confidence, even though unfortunate side effects from our agriculture escalate. Usually there is no apology, and the growing array of problems are seen as opportunities for more research. This is but one of the masks of hubris which has become a driving force of modern agriculture.

Sustainable agriculture will have to draw its strength from a different tradition, a tradition which I think will be more like the naturalists of the nineteenth century than modern reductionistic biologists. Most modern scientists do respect the old naturalists, but only because they were stepping stones to the present, not because they were people who just might have viewed the living world more totally and wisely than they. It is easy to understand how so many modern biologists so readily embrace such arrogance. It is an attitude of science and technology in general, legitimate almost everywhere we turn. Many people who would be appalled at the suggestion that Shakespeare was a mere stepping stone to C. S. Lewis, for example, scarcely flinch when the nineteenth century naturalists are viewed as doing the best they could, given the level of science and technology at the time. Maybe the old naturalists didn't see the world accurately, but neither do we. What is on the line here is that though we have the opportunity to view the world more completely or accurately, our allegiance to reductionism and our beliefs that we can and should confidently act on the basis of knowledge prevents us from doing better than many (or maybe even most) of those naturalists. Part of this attitude among scientists has been spurred by the dazzling array of hardware the technologists have given us. And though a ten-power hand lens does limit how much of the world we can view and comprehend, so does the overweening pride that an electron microscope might promote in any of us.

The old natural historians are regarded as having been descriptive rather than rigorously analytical and are therefore dismissed. In the minds of most, natural history didn't begin to grow up and graduate to something called ecology before around 1910. About this time, industrial and economic words like "production" and "consumption" were added to the lexicon. Nevertheless, before that time natural history was a tradition in which the untrained, but highly-educated, Henry David Thoreau could be a contributor. He was preoccupied with succession, and many of his observations were quite insightful. I think that succession agriculturists will want to adopt Thoreau's approach and put science and technology in their service rather than adopt them as master. If this happens, it will be in the tradition of Gilbert White, Charles Darwin, John Muir, John Burroughs, Thoreau, Liberty Hyde Bailey, Aldo Leopold and Paul B. Sears. I suspect that many of its philosophers will respect the interactions as much as the units which interact.

Agronomists interested in succession agriculture will want to brush up on their ecology. Statistical models and clever manipulations will be useful, but they will use them with the understanding that agriculture comes out of Nature. And so, they will act with the assumption that we neither know nor can know about the myriads of interactions in Nature.

Modern agriculturists will protest that we have always stayed ahead in the challenge to feed expanding numbers. It is worth remembering that our progress in feeding people has always been in the period of an expanding energy pie, whether this growing pie be at the expense of our forests, our fossil fuel reserves, or the young dispersed coal of our soils, the more important recyclable carbon slowly accumulated, but jealously guarded and protected by the prairies and forests. Whether our source has been old coal or young, concentrated or dispersed carbon, progress in agriculture has been

Wes Jackson & Paul Sears, Nov. 6, 1982.

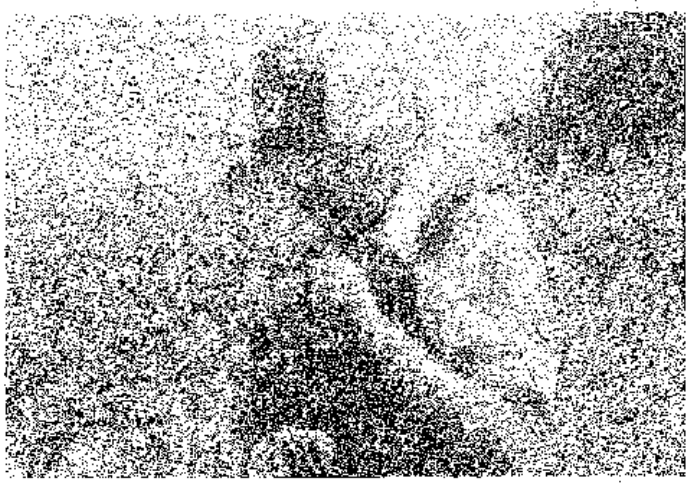
the most dramatic during the peak of our mining and wasting of these reserves which nature supplied. But the old rules that have been emphasized in the recent past won't do for the future.

An exciting new area of research awaits the young scientist who begins with the prairie or, as Sir Albert Howard did with the forest, as an analogy in shaping a new agriculture.

Zen and the Art of Plant Breeding

Some grain crop breeders warn that without pesticides, pest problems will mount in a herbaceous perennial polyculture. We know that without chemicals, pest problems can increase significantly when monocultures are planted in the same fields year in and year out. It is also true that insects and pathogens could build up, and weeds could creep into a polyculture mix. But there are numerous twenty-year old pastures around, and grass breeders and pasture experts seem to have few pest problems, even with minimal management. Walter Pickett, research associate at The Land Institute, talked with several grass breeders at the national meetings held at Pennsylvania State University this past summer about the prospects for developing high seed-yielding perennials. He reported that they are unconcerned about the difficulty of pests in perennial polycultures.

The differences in breeding strategy between the traditional grain crop breeders and forage breeders explain these opposite responses. A wheat or corn breeder, for example, may go with one strong gene for resistance to a particular pest. This is easy to handle in a breeding program, but it is also easy for the pest to quickly overcome. Consequently, the breeders are forced to release one new strain after another to stay ahead. Forage breeders, on the other hand, breed for general resistance to a disease. They want to keep the pest the way it is and not force it to change. By keeping the pest genetically broad based, that is, with lots of genetic variation and adapted to everything, it is likely to not be very well adapted to anything. It may be better to keep susceptible plants in the mix as hosts for insects or pathogens, so that when a reduction in resistance to a new form arises in the larger population, it will quickly be "watered down" through genetic recombination. Another way to look at it is that the presence of the pest keeps the population "toned up," and even though a generalized resistance may lead to reduced yield, it is a sunlight-sponsored resistance and a safe one besides.



Laura Jackson

Let us imagine that a particular farm in the future is going to support itself by the energy harvested from that very farm. It is safe to guess that the small extra energy cost to a domestic ecosystem for sponsoring generalized resistance is many times less if biological information manages it than if we control the pests with plowing and pay the high energy cost. Even if the traction energy for working the ground comes from the same farm and goes through a draft animal, it will be high. If it comes from the same farm and goes through a tractor as an alcohol fuel, the energy cost will be higher still. The energy costs for protection seem certain to be lowest when the protection is from within roots, stems, leaves, flowers and seeds, where we can take advantage of the efficiencies of miniaturization inherit within the plant.

The Patch and the Field

One of the most important considerations associated with any human endeavor has to do with the proper scale of an operation. In agriculture, as the ratio of people to acreage changes, there has always been a shift in what gets emphasized. Let us assume for a moment that somewhere in our past, we made a bad bargain when we moved toward labor-intensive till agriculture. Till agriculture does seem alien for a species which evolved as a hunter. Why would anybody be willing to spend most of his or her waking hours in the field doing the dull, backbreaking work that large scale till agriculture requires? Very early in agriculture, the ox must have been a welcome substitute for such human toil. Fossil fuel-driven traction was even more welcome. While we were thinking about how much better our backs felt, we probably gave little thought to what the consequences of a shifting ratio of human eyes to acres might be. As the human-powered hoe gave way to the ox-pulled plow, and as the fossil-powered tractor allowed the farmer to cover more acreage, how many of us would have dared to ask: "How much acreage can one person survey and comprehend?"

Maybe we have asked this question as agriculturists, but we have failed to take it seriously. Production agriculture in the West has always featured the field as the ideal unit.

for producing food. A large field invites the use of large machinery, or put another way, large machinery invites proliferation of large fields, and the consequences have been devastating. Farmers have bulldozed down hedge rows and shelterbelts and have cleared the trees along small drainages in order to "farm right through." Ironically, if a fence line tree falls down on the edge of a field, that same farmer will farm around that tree for years. With big and expensive equipment, the farmer cannot afford to do anything but pull into a field and start moving in circles around the property. On hilly ground, it is inevitable that he will go up and down hill over much of the area. This leads to erosion, and though it may be theoretically possible that with enough energy input as much soil can be built as is lost, it seldom happens. On the other hand, what if the acreage which erodes when tilled were left in native grass, and the number of operators were to remain constant? Some of the products of biological information would now be utilized to stop erosion and promote more efficient water use and constant fertility--all run on sunlight. When nature works for us, we can afford to allow the ratio of humans to acreage to remain constant or even decline. Left as a tilled field, it will remain sustainable only while high energy lasts.

There is another consideration not widely discussed. Where the scale of the "factory" increases in the field, the number of agronomic decisions (cultural) which the farmer must make in order to insure a substantial crop is reduced. Increase the number of decisions, and the number of mistakes is also increased. No matter how minor an error or forgiving by nature a mistake may be, a miscalculation is obvious to every farmer who drives by, and soon becomes a candidate for rural gossip. Chemicals and powerful equipment are used as a welcome substitute for a mind which must otherwise look at the sky, the ground and the calendar and risk bad luck with the weather. With the factory dominating the field, the farmer may be little better than an industrial manager, but his status in the community can remain high because miscalculations and bad luck can be cancelled out with powerful equipment and chemicals. A person with an ordinary garden, which provides variety for an average family, makes many more agronomic decisions than the single or two crop farmer who covers thousands of acres. The ordinary gardener applies more cultural information and works with much more biological information in doing so. If we consider these two opposites, the garden and the production farm, somewhere in between the garden and the field is an optimum "patch level agriculture" for America. With till agriculture and annual crops, the patch could be defined as that unit in which biological and cultural information are joined together in a sufficiently harmonious relationship to insure the health of non-eroding soil, while meeting a fair portion of the needs of the farmer and society.

Asking Questions – Seeking Answers

Walter Pickett

Sustainable agriculture based on mixed herbaceous perennial grain crops, so far as we can see now, raises three basic biological questions. We give high priority to three experiments which offer the best promise to provide insights into these questions. When we first began this work, we anticipated that sooner or later, fellow agriculturists and ecologists would ask the following:

1. Can a perennial polyculture out-yield a perennial monoculture?
2. Can herbaceous perennialism and high yield go together?
3. Will the management of a domestic prairie for seed products be practical? (For example, how are the pests--weeds, insects, pathogens, etc.--to be managed in the absence of plowing or spraying? How will the species ensemble be maintained?)

For the first question, we soon realized that the literature is full of examples which show that annual polycultures generally do better than annual monocultures, particularly in the tropics where most of the examples come from. Also, perennial polycultures of forage crops generally do better than perennial forage monocultures. Because management problems have made monocultures generally more popular, we have refined this question somewhat and ask instead, "What are the relative merits of perennial monocultures and perennial polycultures for grain production, and what are the liabilities?

We've had to abandon attempts to compare seed yields on a polyculture vs. monoculture experiment that Wes and Marty started three years ago. They included three perennial grasses and four perennial forbs growing separately and together in various proportions. Unfortunately, the various species didn't mature together, so the seeds had fallen from one species before the seeds of another species were ready to harvest. We're now planning a similar experiment using species that hold their seeds better, perhaps Agrotriticum, Curly Dock, Maximillian's Sunflower, and Wild Senna.

The first polyculture experiment hasn't been abandoned just because seed yield couldn't be measured accurately. The plots are still giving us information about species compatibility and weed control. We also can compare insect and disease damage in monocultures vs. polycultures.

The second question is perhaps our most basic. If a high-yielding perennial plant is impossible, then the possibility of a high-yielding perennial polyculture is questionable. We are approaching this question from many directions, but the results which have come from experiments begun or carried out by Marty Bender have given us the earliest positive results.

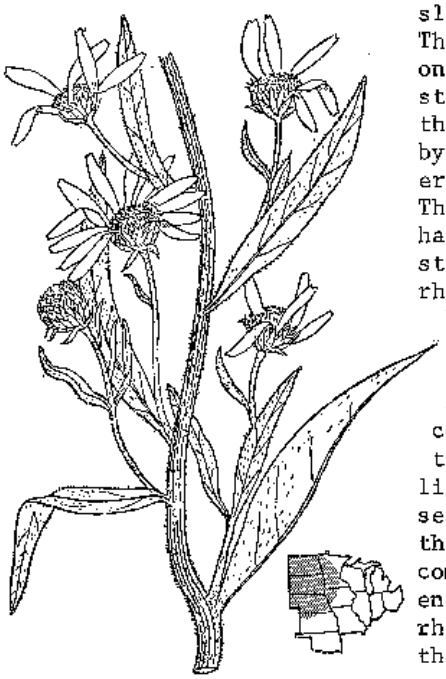
Last August, Marty harvested Curly Dock (Rumex crispus) at Cheyenne Bottoms in south-central Kansas. This was a natural stand of Curly Dock, with no fertilizer, no insecticides, no herbicides (nor weeds), no human genetic work on the variety, and the plants were of unknown age. The yield of Curly Dock seed and hulls was 72 bushels per acre, figuring at 60 pounds per bushel. This was about half seed and half hulls, or 36 bushels per acre if we're allowed to count only seed. Direct comparison with domestic annuals (a good wheat yield is around 30 bushels per acre) isn't really fair, but we're impressed even though they must have had plenty of water.

This fall we planted two experiments using Curly Dock. One is to study the effect of various agronomic treatments, e.g. weeding. The other is to compare different collections of Curly Dock that Marty has collected.

One of our Wild Senna (Cassia Marilandica) experiments this year was aimed at the yield question. We planted an area 50 feet by 330 feet to this perennial legume from 40 different sources. The Wild Senna from Ellis County yielded best with 30 bushels per acre. We now believe that if the experiment had been planted earlier, the yield could have been higher. We also believe that next year these same plants will do better. We are eager to learn whether the yields of these plants in their second year will be correlated with their first year yields.

Another yield trial compares the yields of Maximillian Sunflower (Helianthus Maximillian) seedlings to their second year parents. We have only two rows of each age, but they will give us a rough idea of yields of different age plants. Next year we will plant two more rows and compare seedlings, year-old, and two year-old plants.

Presently it looks as if seedling plants have a disadvantage because they get off to a slower start. They can draw only on the energy stored in the seed; then they must get by on the solar energy they can catch. The year-old plants have larger reserves stored in their rhizomes. They have the means to quickly put up enough stems and leaves to cover the ground, trapping more sunlight early in the season. We believe that this more than compensates for the energy going to the rhizomes rather than the seed.



Maximillian Sunflower

This fall we also planted an acre of "W-21" Agrotriticum. W-21 is a hybrid between wheat and tall wheatgrass. It is reported as yielding as high as 33 bushels per acre but not every year. It generally lasts three to five years between plantings.

Our bet is that straight selection of wild plants would give us a compelling high yield. But there may be another way to bring this about. What if we were to cross various species into a single interbreeding population? This summer, I started intercrossing Maximillian's Sunflower with four other perennial species. A third population is being prepared by crossing Maximillian's Sunflower with the domestic annual sunflower. These three populations will then be treated alike and the resulting improvement in each population will be observed over a long period of time.

We plan to do a similar experiment in which we compare pure Eastern Gama Grass with Eastern Gama Grass X corn hybrids. This particular consideration is important if we are to try to turn our already domesticated crops into perennials.

The third consideration--the management question--does present a challenge to us. The most important specific question is, how are we to control pests in a perennial polyculture? Until recently, cultivation was the farmer's main weapon against pests. While working the soil, he was destroying weed seedlings, insect eggs, and disease-carrying dead leaves. Recently, minimum till methods have substituted chemicals for cultivation. However, our observations indicate a different method is possible.

The polyculture experiment mentioned earlier was weeded as needed during its first year, and once in the spring of its second year. No weeding was done in its third year, but the plots are still weed-free. The grass plants compete strongly for root space and the last year's leaves form a dense mulch which, together with the live leaves, shade the ground thoroughly. No weed seedlings, nor any other seedling, can survive. The sunflower plots are equally weed-free, but for a different reason. The plants aren't as dense, and there is little mulch. However, it has been found that sunflower roots give off a natural herbicide. The sunflowers and grasses planted together in the mixed plots have co-existed for three years, but the sunflowers planted alone have successfully kept out grass and forb intruders alike.

Encouraged by these observations, last spring we put out an experiment with four species, each planted alone. They are Illinois Bundleflower, Wild Senna, Sawtooth Sunflower, and Maximillian's Sunflower. This fall we planted Curly Dock. So far we have no results on the Curly Dock, but we have some tentative results on the others. The Illinois Bundleflower (which can survive and compete in roadside ditches) was hurt most by the competition. The plants didn't inhibit weed growth, but were themselves inhibited by the weeds. Next was Wild Senna. It didn't inhibit weed growth, and

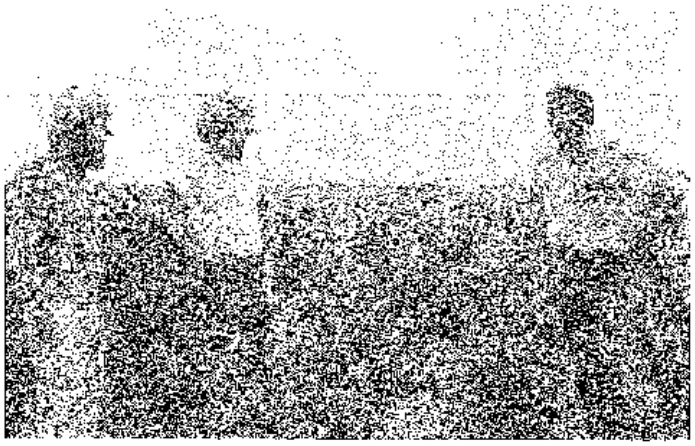
weeds didn't inhibit its growth. One could see little difference in the Wild Senna plants between the weeded and unweeded plots.

Both sunflower species reacted the same. The weeds in the unweeded sunflower plots weren't as vigorous as the weeds in the Wild Senna or Illinois Bundleflower unweeded plots. Perhaps more important, the only obvious difference between the weeded and unweeded sunflowers was that the unweeded sunflowers bloomed a few days later than weeded ones.

In July, the unweeded half looked terrible. We couldn't have found the rows except that we knew what to look for. Wild False Buckwheat made the unweeded plots tangled messes. Annual grasses and sundry other things grew underneath. But by mid-August, the weeds in the sunflowers were looking wilty. Soon afterward, the weeds in the Wild Senna and Illinois Bundleflower followed suit. By early September, the experiment was a showpiece. Both the weeded and unweeded plots were nearly weed free as the summer annuals died out, leaving our perennials. Now winter annuals have sprouted and there are weeds again, but not like before. All the perennials are in good shape for the winter.

An outbreak of aphids in the greenhouse has given us an unexpected result. Various varieties and species of corn, sorghum and wheat are all densely infested with aphids. But our ten plants containing all the chromosomes of domestic corn, wild corn and Eastern Gama Grass are completely free of aphids. We quickly called some corn breeders to see if this was a new discovery. Dr. Dewet, at the University of Illinois, said that he had found gama grass to be resistant to greenbugs. He had also found corn carrying a few gamma grass chromosomes to be resistant. So far, it seems that no one has transferred this trait to corn. Our next step is to decide whether this will be important in our breeding program, or if it is just another interesting observation with no immediate value.

Although we have begun to address the basic biological questions, there is still much to explore. We will continue to seek answers through experiments in the next growing season.



Walter Pickett, Marty Bender, Wes Jackson.

Brief Observations on Small-Scale Agriculture in the Southwest

Marty Bender

Editor's Note: Research Associate Marty Bender has been on a leave of absence this fall to study in the agroecology program at the University of California, Santa Cruz. He sent this report of his early September trip through the Southwest.

As I drove to California, my trip turned out to be more and more of an agricultural tour, although it wasn't initially planned that way. My first stop was at Ghost Ranch, a conference center in northern New Mexico. At the small farm project there, Missy Martin and Lynn Hirschberg, a former student at The Land, are trying to develop Indian Ricegrass as a cash crop for the local people. Indian Ricegrass is a native forage grass. Its seeds are used for revegetating rangeland and sell for a good price. In three years, several acres of Indian Ricegrass have been established and a pedal-powered thresher and seed cleaner have been developed. I showed Missy and Lynn how to operate a hand-held harvester like the one we use at The Land Institute. I also suggested possible selection experiments they could do to improve Indian Ricegrass.

While driving through Arizona, I looked at the agricultures of the Navajo, Hopi, and Papago Indians. I did not see any polycultures with bean plants climbing up corn stalks, which is what many people visualize about Indian agriculture. What I saw were monocultures with the plants widely spaced as in dryland farming. Since I was unescorted when I traveled through the Navajo and Hopi reservations in northeastern Arizona, I did not know where to venture to get a broad scope of their agricultures. In a region where annual rainfall is less than ten inches, the Hopi and Navajo grow corn, tepary beans, squash, sunflowers, watermelon, and fruit trees. In the bottom of Canyon de Chelley National Monument, the Navajo grow the aforementioned crops and alfalfa in monoculture plots of ¼ to ½ acre each. The Hopi cultivated small plots so cleanly that it appeared as if the crops were growing in sand dunes. The Hopi also farmed corn fields as large as ten acres with tractors of less than 50 horsepower.

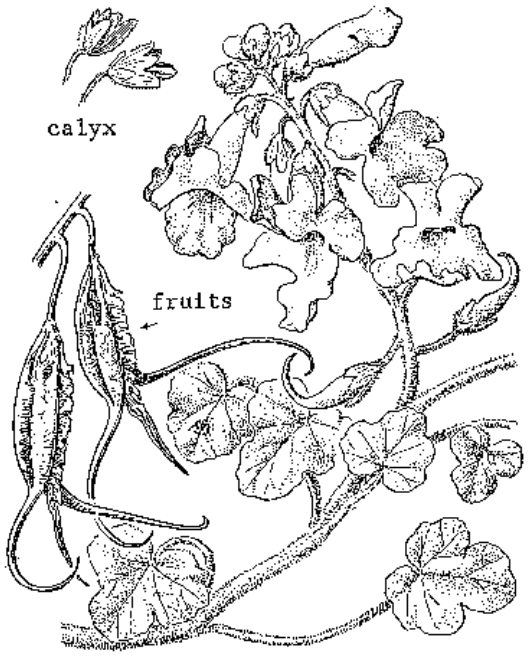
Southwest of Tucson, Arizona, I was fortunate to have Gary Nabhan show me the floodwater farming of the Papago, which he has been observing for many years. In floodwater farming, the Papago utilize rain that quickly comes down off the nearby mountains into arroyos on the level plain. When the velocity of the water slows down, the arroyo widens and the water spreads out and soaks into the soil. This location, called akchin (Papago for "arroyo mouth") is where the crops are grown. The floodwater

flow also deposits leaves and twigs of leguminous shrubs and excrements of small and large animals on the plots, thus increasing the humus content in the soil, which in turn increases the water-holding capacity of the soil. Some Papago also dig collection ponds, called charco, to catch water from the arroyos. Water is stored in the charco until the Papago farmer opens up the irrigation ditches to drain the water onto the fields.

The Papago grow corn, tepary beans, squash, watermelon, and devil's claw. Dried devil's claw pods yield fibers for basket weaving. The seeds of this domesticated species of devil's claw do not have the black seed coat typical of the wild plants; thus, these seeds germinate more easily. In Kansas, there is another species of devil's claw, whose seeds I have eaten from the plants we have in the herbary.

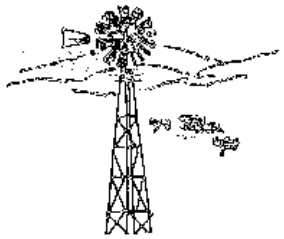
The corn of the three Indian cultures is similar in appearance, but it is genetically different. The corn is three to four feet tall with as many as five stalks per hill. The large ears are located near the base, quite unlike the hybrid corn of the Midwest. About a dozen seeds are planted at each hill as deep as a foot where there is moisture to germinate the seeds.

These valuable adaptations of corn and devil's claw are not all that need to be preserved. Papago agriculture has declined perilously this century due to the infiltration of the values of our economic system. The Papago used to floodwater farm about 10,000 acres at the beginning of the century. Now they farm less than 100 acres. If you wish to delve more into native Southwestern Indian agriculture and the significance of its decline for our culture, then read Gary Nabhan's book, The Desert Smells Like Rain, and chapter two in Wendell Berry's book, The Gift of Good Land.



Devil's Claw

Biological Pest Control in Livestock



Dana Jackson

Seldom do we focus on animals or animal behavior in classroom work at The Land. Although we recognize the necessity of livestock on successful organic farms, and think that someday we would like to use draft horses, we haven't delved too much into animal science. When we talk about biological pest control, we usually think of efforts to thwart aphids in the cabbage with ladybugs. However, two different scientists opened our eyes and minds to biological pest control in animal populations this fall when they visited The Land and made presentations.

Dr. Dick Richardson, a geneticist, a Professor of Zoology at the University of Texas, and a rancher, stopped to see us early in September. He agreed to make an evening presentation, so we invited area biologists and farmers whom we thought would be interested in the work he is doing. Dr. Richardson's paper, "Autocidal Control of Screwworms in North America" had appeared in Science, January 22, 1982. The cover of that issue featured an old fashioned water pumping windmill with cattle grazing nearby. Illustrating the basic ecological premise that you can never do only one thing, Dick explained that the coming of windmills in Texas made year-round water supplies possible, and cattlemen were thus able to keep larger herds. Screwworms, which eat the living flesh of cattle, were not a problem in Texas until the late 1800's when there was a large increase in the number of cattle in the Southwest. Overgrazing by cattle and fewer prairie fires allowed woody legumes to replace the grass and deer to replace the antelope. With a supply of legume nectar to feed the screwworm flies, deer and cattle as hosts for the screwworm, plus a year around supply of water, the screwworm populations increased to become a curse on the cattle industry. The screwworm populations were spread to Florida and also migrated north each spring, usually to about the 40th parallel. By 1958 the losses to the screwworm pest amounted to $20 million per year.

In the late 1930's, the idea was conceived of radiating male flies to make them sterile and then releasing them to mate with wild females, but it was not until much later that a method of culturing the screwworms on hamburger was developed which makes it possible to produce sufficient numbers of sterile males to make the technique workable.

The USDA began a program of releasing sterile male flies in 1950 which worked well until 1968. Severe screwworm outbreaks occurred in 1972-1976 and again in 1978. Dick Richardson set out to find out why, and learned that the

male sterile flies produced for the USDA in a Mexican factory 1500 kilometers south of Texas did not always interbreed with the target females because they are genetically different. The USDA needs a broader understanding of the genetics of the pest and changes in their program. Richardson recommends a mass culture facility in the U.S. with a staff able to respond to an outbreak by releasing the right type of male sterile flies.

Dr. Ray Coppinger and Jay Lorenz from Hampshire College of Amherst, Massachusetts, gave little advance notice of their visit on October 26, so we did not have time to arrange for biologists and farmers to listen to their presentation. However, Dennis Johnson, a Friend of The Land who raises sheep just a few miles from us, was able to come over on short notice. Late in the afternoon of October 26, we learned that a sheep rancher from Lenora, Kansas, was coming to The Land to pick up a livestock guarding dog from Coppinger and Lorenz. The rendezvous occurred about 10:30 P.M. that night, and the next morning when our students arrived, they were amazed to find the driveway blocked by a long chain, attached on one end to our pickup and on the other to a van, with large dogs hooked to the chain at various points and a bunch of puppies running loose around them.

Ray and Jay spent the morning at The Land and gave a fascinating slide presentation about the use of guard dogs in Europe. Ray's slides taken in Turkey showed how the sheep, the guard dogs and humans live closely together.

In the introduction to a booklet prepared for the Livestock Dog Project, Ray and Lorna Coppinger explain the role of the guard dog:

> "The livestock guarding dog is alive and well, and working in Europe. It travels along with the flocks on their seasonal migrations, it stays with them all day and night, and it is an effective defense against would be predators. The livestock guarding dog is large and placid, with centuries of inherited savvy, appearing content to mingle with the livestock, protecting them simply by its mere presence. Few wily predators will attempt to invade a flock of sheep when a guarding dog is on duty, since the most important thing to a predator, even before the needs of its stomach, is to keep out of trouble."

Ray and Lorna Coppinger began directing research on the use of dogs for guarding in 1976, importing ten pups from Old World stock to begin the Livestock Dog Project at Hampshire College's Farm Center.* Ray is Professor of Biology and Lorna is Faculty Associate in Biology and Outreach Specialist in Agriculture at Hampshire College in Amherst, Mass. Jay Lorenz, who accompanied Ray on the trip through Kansas delivering dogs to cooperating farmers in the research project, is a research associate who keeps records on the 265 dogs which are imported,

bred or acquired through donations from breeding clubs. As of May 1981, close to 150 sheep producers were leasing working dogs from the Livestock Dog Project and their performance is carefully monitored and recorded through the project.

Ray told us that the sheep industry loses 100 million dollars a year because of predators (dog packs, wolves and coyotes). The U.S. government spends 5 million dollars a year to shoot or trap 70,000 coyotes, mostly in the West, and it is estimated that farmers kill about 350,000 on their own. Yet this is about 7% of the coyote population. Although individuals are helped by the federal program, it isn't making a real impact on the coyote problem. The use of toxic chemicals, such as 1080 for predator control, has been banned. Individuals can use M-44 (a device that shoots sodium cyanide into the mouth of a predator pulling on it) only after application to the EPA for a license. There is a tremendous need for safer predator control, and the guard dogs, a biological pest control, could be the best solution in sight.

The effectiveness of guard dogs is limited, however, if ranchers do not have sheep with strong flocking tendencies. Many Americans prefer sheep that scatter out and make better use of the pasture, and these are from English breeds. On Old MacDonald's Farm, it was "here a sheep, there a sheep, everywhere a sheep, sheep." But the European guard dogs were selected to work with sheep that flocked or were bunched together every night on a special bedding ground. The sheep and dogs must go through a confinement so they can make a social bond before the dogs can protect the sheep on the range.

The control of screwworms in cattle by releasing male sterile flies, and the control of coyote predation of sheep by guard dogs were not topics we would have scheduled on our regular agenda. However, our concept of biological pest control has been significantly broadened by the interesting presentations of these visiting scientists.

*See: "So Firm a Friendship," Natural History, March 1980; "Dogs in Sheep's Clothing Guard Flocks," Smithsonian, April 1982; "Livestock Guarding Dogs," Country Journal, April 1980.

What Happens if an Electric Utility Goes Bankrupt?

Ivy Marsh

In the current era of economic recession, with personal bankruptcies at an all-time high and corporate bankruptcies up 44% by mid-June over a similar period in 1981, the question has been raised, "What would happen if a major utility went bankrupt?" So far none has.

BACKGROUND

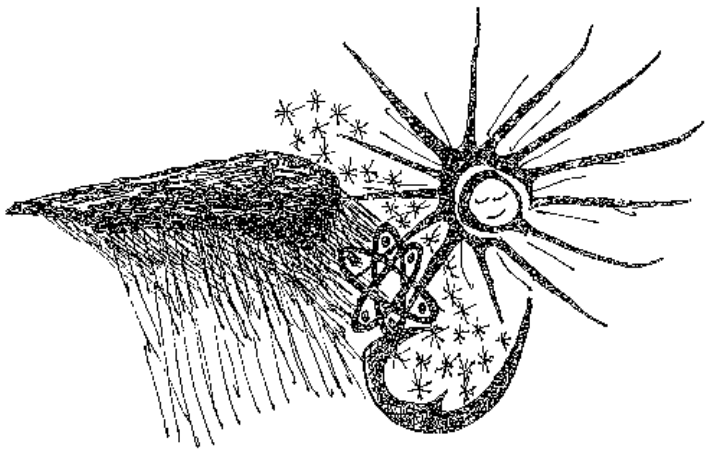
In a talk on utility credit ratings to the Consumer Information Board on April 30, 1982, Brian Moline, Kansas Corporation Commission General Counsel, stressed four basics: the utility industry is capital intensive; dollars today are in short supply and borrowing is competitive; the financial community is sensitive to risk; and the higher the risk, the lower the available capital. Capitalization takes three interrelated forms--equity (the stock in the corporation), proceeds (rates to consumers), and debt (borrowing)--both short-term (normally unsecured promissory notes) and long-term (usually bonds: mortgage, debenture, guaranteed, joint, assumed, etc.). Stipulations about the precise terms of the bonds are spelled out in a "Bond Indenture" document, including the restrictions and remedies in case of default. The crucial difference between a stock and a bond is that a company, in time of severe financial stress, could elect to withhold dividend payments to holders of common stock, while failure to pay bond interest or the principal at maturity is grounds for default. If a company defaults, all of its assets could be sold to satisfy claims, or an arrangement might be made to convert to some form of equity ownership.

BOND RATINGS & THE "NUCLEAR REGULATORY CLIMATE"

Two nationally known rating services, Moody's and Standard and Poor's, compare and rate utility credit. Their analysis is based upon 6 financial and 5 non-financial criteria--one of the non-financial ones is the "general climate of the regulatory body." Companies are then rated "Investment grade"--from Aaa down to Bb--or "Speculative grade"--B to Ccc. The principal aim of a bond rating agency is to distribute companies among rating classifications in order of relative risk of default. Since 1974 both S&P and Moody have had a steady downgrading of utilities. Today there are no Aaa ratings, and Baa is common. Rising interest rates, the ratio of debts to property values, and declining coverage of interest or available earnings are cited as contributing factors to this general rating decrease.

S&P defines a "favorable regulatory climate" as a commission that is aware of the financial implications of its decisions--not just dollars and cents, but the implications on debt service and credit. Kansas rates 3 on a declining 1 to 5 scale in the "regulatory climate" category. There are signs, however, that the raters themselves are showing an increased awareness that what they once considered "poor regulatory treatment" can in fact be the result of poor management by a company. The raters are ruthless; companies who have invested heavily in nuclear power, for example, and face severe economic problems as a result, are now becoming considered "poor judgment" risks, even though at the time they made the decision to take the nuclear path, many of these same analysts considered that to be an appropriate move. At an S&P seminar in 1980, participants were told that no moral judgment is applied in evaluating a company--only the dollar risk is calculated.

It is hard to overestimate the importance of a utility's credit rating, for it reflects the financial soundness of the company. In studies which have been done on default of corporate bonds, ratings were indicators of the event--almost a self-fulfilling prophecy. If a bond rate drops, a corporation usually can get money only by internal methods (short term borrowing or stock issuance, both of which cause the value of the stock to drop). In summary, if a corporation loses its bond rating, there are no good choices. In 1981's Financial Data on 74 Electric Utilities, Moody's bond rating for KP&L was Aa; for KCPL, an A; and for KG&E, a Baa. In August 1982, KCPL's and KG&E's bond ratings were lowered to Bbb. A spokesman for KCPL blamed, in part, the "poor regulatory climate" for the lower rating. Tom Taylor, KCC spokesman, emphatically denied the charge, and said the construction costs of Wolf Creek were at the heart of the problem. When I asked Pete Loux, chairman of the KCC, about KCPL's reaction, he said, "We always get the blame, but we can't delegate our responsibilities to Wall Street. We have to make independent



judgments based on fact." Then he laughed and added, "Why is it that KP&L has one of the best bond ratings in the country? They operate under the same 'regulatory climate' as KG&E and KCPL. We always get the blame, but nobody ever gives us the credit." Brian Moline also cited construction costs of Wolf Creek for KCPL's woes. "They're having incredible cash-flow problems because of that huge plant. It costs a fortune, and they had to borrow money." A Standard and Poor spokesman said the reduction reflected "expectations of inadequate cash flow and limited financial flexibility... The utility's external requirements will continue to remain burdensome until construction of the Wolf Creek nuclear unit is completed." In October, KCPL was still rated Bbb, but a minus had been added to KG&E's, making it Bbb-. Another firm rates them for financial pressures. KP&L received a #1; KCP&L, a #4; and KG&E, #5 on a 1-5 scale. A footnote stated that Wolf Creek was the problem for KCPL and KG&E.

MOLINE'S ANSWER TO THE TITLE QUESTION

In the decade of the '70's, electric utilities faced growing uncertainties--load growth estimates were declining, fuel options limited, capital needs rising, and internal cash flow decreasing. All of these constituted risk factors. In November 1981, during an informal question-and-answer session with the CIB, when asked what the effects of the bankruptcy of a utility would be, Mr. Moline commented that in one respect a healthy rate of return is good not only for the company but for the ratepayers as well because "going under gets very expensive for the ratepayer. The stark choices are to either lump an incredible amount onto the customers or let the company go broke. It's hard to calculate the effects of that--they go well beyond that one company. Even a badly-run company going down has an effect on good companies on Wall Street. They would say, regarding the regulatory process or climate in Kansas, 'Don't put a dime in Kansas; they let a company go under.' This could affect the bond capability of other well-run utilities in Kansas. This situation would require a great deal of thought." He seemed relieved that the question was only theoretical.

In April 1982, asked to comment further about this to the CIB, Mr. Moline said that the legal process for an orderly dissolution or division of a company would probably be that in a corporate sense it would continue to operate, either in a voluntary or an involuntary manner. If voluntary, another company would come in to operate it; a record number of corporations have had bankruptcy result in this solution. If involuntary, others would present a petition to declare a corporation bankrupt, stating that the corporation is not paying its debts or that there exists a realistic perception by its creditors that the corporation will not pay its debts. The corporation then has two choices--to liquidate (shut down) or reorganize (try again). Most courts seem to believe that an entity is best as a going concern and try to ascertain if the book value exceeds a corporation's total debts. If it does, reorganization would be indicated. If the corporation were a utility where its customers obviously need the product (electric power), reorganization would almost certainly be indicated. Moline was not aware of any complete liquidations of a utility since the depression, and even then ways were found to provide the affected customers with uninterrupted power. In this theoretical bankruptcy case, there would be an immediate freeze on interest, debts, etc., but the business operations would continue under a trustee. The money would come through rates alone; possibly short-term borrowing could be arranged to get operating income to keep the company going. They would need supplies and services from vendors who may already be creditors who have "frozen" bills. Under these circumstances it would be difficult for the regulatory body to deny a rate increase and if it tried, the courts would probably reverse the decision. Once the corporation emerged from bankruptcy it would again seek capital, but it would be years before established lines of credit would be available. Moline's conclusion was that the bankruptcy of a single major electric utility would send shock waves through the whole utility industry nationwide.

This prediction is borne out in a fascinating chapter by Douglas Anderson titled, "State Regulation of Electric Utilities," in The Politics of Regulation, edited by James Q. Wilson. Anderson relates the woes of Consolidated Edison of New York following the October 1973 oil embargo. Seventy-five percent of Con Ed's fuel was produced by burning foreign oil which rose from $4 a barrel to $24. Even though the N.Y. State Public Service Commission authorized a temporary rate increase to help compensate, the company was on the brink of bankruptcy because it couldn't raise working capital. Banks refused loans and bond purchases ceased. No dividends were paid to holders of common stock in April 1974, and the stock actually stopped trading for a while. It was the first time in 89 years that a giant utility had failed to pay quarterly dividends. This created the "shock waves" Moline referred to, and the common stock of other utilities fell drastically. Some companies postponed construction of new plants in the light of these new developments.

Any time investors view utilities as a risky investment, the companies' problems are compounded. Financial analysts in the bond market downgraded the bonds of many electric utilities which meant that ultimately the consumers paid for the increased costs of borrowing money. It is doubtful if utilities will ever again achieve their "blue chip" status, but thus far the industry, including Con Ed, has managed to survive the huge capital and fuel costs and the declining load factors without becoming insolvent. While there is no question that these fac-

tors have permanently changed the economics of the utility industry, the fear that we would "freeze in the dark" if a utility went bankrupt appears to be unfounded. The changes in management involved in the production and distribution of electricity would not be discernable to the average customer, but the effect would become apparent when the next bill arrived. Rates would probably increase dramatically.

CHANGES IN ROLE OF REGULATORS

These kinds of technological and economic changes have also altered the function of regulators by forcing them to take a more active role in rate structuring and other factors in order to protect the interests of all parties. Commissioners must feel they are being pelted from all sides--utilities demand rate increases to meet rising costs; consumers demand affordable (translate "lower") rates; "environmentalists" demand action on conservation and wise energy use. It must seem to them that the best they can hope for is the negative goal of trying to see that no faction is so badly hurt it cannot survive. More commissions are beginning to accept the promotion of economic efficiency within utilities as part of their legitimate oversight responsibilities, rather than the narrower focus of simply seeing that profits are not excessive, which seemed to be their main function in "the good old days." Costs involved in both the production and the pricing of electricity are being closely followed. Investment analyst Martin Weiss, publisher of a biweekly newsletter "Money and Markets" advised: "I look for regulators to be much tougher because of consumer pressure," and said utilities are running out of cash. "They're on the thinnest ice of any industry in the country." In a June 2, 1981, Wall Street Journal article, John Emshwiller said, "There is a growing concern that the industry won't be able to come up with the hundreds of billions of dollars needed to supply electricity in the next decade, and that some utilities might go broke trying." In welcoming remarks addressed to an energy conference in Topeka in January 1982, Kansas Corporation Commissioner Jane Roy reminded participants, "As the shoe gets tighter, we and our staff scrutinize with increasing care how utilities spend their money and request inclusion of these expenditures in their rate base. The rate of return must be fair, because if our utilities are in trouble for any reason, we Kansans--even if we have no monetary investment in utilities--are also in trouble."

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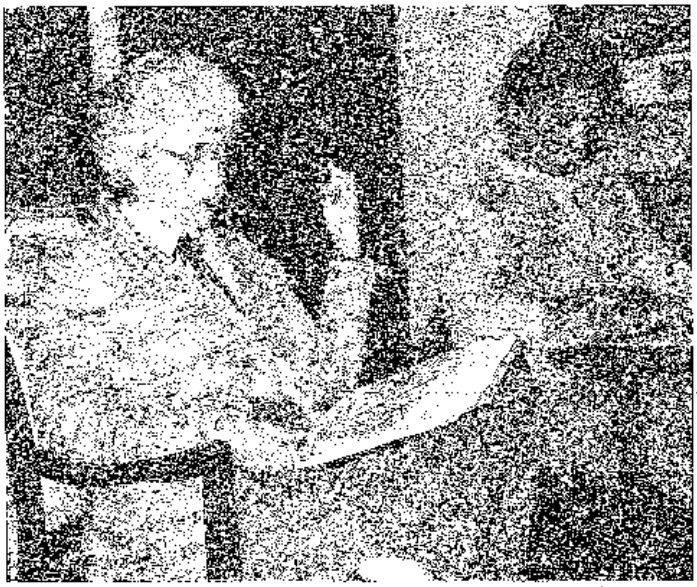


Ivy Marsh talking to Land Institute students about electric utility regulation. Ivy was selected to serve on the Consumer Information Board of the Kansas Corporation Commission as a representative of The Land. She is also a member of the Board of Directors of The Land.

LIMITATIONS OF KCC

The KCC itself is "regulated" by the Kansas legislature. It was established by state statute. Since private utilities are a monopoly, the KCC was given jurisdiction to regulate them, and was ordered by the legislature to grant utilities rates which would allow them to recover their legitimate expenses and earn a return on their investment. In a 1981 "Energy Project" paper, Kansas Legal Services, Inc., pointed out that a utility is never guaranteed a profit by the KCC--only the opportunity to earn a certain level of profit. The courts have said that a utility's profits are to be similar to other businesses having comparable risks and should allow a utility to attract investment in the company. The KCC has also indicated that it would not reward bad management.

CONSUMER REVOLT

Nationwide, there is a growing consumer opposition to regulatory practices, especially those involving rate increases. In the Pacific Northwest, consumers are angry about rate-making treatment involved in the cancellation of nuclear plants. In California, customers are angry about a $900 million rate increase awarded to PG&E in late 1981. In several states (Arkansas, Michigan and Ohio), consumer organizations have attempted to change the method of selecting utility commissioners from appointed to elected. In Michigan, there is also a consumer movement to rescind the automatic fuel adjustment clause. The Wisconsin legislature recently narrowly defeated a bill that would have created an elected commission instead of an appointed one, and rejected by a single vote a bill to repeal the automatic

fuel adjustment clause. (In the past decade, most states have allowed an automatic fuel adjustment clause which allows a utility to "pass through" to customers the actual fuel costs without first going through the hearings process.

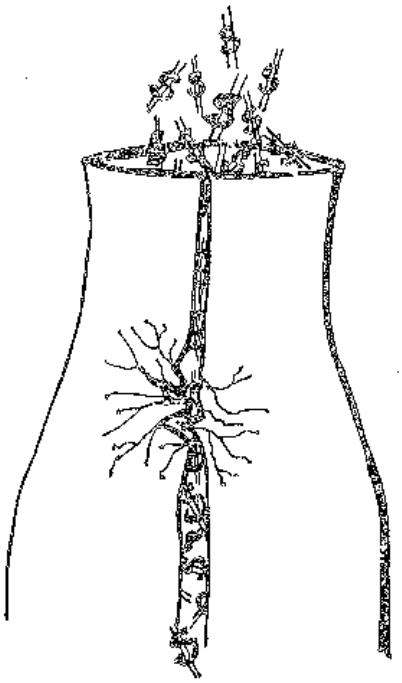
In November 1980, voters in 5 states (Oregon, Missouri, Montana, South Dakota and Washington) voted on referenda that would hinder the growth of nuclear power in their state. Two of the five passed. Oregon voted to require statewide voter approval of site certification for nuclear plants and for availability of permanent nuclear waste disposal sites, and prohibit Oregon utilities from financing nuclear power plants. (A court challenge is pending.) Both PG&E and So. Cal. Edison have challenged a 1976 California law imposing a moratorium on building new nuclear plants until the question of disposal of waste is settled. A Federal court overturned the law, but an Appeals court reversed that ruling. The Supreme Court has agreed to consider this landmark case, which could determine the future of U.S. commercial nuclear power. A ruling is expected in 1983. Five other states have similar laws. The utilities contend the 1954 Atomic Energy Act gives regulation of nuclear power to the Federal government, and that states lack jurisdiction to control their construction or operation. This will be a classic test of nuclear power versus states' rights--both are issues strongly supported by President Reagan and the far-right. If the Court overturns the California law, Congress could consider enacting similar moratorium legislation on the federal level. In Washington, voters favored a ban on the importation and storage of non-medical radioactive waste.

The most interesting development that has occurred, in my opinion, is the November 1981 Initiative 394 in the state of Washington which passed by a 59% margin and stipulated that as of July 1, 1982, public agencies must gain voter approval before they issue bonds to finance the plants with a capacity of 250 megawatts or more. This will affect some nuclear power plants currently under construction. The initiative does not include investor-owned utilities, and a court challenge is expected.

NUCLEAR ASPECTS THAT COMPOUND THE PROBLEM

Utilities that have invested in nuclear generating plants, either those currently in operation, or completed but not operative, or postponed, or cancelled, have money problems which are hard to overestimate. Because of skyrocketing costs, high interest rates, expensive delays, faulty designs requiring correction, and

Don Winston of the Atomic Industrial Forum said, "I think economics is what it's all about. No one can afford the damn things."



a decreasing demand for electricity, nuclear power no longer has the cost advantages that were projected in earlier days. There has been an ever-increasing number of cost overruns and reactor cancellations or postponements. These higher costs are in part attributed to the fact that this is not a "known" field of technology; there has been a lot of "learn by doing," which is costly, and has led to a number of safety-related regulations requiring back-fitting or retrofitting of existing plants as serious flaws develop.

In an article in the Union of Concerned Scientists' bulletin Nucleus, Spring 1982, Charles Komanoff and Eric Van Loon state, "Since 1974 over 100 plants, including 20 under construction, have been cancelled or indefinitely postponed by U.S. utilities, and not a single new reactor has been ordered...Earlier this year the Washington Public Power Supply System (WPPSS, or WHOOPS! to those who have watched its soaring costs and plunging bond ratings) terminated the two least-completed (nuclear) plants, writing off a $2.25 billion investment rather than risking $10 billion more to finish them...Rising costs and a brewing ratepayer rebellion are threatening at least one of the three other WPPSS plants as well." The TVA has "postponed" 3 reactors on which it has spent $2.1 billion. Estimated costs for decommissioning a plant and the technical problems involved in doing that are horrendous and would require a lengthy article on that topic alone.

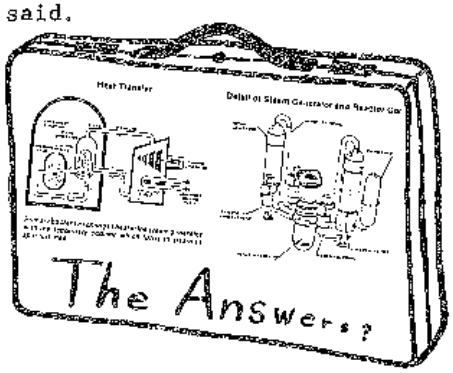
In March of 1981, Merrill Lynch, a pretigious investment firm, advised utilities that the best way to improve their financial position would be to cancel 18 of the 78 reactors which had obtained construction permits. Don Winston of the Atomic Industrial Forum said, "I think economics is what it's all about. No one can afford the damn thing." Nuclear plants are more capital intensive than conventional ones, and of

necessity they have higher safety standards. The ratio of capital costs to operational costs is much higher than for conventional fossil fuel plants. The unreliability, with frequent shutdowns and outages, adds to the cost. Public confidence in the technology has seriously eroded, and there is increasing concern about the safety, health, and environmental impact of nuclear power generation.

You might conclude from all of this that nuclear power clearly will play no significant part in our U.S. energy future. Forget logic. As General Omar Bradley said, "Ours is a world of nuclear giants and ethical infants." In an effort to protect or bail out the nuclear industry, the Reagan Administration has been exceptionally active in trying to, as they put it, "improve the regulatory climate regarding nuclear power by removing unnecessary obstacles." They have worked to lift the ban on reprocessing the uranium in spent fuel rods into plutonium, and ordered the NRC to speed up the licensing procedures for nuclear plants by nearly half (from an average of 14 years to 6 to 8). In addition, they have asked Congress for an estimated $100 million for TMI cleanup costs.

In the January 1982 energy conference mentioned earlier which was held in Topeka, a really terrible U.S. Department of Energy spokesman, William Silvey, assured us that "nuclear power has clearly shown how safe and economical it is. The red tape is phenomenal, and licensing is difficult. The Reagan Administration, including our office, in this regard is looking for ways to remove obstacles to nuclear power." When a question was asked, either technical or non-technical, his stock answer was, "I can't tell you right off, but I have the answer in my briefcase." I wondered why they hadn't just sent the case and left the speaker at home. If you've ever wondered what Pandora's box looks like, try visualizing Mr. Silvey's briefcase.

At least one pro-nuclear federal bureaucrat, NRC Commissioner Victor Gilinsky, is pushing for tougher federal regulatory practices in the nuclear industry. He told members of the Atomic Industrial Forum, Inc., that they should be thinking less about how to water down requirements and more about how to strengthen them. "What this industry can stand least is another serious accident--Another TMI and you can kiss Wall Street financing goodbye...If I owned one of those plants, I would want the toughest possible NRC," he said.



POSSIBLE SOLUTION

The good news is that both consumers and regulators are taking an increasingly active part in precipitating events which appear to be in the best interests of everyone. For example, there is the "creative financing" proposal the Corporation Commission of Oklahoma proposed to Central and Southwest Corporation, which had invested approximately $177 million in construction work on the Black Fox nuclear unit (61% of which is owned by the company and was scheduled for completion in 1993). This cost was denied in its entirety and the commission attached a statement to its decision regarding Black Fox. Commissioners had earlier ordered an independent consultant, Touche Ross, to do a feasibility study. This report concluded that the nuclear plant should be cancelled. The Commission outlined a rate-making treatment plan (spreading the costs among the ratepayers) they would accept if the company would agree to cancel it. The cost of the unit at that point was about $200 million; $47 million profit from a recent sale of oil and gas properties would have to be applied against that, as well as the salvage value of work to date (estimated at about $11 million), leaving a $142 million cost which the Commission would allow to be amortized over a 10-year period. The Commission gave the company 30 days to make a decision. The plant was cancelled.

To protect consumer interests, a number of state corporation commissions have refused to allow construction work in progress (CWIP) costs to be passed along to ratepayers until a plant is almost ready to go on line. Kansas is one of those states. Some commissions have disallowed a rate of return on the investment base if it represents excess generating reserve capacity. Such an action would almost certainly cause a company to reassess the need for new plant construction if such a project would result in an unacceptably high reserve margin. Some state commissions are beginning to impose moratorium periods on utilities, denying them new rate application filings for a specified period of time after their most recent rate decision (although provision is made for this restriction to be lifted in the case of an emergency or sharply changing conditions.) Pete Loux, however, believes a stipulated moratorium period violates the 14th Amendment--" 'confiscation of property without due process' is the issue. There's a very slim chance it would hold up if we tried it. It would be overturned by the court," he told CIB members at their August meeting.

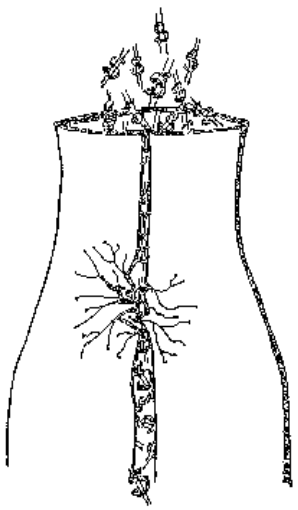
You might well wonder how a company goes about explaining to its stockholders why they are choosing to postpone or cancel a nuclear plant, especially if those costs will have to be paid by the investors rather than the ratepayers. Duke Power Co., in the North and South Carolina area, found itself in that position in February 1981, when it suspended its Cherokee station,

with a current sunk-in investment of about $600 million. They announced that such an action was being taken because of (1) the company's need to earn a reasonable rate of return to issue stock without diluting existing shareholders' equity; (2) the lack of realistic and consistent regulation that would remove the uncertainty surrounding nuclear power; (3) the nation's negative overall economic climate, which must improve for securities to sell in line with the industry's financing capacity; and (4) the currently excessive rate of inflation. Expressing many of these same concerns on February 3, 1982, Duke cancelled its Perkins nuclear station, which had an investment of about $12 million. Duke plans to apply to state regulators to pass the costs to ratepayers, but if denied, it would cost the stockholders about 4¢ a share to absorb the cost.

KANSAS NUCLEAR PICTURE

Both KCPL and KG&E have substantial investments in the Wolf Creek nuclear plant in Kansas. The KCC is not unmindful of problems at Wolf Creek. In its 12-31-81 KG&E rate decision, the KCC emphasized that CWIP for Wolf Creek was not allowed into the rate base yet, and that the Commission was concerned about the rising costs of that project and its completion. "The Commission urges KG&E to do everything that it can to promote productivity efficiency to complete that plant as soon as possible...The Commission likewise expresses its concern with the apparent inability of KG&E to accurately estimate the costs of Wolf Creek."

This is not just a matter of regional interest. An August 11, 1982, Wall Street Journal article said, "When KG&E opens the Wolf Creek nuclear plant it will be able to say that it is the smallest utility running a nuclear plant. It may also enjoy the dubious distinction of having the biggest rate increase ever required to pay for such a facility." On August 21, KG&E and KCPL announced that Wolf Creek faced another one-year opening delay (to May 1985) at an estimated cost of $2.3 to $2.5 billion, which will raise rates between 60% and 100% (depending on who's estimating) higher than current ones. The delay adds more than one million dollars a day to the cost of the plant.



During a tour of the plant in July 1981, I heard no indication from any of the top brass of those two utilities and the construction company involved that they wanted out, yet their efforts to sell 17% of the plant to KEPCO (who bought only 6%) and another 9% to KMEA (who bought none) would seem to indicate that they have more power and less money than they would like. Because I hate to see Kansas lose its moral position in preventing nuclear waste products from being stored in Kansas by producing wastes of our own, I have tried to explore ways to keep the plant from ever becoming operational, yet still allow the companies involved to stay solvent by allowing them to recoup most of their expenses. If I could decide the issue, I would reluctantly ape the actions of the Oklahoma commission and offer KG&E and KCPL a chance to spread the cost of the plant to their ratepayers (perhaps to all of the ratepayers in Kansas, even those of companies who are non-nuclear because they would have some tangible benefits from living in a nuclear-generating-power-plant-free state) in return for an agreement to cancel. The costs would be less than those of the WPPSS cancellations which were passed to ratepayers, and about the same as those of the TVA cancellation.

Those opposed to this thesis would most certainly argue, correctly, that this penalizes those companies that are well-run, whose managers use better judgment. That's true, but one doesn't always have the choice between good and bad--there are times when the lesser evil is the only choice available. This appears to be one of them. If the only way to keep Wolf Creek from coming on line is to accept that some of the costs will be passed along to Kansas ratepayers rather than borne entirely by the investors (who should actually be the ones to accept the risk), I would opt for the bailout.

A similar situation is being faced in Missouri. An article in the Kansas City Times, October 30, 1981, titled "Economy Strikes at Nuclear Power Industry" by Mitchel Benson, pre-

If the only way to keep Wolf Creek from coming on line is to accept that some of the costs will be passed along to Kansas ratepayers rather than borne entirely by the investors (who should actually be the ones to accept the risk), I would opt for the bailout.

sents the issue. "When Union Electric (Missouri) announced the cancellation of its 1,150 megawatt nuclear reactor, company officials also said they intended to ask the Missouri Public Service Commission for permission to collect an estimated $70 million from their customers. That was the utility's estimate for contract and penalty costs that it said it will suffer because of the cancellation. But representatives of the Missouri Public Interest Research Group, armed with copies of a proposition approved in 1976 in a statewide vote, hope to prove that the cost of cancelling a nuclear power plant in Missouri belongs in the debit columns of a utility's investors, not its customers. The initiative proposition, passed by a 2-1 margin, prohibits utilities from including in their rates the costs of new generating plants until the plants are in operation. St. Louis attorney Tom Ryan, Co-director of the research group, said that without proposition one, 'there is no incentive for Union Electric to make hard-nosed decisions because they could easily reach into the back pockets of consumers. Definitely we plan to protest. The risk of a nuclear plant should be on the investors, not the consumers.' Union Electric Chairman Charles J. Dougherty views things differently. The $70 million 'is a legitimate cost of doing business,' he said."

CONCLUSION

A Land Report article recommending the bailout of a utility for building a nuclear plant? You bet. It isn't a universally accepted position, and I've faced some formidable oppoisition from friends I respect, but nevertheless I prefer an economic bailout of foolish nuclear utilities, repugnant as that alternative is, to having a plant go on line. I fear that Kansas Legal Services and other groups for whom I have the greatest respect would adopt a position similar to the Missouri protest group, opposing any kind of settlement that would put the greater burden on the ratepayer, even if the alternative would appear to be having Wolf Creek become operational. I also believe that working hand-in-hand with pro-nuclear advocates to develop better safety and regulatory standards for the construction and operation of nuclear power plants doesn't constitute a cop-out. If we have to have them, let's at least make them as safe as humanly possible. I'm in Mr. Gilinsky's corner on that issue.

In a brief visit with Amory and Hunter Lovins May 30 at The Land Institute's Prairie Festival, I asked them this article's opening question, "What would happen if a major utility went bankrupt?" The question seemed to interest them, though it was obvious they had heard it before. They felt that not enough research has been done on this, or if it has been, it wasn't sufficiently publicized. Their conclusion was that while one could do an endless amount of speculation about numerous possibilities, "The bottom line, probably, is: Nobody knows!" At least that beats, "I have it in my briefcase."

Solar Ponds

Barry Moir and Stu Slote

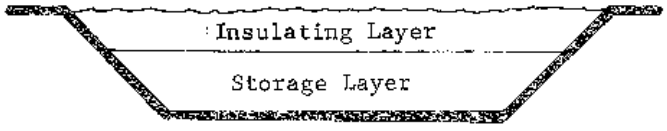
If solar energy is to reduce our use of conventional fuels, it will have to be adaptable to meet the large demands of communities, municipal facilities, and industries. However, large scale solar systems often fail to meet important criteria of appropriate technology:

-low in capital and operating costs,
-able to be widely used and on a small scale,
-flexible to meet a variety of energy needs,
-creates jobs, employs local skill and labor,
-uses local materials whenever possible,
-understandable to beneficiaries and non-beneficiaries and suggests further innovations,
-minimizes pollution and adverse environmental impacts.

The solar pond, a body of water designed to collect and store solar energy, can meet the criteria above. The solar pond looks like a swimming pool but there the similarity ends. The typical swimming pool captures a significant amount of solar energy during the day. However, as heated water rises to the top via natural convection, most of the energy is lost to the air. The solar pond greatly reduces this heat loss with a layer of insulation near the top slightly below the pond's surface. Most of the sunlight goes through this transparent insulation layer and strokes the pond bottom, which is covered with a black liner (usually heavy plastic). The heat is transferred to and stored in the fluid in the lower depths of the pond. This hot fluid is used to meet energy needs through a network of insulated pipes and heat exchangers.

The amount of extractable energy and its working temperature are dependent on several design parameters. The pond edges and bottom should be insulated and the insulating cover should be highly transparent to maximize solar gain. The pond's depth coincides with the availability of solar energy and user's demands throughout the year.

The performance of the pond is principally determined by the mass of fluid in the storage layer. Typically, this volume is so great that even daily or weekly variations of solar energy



have almost no affect on the pond's overall temperature. In almost all warm summer climates, the lower storage layer can approach boiling temperatures although boiling is not desired.

There are many types of solar ponds built and proposed which differ primarily in how they minimize heat loss through the upper surface to the outside. Inhibiting natural convection usually requires a solid transparent membrane or chemicals as its insulating layer. The most common pond utilizes varying densities of salt water to minimize natural convection. Salt gradient solar ponds rely on a high ratio of salt to water in the lower layers, which progressively decreases in layers approaching the surface. As a result, the more dense (heavier) salt water stays at the bottom and continues to absorb heat. Because salt is expensive, hazardous to the environment in large volumes, and corrosive to most plumbing materials, other designs have been developed. These ponds use fresh water at the bottom which is easily accommodated to most heating systems. Upward heat loss is reduced with lightweight transparent gels (cellulose or silicon) or layers of water separated by transparent membranes.

The hot storage fluid can be used to meet a variety of needs. Space and water heating for residences is an obvious application. The solar pond(s) can also heat many buildings simultaneously via a district heating network. Ponds may supply process heat (100 - 160°F) to industries, commercial businesses, and institutions such as hospitals. In warm sunny climates, solar ponds can be used to generate electricity through a vapor-compression refrigeration cycle. Presently, in colder climates, electricity generation is not cost-effective when compared with photovoltaic cells.[1]

There are a variety of solar ponds, prototype and full-scale, operating around the United States. Space and/or water heating is furnished by ponds in Ohio, New Mexico, Virginia, California, and soon Maine and Massachusetts. In the Salton Sea in California, Southern California Edison is designing a solar pond to generate electricity.[2]

Solar ponds for space heating have been proposed in two locations in Massachusetts. In the city of Northampton (30,000 residents), 395 acres of ponds (1.8% of the total area) would be sufficient to supply the heat needed year round in all but the most remote of the city's homes. Space heat would also be provided for industrial and commercial buildings, and during the summer, spare heat could be used for industrial processes.[3] In Leverett, David Mager is building a 1,000 square foot gel-over-fresh-water pond to heat his old farmhouse and provide hot water.[4]

In David Mager's case, neighbors were upset about the potential pollution of groundwater. Fortunately, David Mager was able to discuss his pond design with neighbors at a town meeting and prospects look brighter for its completion. For the city-sized project, major hurdles to be overcome are the lack of sources of capital with respect to non-conventional energy technologies and the inability of local political structures to effectively deal with today's energy problems.

While a number of technical bugs remain, the solar pond can contribute greatly to a community's well-being. The economic benefits include the reliability of supply and the recirculation of money spent on energy within the local economy. Compared to the use of fossil fuels, solar ponds have a more benign effect on the local and global environment.

References and Notes

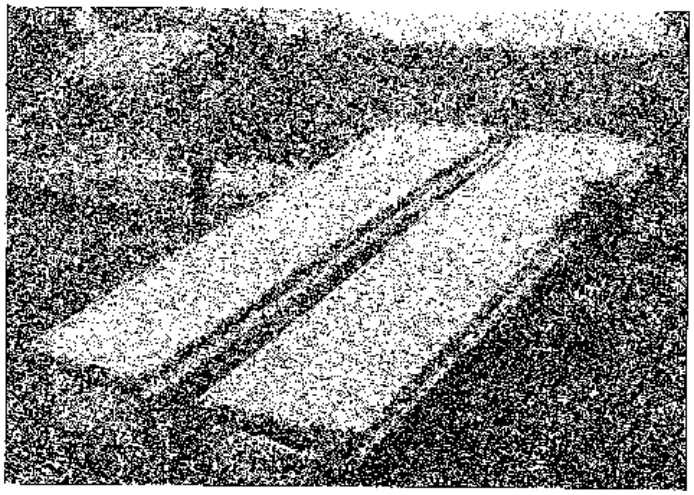
[1]Alan Crass, Professor of Physics & Public Policy, School of Natural Science, Hampshire College, Amherst, Mass., Jan. 1982.

[2]Multer, Robert K., "Solar Pond Energy Systems," Ashrae Journal, Nov. 1980; and letter to Barry Moir, June 1981.

[3]Energy Self-Sufficiency in Northhampton, Mass., Oct. 1979, prepared by Hampshire College, Amherst, Mass.

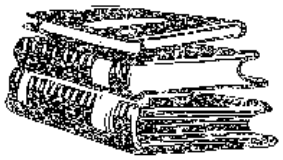
[4]From conversation with David Mager, Leverett, Mass., Jan. 1982.

Solar Devices in Use



Solar Food Dryer with apples in it.

Dana, Walter, Solar Growing Frame with seedlings.



Books

How to Grow More Vegetables

By John Jeavons
Ten Speed Press, 1982 $8.45 postpaid
140 pgs., Bibliography, many illustrations

REVIEWED BY *Regina Grabrovac*

The revised and enlarged edition of How to Grow More Vegetables by John Jeavons carefully explains the Biodynamic/French intensive gardening technique. This method of gardening combines biological pest controls, intercropping and organic fertilization in a truly complementary manner; yields per acre can average four to six times that of conventional U.S. agriculture. Its reduced water and labor requirements make it an attractive option for the home gardener.

The technique was originally developed near Paris in the 1890's by Rudolph Steiner who saw that conventionally grown crops were low in nutritional value and in yield. Steiner traced this decline to the use of newly introduced pesticides and synthetic fertilizers which disrupted beneficial microbiological soil balances.

With numerous illustrations, Jeavons explains the preparation of the double-dig, raised bed, which is characteristic of the biodynamic/French method. This soil preparation stimulates microbiological activity and allows the plant roots to easily penetrate the soil in order to receive the available soil nutrients.

Composted material should be used for fertilizer. Jeavons devotes an entire chapter to the description of simple composting methods. Chapters on seed propagation, fertilization, biological insect and pest control, and companion planting fully prepare the beginning gardener for every step; for the intermediate gardener or the energetic beginner, there are numerous charts by which to gain a more complete understanding of companion planting. For example, tansy deters Japanese bettles, striped cucumber bettles, squash bugs and ants.

For best results, Jeavons recommends the use of the biodynamic/French method in its entirety. Curious gardeners may, however, wish to pick up a few tips in order to improve their conventional gardens. The simplicity and artistic layout of a Jeavons garden is worth investigating.

The Bountiful Solar Greenhouse: A Guide to Year-Round Food Production

by Shane Smith
John Muir Publications, 1982, $8.00.
205 pages, numerous tables, charts, illustrations.

REVIEWED BY *Barry Moir*

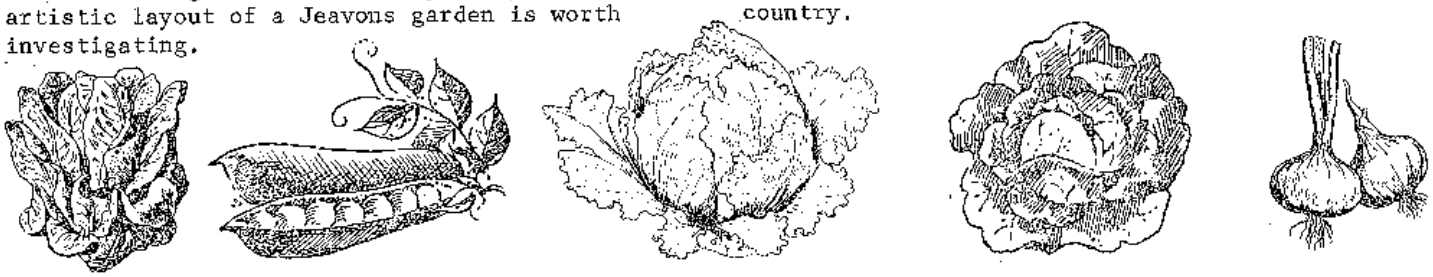
If you anticipate having a food producing solar greenhouse someday, then you should read Shane Smith's book.

Smith explains how to lay out the growing areas so that all plants will receive enough light, water, heat and carbon dioxide. General outlines for planting are followed by specific recommendations for 85 winter and summer vegetables, herbs, flowers and tropical exotics (imagine growing your own figs, coffee or tea!). Detailed procedures for diagnosing and treating diseases and insect outbreaks are explained completely to avoid confusing the symptoms and cures appropriate to the greenhouse environment with the more widely known practices appropriate to the garden. The author mentions chemical "cures" but relegates them to the last ditch role. His overwhelming recommendation is to use the safer integrated pest management techniques to minimize insect and disease losses.

Smith evaluates available seed varieties for the most popular plant species on their performance in the greenhouse. While he does not describe how to grow varieties to produce fertile seeds, he does relate sources of this information and goes on to explain how to propagate cuttings.

The author also covers germination and pollination practices, with special concern for transplanting and maximum fruit production. All the information is related to how the greenhouse can supplement and enhance outdoor gardening. However, Smith is steadfast in upholding the differences involved in growing crops indoors.

Finally, the tables, charts, and appendices included provide a great amount of critical information in a clear form. Following the procedures described in this book in a well designed greenhouse can most surely guarantee bountiful harvests in greenhouses all across the country.



Where the Sky Began: Land of the Tallgrass Prairie

by John Madson
Illustrations by Dycie Madson
Houghton Mifflin Co., 1982
284 pages, appendix & index

REVIEWED BY *Curt Laub*

> "Each stem of prairie grass stands straight, a slender antenna between the flood of solar energy and the deep banks of energy stored within the soil."

This type of description, from the naturalist's viewpoint, is typical of Where the Sky Began, John Madson's look at that part of the American prairie east of the 98th meridian, dominated now by the corn belt, the tallgrass prairie. Intricately woven threads that make up the prairie, from continental ice sheets to microscopic humus producers, are introduced to the reader. Illustrations by Dycie Madson enhance the text.

Where Peter Farb's The Face of North America briefly touches the prairie region, Madson provides a picturesque account of the forces that shaped this rich land--from the warming and drying of early Cretaceous that replaced sequoia forest with hardwood, through the forming of the Rocky Mountains and the resultant rain shadow and temperature extremes that suited grassland better than forest, to the ensuing ageless "silent struggle between trees and grass." As Madson writes, "It has been going on for perhaps 25 million years...and the intrusions of glacial epochs and corn farmers are only interludes of little consequence."

Climate is the overshadowing force shaping the prairie. We see its extremes: blizzards, ("a hissing moan whose sustained timbre hardly wavered, a deep hum that drove through our ice sheltered caps."); thunderstorms ("rolling eastward across the land on flickering legs of fire."); the "atmospheric dynamite" of tornadoes, ("air gone mad,"); and drastic temperature changes.

Madson grew up amongst the bluestem and Indian grass. His is an insider's view, in the second part of the book, of the people of the plains, their character, folklore and vitality. He looks at the tall prairie's influence on newcomers, from the first European explorers to frontiersmen, pioneer farmers, and their descendants, the modern corn growers.

But human impact upon the prairie is also made clear: erosion, plant and animal extinction, and elimination of most of the tallgrass "people pastures, pastures for the human spirit."

The appendix gives a listing of some prairie preserves, most of them quite small, remaining in the twelve states encompassing the original tallgrass prairie.

Save the Wagner Prairie

John Madson dedicated Where the Sky Began to Larry Wagner, a prairie conservationist from the Kansas City area. Nearly 250 people gathered at the Wagner farm near the western edge of metropolitan Kansas City on September 19 to honor John and Dycie Madson. The 300 acre haven of tallgrass prairie, lakes and wooded trails must be sold because of a devastating financial setback to the Wagners, and developers are ready to snap it up. A special task force has begun raising money to preserve it for community and school use. To help, send contributions to the Grassland Heritage Foundation, 4101 West 54th Terrace, Shawnee Mission, Kansas 66205.

Coming Home from Topeka

Julie Coates

If all you ever saw of earth was prairie,
you would swear the world was made of
grass and rock:

undulating grassland
stretching beyond imagination
buttoned-down here and there
with cottonwood and cedar scrub
edgepoints laced forever in place
by twining creeks
holding anchor on the earth
against the ceaseless wind.

Diet for a Small Planet

by Francis Moore Lappe'
(10th Anniversary Edition - COMPLETELY REVISED)
Ballentine Books, 1982, $3.50
390 pages, 10 appendices

REVIEWED BY *Margo Thompson*

Why are people throughout the world hungry and malnourished during a time of such abundant agricultural production? Why are increasing numbers of American farmers going out of business each day when there are hungry people to feed? If neither farmers nor those in need benefit, who does? What can one do to help redistribute the power within our food system and thus achieve a more equitable distribution of goods?

Frances Moore Lappe' addresses these questions and more in her information-packed, 10th anniversary edition of Diet for a Small Planet. With rigorous documentation and clarity, Ms. Lappe' has synthesized numerous astounding facts to illustrate the actual motivating forces at every level of our food system. From international food production and export policy to protein availability in one's personal diet, the links between power, wealth, and myth become crystal clear. When we realize that two-thirds of our agricultural exports go towards feeding livestock rather than people, we can begin to understand why increased production and food aid do not begin to alleviate hunger in third world countries. When we see that every country in the world has the capacity to produce sufficient food for its people, and that intensive production-oriented American agriculture is destroying its own resource base, we begin to question the U.S. "food for export policy." After learning that Cargill, the largest grain trader in the U.S., is also the largest cattle feeder, second in overall animal feed production, fourth in poultry operations, and owns the second largest meat packing firm in the country (Missouri Beef Packers), the basis for the explosion in animal production and consumption since World War II becomes apparent. Such concentration and integration is rampant in the food industry and has resulted in food choices grounded in profit and power rather than sustainability and need.

However, Ms. Lappe's intention is not to generate hopeless frustration in the face of the international corporate and political stranglehold; nor does she induce immobilizing guilt which would cause us to slink away to live in isolation as closet meat eaters. Rather, hers is a message of encouragement to take the power available to us to make responsible choices in our personal lives. Through awareness and action with respect to our personal diet, we can achieve an understanding and ability to act on a larger scale. Diet for a Small Planet cuts through the mystifying web of myth that surrounds every level of our international food system and provides us with the clarity and hope--not to mention the delicious recipes for a healthy diet--necessary to achieve a truly democratic and sustainable future.

Extinction: The Causes and Consequences of the Disappearance of Species

by Paul and Anne Ehrlich
Random House, New York, 1981
250 pages, appendix, notes, index

REVIEWED BY *Nora Kelleher*

Anne and Paul Ehrlich's goal in Extinction is to emphasize the seriousness of problems associated with the extinction of living species. They outline many reasons, beginning with compassion, aesthetics, fascination and ethics, why it is we should care about the loss of plant and animal species. David Ehrenfeld's "Noah Principle" is given as the first ethical argument for the preservation of non-human species: "because they exist, and because this existence is itself but the present expression of a continuing historical process of immense antiquity and majesty. Long-standing existence in nature is deemed to carry with it the unimpeachable right to continued existence." The authors also describe homocentric arguments for the preservation of species, such as their potential usefulness. A plant on its way to extinction may be holding a key to a food, fuel, or health problem. Indirect benefits through life-support systems are also explained. This is an extension of the understanding that all life is interrelated. One misplaced puzzle piece will have a great impact on the overall configuration.

Extinction describes how species are endangered by humanity through urbanization, agriculture, and the momentum of industrial society. In this section, as throughout the book, the authors absorb the reader with fascinating illustrations of specific plants and animals endangered or destroyed.

In discussing what can be done to slow down biological depletion, the Ehrlichs review environmental laws and their potential as legal tools, such as The National Environmental Policy Act and the Endangered Species Act, and they describe the efforts in zoos and preserves to save organic diversity. But in the last chapter, they emphasize the critical preservation technique, which is the transformation of society: "...It is the everyday activities of human beings that most threaten other organisms--the ways that people treat natural systems in the process of obtaining food, clothing, shelter and other amenities." Only by developing a sustainable society, "one dedicated to living within environmental constraints rather than perpetually growing with the hopeless goal of conquering nature," can we decrease the number of biological extinctions.

Friends and FOE

Dana Jackson

On my first visit to the Friends of the Earth office at the old Spear Street address in San Francisco, I was very impressed with the staff. Serious young people in jeans and running shoes worked behind stacks of books, papers and old typewriters, in cubicled offices papered with environmental posters. In spite of low salaries and relatively little recognition, these intense, intelligent people were obviously committed to working on environmental issues and loyal to FOE.

FOE was started in 1969 by David Brower, the fabled hero of John McPhee's book called Encounter with the Archdruid, who turned 70 this year. Due to David's special leadership and his ability to inspire co-workers, FOE is now a two million dollar a year operation with 32,000 members. FOE is small compared to the 340,000 members of Sierra Club and the 470,000 members of Audubon, but it exerts influence beyond what its size might suggest.

Although Wes and I joined FOE when we lived in California, we gained a real appreciation for the organization when it published Amory Lovins' Foreign Affairs article, "The Road Not Taken," in a special edition. Amory's early books were also published by FOE, and when he first visited The Land in October 1978, he was the British representative for FOE. Now as then, FOE always seems to take the lead in bringing the new and vital issues to the attention of the environmental community.

Not Man Apart, the monthly FOE publication, is a low-cost tabloid loaded with information about environmental issues. The section called "Nuclear Blowdown" is read by everyone who keeps up on nuclear power issues, including the professionals within the nuclear power industry. Not Man Apart covers a wide spectrum of issues, including agricultural-related problems such as pesticide use and soil loss. Not only does it give the reader an update on most of the important issues, it frequently carries longer articles thoroughly examining special problems. It is one of the most popular environmental publications that we get at The Land, and we subscribe to many.

Many Friends of The Land probably belong to national environmental organizations such as Sierra Club, FOE, Audubon Society, Natural Resource Defense Council, Solar Lobby, etc. However, if anyone reading this is not now a member receiving publications and action alerts on environmental issues, we urge you to join Friends of the Earth. Even if you already belong to another organization, join FOE, too. The Land certainly supports the good work done by all the environmental organizations trying to protect the earth, but we do have a special association with Friends of the Earth. David Brower, now Chairman of the Board of FOE, spoke at our first Prairie Festival and is a member of The Land's honorary Board of Directors. Amory Lovins, now Vice President of the FOE Foundation, and Alan Gussow, President of FOE Foundation, have also been Prairie Festival speakers and are now honorary board members. A former student, Pat Dreese, is president of Kansas Friends of the Earth. Besides these associations, Wes's book New Roots for Agriculture was published by Friends of the Earth, and Wes now serves on the FOE National Board of Directors.

A membership in FOE is $25 (regular), $100 (sponsor) or $12 (student/low income) and includes a subscription to NOT MAN APART.

FRIENDS OF THE EARTH
1045 Sansome Street
San Francisco, California 94111

Friends of The Land

The Friends of The Land have been extremely important. Many helped collect materials to build the first classroom/office/shop; many donated their time and labor to begin reconstruction after the building burned in October 1976. Friends donated books and money to help develop another library and began contributing to the general support of The Land through yearly gifts. The Land needs these friends, and new friends too.

The Land Institute is a private, educational-research organization. In recent years, several private foundations have awarded grants for special programs. These would not have been made if The Land had not shown a record of broad-based support from individuals who make annual contributions. Continued financial support from Friends of The Land is vital.

Contributors receive THE LAND REPORT and other occasional publications, plus notices of events sponsored by The Land Institute. The Land Institute is a non-profit organization, and all gifts are tax deductible.

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On the Front Cover

The light air about me told me that the world ended here: only the ground and sun and sky were left, and if one went a little farther there would be only sun and sky, and one would float off into them, like the tawny hawks which sailed over our heads making slow shadows on the grass.

from My Antonia by Willa Cather

Terry Evans' photograph in dazzling color was the theme poster for the conference, "PEACE: the Kansas Dream," which The Land Institute co-sponsored on October 15-16. It is available with either the conference title or the Willa Cather quotation printed on it. The 14" X 20" poster sells for $7, and profits go to the Center for Peace Concerns. Buy it at The Land or the Center for Peace Concerns, 617A United Building, Salina, Kansas (Phone: 827-4517). (No mail orders, please.)

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