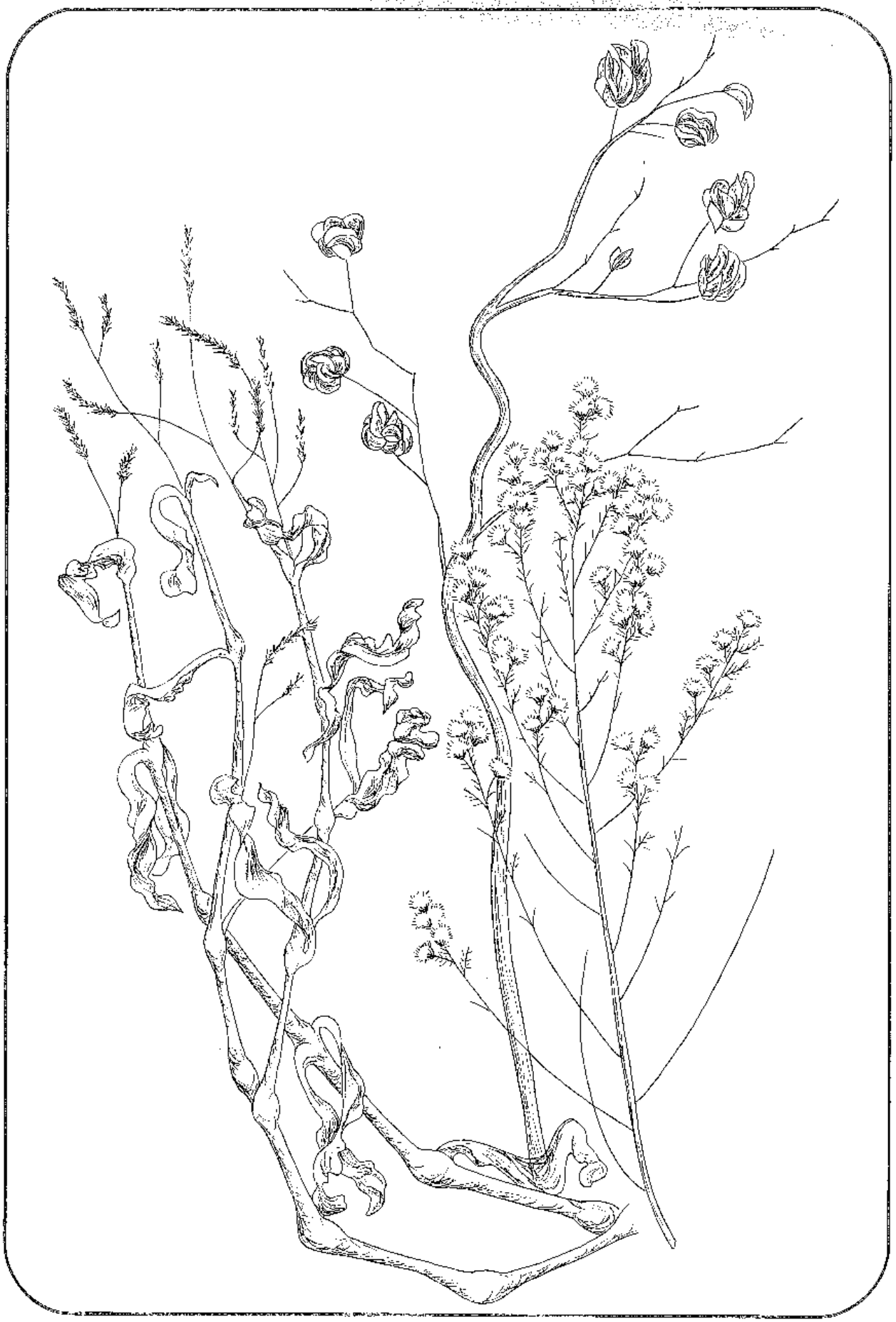
THE LAND REPORT



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Contents

Fall 1985

PHOTOGRAPHS in this issue by Dana Jackson, Michel Cavigelli and Danielle Carre' with special help from Terry Evans. Bicyclists on page 2 photographed by Scott Williams of The Salina Journal.

On the Cover

Iralee Barnard, a Friend of The Land from Dickinson County, Kansas, sketched these prairie plants (smartweed, Illinois bundleflower and aster) as they appear in late fall and winter. Iralee has also produced a note card collection of prairie wildflower sketches containing two different designs for each of three seasons: spring, summer and fall. She sells packages of eight, each for $2.50 plus $1.00 for postage (for any number of packages). Her address is Rt. 2, Hope, Kansas 67451.

At The Land

The Fall Session

The fall session officially began on September 9. It unofficially began on August 19 when we returned to the 9:00 A.M. to 5:00 P.M. schedule. All summer the interns set their own working hours according to how each functioned in hot weather. But by the middle of August, the earlybirds did not have enough light at 6:00 A.M. to do field work, and we needed to have everyone together to coordinate our work better. August 19 was a cool day, and Wendell Berry was here to read us two of his new short stories, so we made the schedule change fairly easily.

After an unforgettable sendoff party organized by the interns, our research associate in ecology for the past year, Judy Soule, and her family moved their household back to Lansing, Michigan, the last week of August. Our new research associate in ecology, John Piper, and his family arrived the same week, so The Land people had the experience of carrying furniture onto, and off, moving vans in a few days' time. Judy has remained on the staff to finish the term with the 1985 interns by returning from Michigan for several two-week blocks of time to teach, help with field work and collect data. Judy will also edit the 1985 Land Report Research Supplement.

In addition to Jon Piper, two other new staff persons joined our circle for warm-up on

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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.

BOARD OF DIRECTORS: Orville Bidwell, Karen Black, Richard Courter, Terry Evans, Bernd Foerster, Dana Jackson, Wes Jackson, Ivy Marsh, Gordon Maxwell, Jim Mayo, Dwight Platt, John Simpson.

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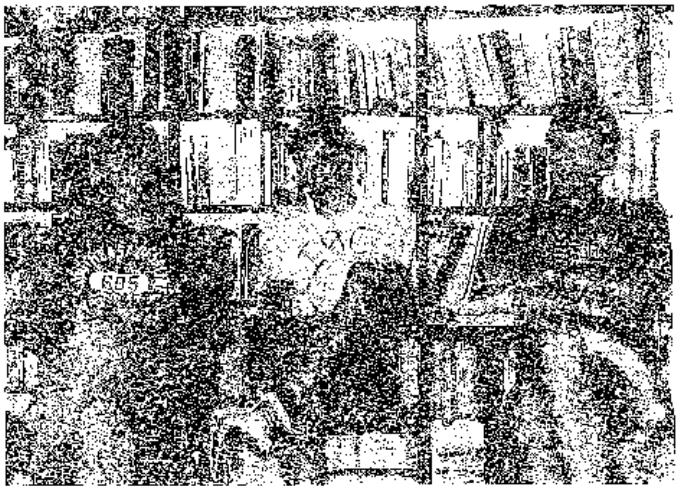
Wendell Berry reads a short story during warm-up on August 19, 1985.



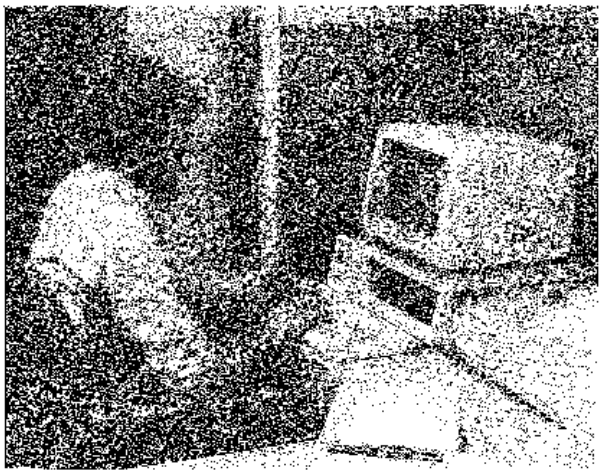
Sara Jackson, Vern Stiefel and John Richards-Laatsch enjoy Wendell's short story.

Sept. 9: Rob Fischer, operations manager, and James Henson, post doctorate in plant breeding. We also made room for members of the Board of Directors of the Kerr Center for Sustainable Agriculture who were holding a meeting at The Land Institute: Bob and Kay Adair, Robert Adair, and Jim Horne.

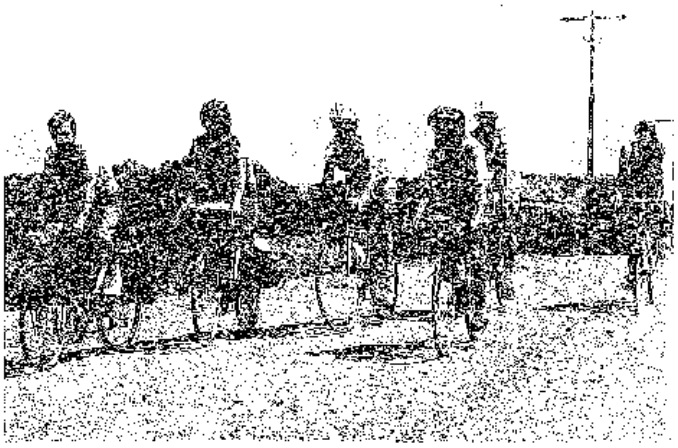
"Warm-up" at The Land is a 45-60 minute opening session during which we practice the art of conversation. The discussions usually begin by someone describing an article or a public radio program related to agricultural, environmental or peace and justice issues. During this warm-up period, we also divide up the work for the day and make announcements.

Following a short break after warm-up, we discuss assignments. Some of the class sessions Judy conducted this fall covered North American Grasslands, the role of fire and grazing on the prairie, and insects. Dana Jackson led discussions of several books and papers, including Economics, Ecology and Ethics by Herman Daly, The Arrogance of Humanism by David Ehrenfeld, and Should Trees Have Standing: Toward Legal Rights for Natural Objects. During the 43 week Land term, approximately two-thirds of the curriculum relates to ecology and genetics, and one third to Considerations for a Sustainable Society.

Several visitors contributed to our warm-ups and class sessions this fall. Peggy Haas from the Rodale Research Institute showed slides and described her work on perennial seed-producers. Bill McAlpin of the Rockefeller Brothers Fund told us about the changes in agricultural practices he has observed in China. Carol Costen, a founder of Network, a Catholic social justice lobby in Washington D.C., spent two days with us. We were very interested in her new projects involving worker-owned business cooperatives. Urs Reuggli from Switzerland told us about the training he had received in biodynamic



Jon Piper enters research data in the new computer. Rob Fischer remodeled the area between the greenhouse and lab (originally the shop) and built a special table for the computer, as well as a desk for James Henson and bookcases for the biology and agriculture books.



Bikes- standard transportion to The Land for Vern Stiefel, Steve Ela, Carol LaLiberte, Dana Price, Lois Braun and Juli Kois. (l. to r.)

Mary Bruns listens with interest as Charles Bradley makes a strong point.

farming. Charles Bradley showed us slides of the Leopold Memorial Reserve near Baraboo, Wisconsin, and told us about the Leopold Fellowship program. Lee Holmes and Dick Law talked about a program in Agriculture and the Liberal Arts which they are organizing at Washington State University in Pullman. Ron Kroese told us about the work of the Land Stewardship Project in Minnesota. Terry Evans showed her prairie photographs and talked about art.

Most of the afternoon work for the interns related to research this fall. Garden work tapered off after our first killing frost the last day of September. We did enjoy lettuce, and chard until their demise in the third week of November when the temperatures stayed in the 20's for several days. A straw mulch protected the leeks, and we could still dig parsnips. Regular maintenance work, such as changing the barrel in the compost toilet, was still needed, but there were no big construction jobs to involve the interns, except for helping Rob hang the large doors for the new barn.

The research work involved harvesting seeds from the experiments, then drying, threshing and cleaning them. By the middle of November, students and staff were entering data in the computer for analysis and writing papers about their experiments. They presented the results of the 1985 experiments to the Research Advisory Group (biology and agronomy professors from several Kansas universities) at Kansas State University on December 9.

The fall term ended on December 20 with the traditional potluck Christmas party. This happy, sad occasion meant the break-up of a good team. After 43 weeks together in warm-ups, class discussions, and side-by-side field work, the interns and staff knew each other well. They could acknowledge common values, yet respect individual differences, and cooperate to get the work done. But the term was over. The interns had to move on to other schools and jobs, and the staff had to go through the applications and choose a new group of interns for 1986.

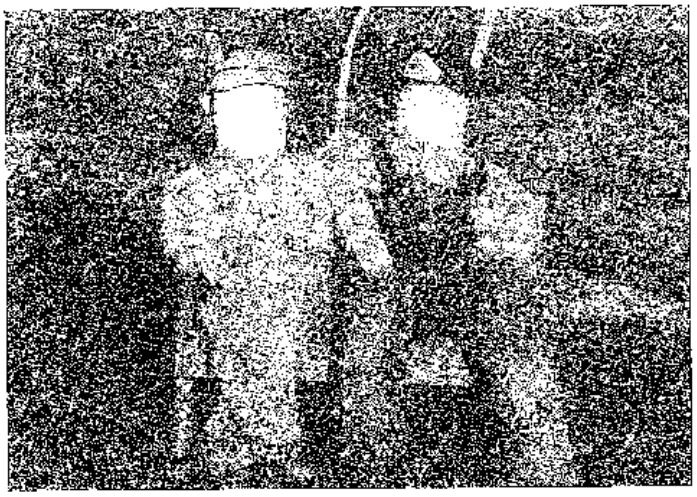
Juli Kois and Michel Cavigelli darn their socks during warm-up.

Attention Alumni!

For our 10th anniversary celebration in the fall of 1986, we would like to compile a directory of former Land Institute students, including information about jobs, marriage, children, travel, plans for the future, and current addresses. Please send the information to Dana Jackson by July 1, 1986.

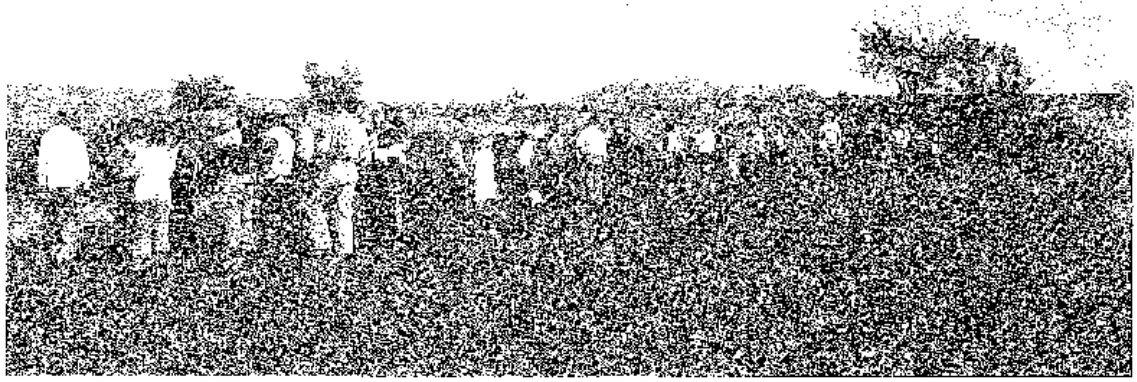
Uncertain Harvest

A television crew from KUVD, Salt Lake City, Utah, spent several days at The Land in the fall of 1982 videotaping students and staff, in particular Wes Jackson. This became a part of "Uncertain Harvest," a program which questions the validity of production-oriented American agriculture. It contrasts Land Institute values and research goals with those of the Epcot Center in Florida's Disneyworld. The program was offered nationally by PBS on October 1, but shown by individual stations on dates of their choosing. Many presented it in October or November, but some may still be holding it for later showing. Check with your local public television station if you have not seen this program.



Juli Kois made straw Halloween spirits to watch over The Land during the Jacksons' absence.

Visitors see research plots on tour.



Visitors' Day

Each October, The Land Institute schedules a special day for visitors. Approximately one hundred persons attended the 1985 Visitors' Day on October 13.

Some visitors brought their lunch and came early enough to see the videotape of "Uncertain Harvest" shown at 12:30 P.M. The program began at 1:30, with introductions of interns and staff. Then there were tours of the buildings and grounds, including some of the research plots across the road. After refreshments in the west porch of the classroom building, we moved back into the new barn for the last part of the program, a talk by Wes Jackson called "What Would be a Sustainable Society."

In 1986, we plan a more elaborate Visitors' Day program as we celebrate the tenth anniversary of the founding of The Land Institute.

Prairie Festival 1986

"SOIL AND SEEDS: THE SOURCES OF CULTURE" will be the theme for the 8th annual Prairie Festival on May 31-June 1 at The Land Institute. The program will include a variety of presentations, workshops and discussions related to the theme, plus many activities to "celebrate the prairie ecosystem and prairie folk."

Gary Nabhan and Karen Reichardt of Native Seed Search in Tucson, Arizona, and Orville Bidwell, soil scientist and Emeritus Professor at Kansas State Univ. have agreed to be on the program. Invitations will be sent in April.

Prairie Treasure is Acquired

The Land Institute recently acquired a fifty year lease and purchase option on 8.3 acres adjacent to the southwest corner of the 160 acres which we own. The land includes a small prairie which we have judged to be more abundant in prairie wildflowers than any other place in the county. This beautiful area begins about 75 yards north of the road across from The Land Institute driveway. Dana Price and Vern Steifel marked a special trail through this prairie last May for Prairie Festival participants to follow and see the wildflowers.

The 8.3 acres also includes a strip of land north of the road which extends to the Smoky Hill River.

Jim Mayo is New Board Member

Dr. James Mayo, a professor in the Biology Department at Emporia State University, is a new member of The Land Institute Board of Directors. He fills the position held by Steve Burr for nine years.

Jim became interested in The Land's research in 1982 when he helped us examine the nitrogen-fixing capability of Eastern Gamagrass and other prairie grasses. He is a member of our Research Advisory Group.

The Board of Directors of The Land Institute is composed of twelve members, elected for three year terms. The board generally meets three times a year, in March, June, and November.

Illinois Bundleflower: A Perennial Food or Feed Crop?

Mary Bruns

In the complex community of the prairie, Illinois bundleflower once grew among the bluestems and switchgrass along with many other prairie forbs. Today most native prairie has been destroyed, but we still find Illinois bundleflower (Desmanthus illinoensis) on roadsides, field edges, and in uncultivated fields and railroad rights-of-way. This perennial legume, which seems to tolerate a wide range of temperatures and moisture levels, is sparsely distributed as far north as Minnesota and South Dakota, as far west as New Mexico and Colorado, and to the south from Texas through Florida.[1]

Illinois bundleflower, which bears seed in tight, round "bundles" of curved pods, is one of the most intriguing plants being studied at The Land Institute. It produces high yields of high-protein seed and is favored for grazing by cattle and deer. Laboratory studies indicate that the plant may also be allelopathic, that is, endowed with chemical components which discourage the growth of other plants near it.[2] With our goal to develop herbaceous perennial polycultures, we are especially interested in plants that will help maintain and even improve soil fertility over time. Illinois bundleflower fixes atmospheric nitrogen via Rhizobium bacteria in its root nodules,[3] and thus has the potential to play the role of "soil-enricher" in a perennial polyculture.

Planted by former research associate Marty Bender in 1978 in the Land Institute Herbary, Illinois bundleflower appeared to be a vigorous plant with good seed yield. It looked so promising that Marty collected seed for further study from sites in Kansas, Colorado, Nebraska, New Mexico, Ohio, Tennessee, and Arkansas. In 1982 Marty planted seeds from each collection site (termed "accessions") to produce parent plants from which Land Institute researchers could obtain more seed.

Last year former intern Martin Gursky sowed seeds from each accession in a plot that will provide seed and data for the next five years. The plot contains thirty different accessions, including a variety of Illinois bundleflower called "Sabine," obtained through the USDA Soil Conservation Service Plant Materials Center in Manhattan, Kansas. Sabine is a native Texas variety which was released for distribution as a perennial "wildlife and range improvement plant" by the USDA SCS Plant Materials Center in Knox City, Texas.[4] Interns will evaluate the accessions for yield, vigor, resistance to disease, flowering period, harvestability, and growth habit to identify the ones that appear to be most fit for a perennial polyculture.

Last fall Martin determined first-year yields from each of the thirty accessions by taking the seed harvest of five consecutive plants within each sample row. When these yields were extrapolated to pounds-per-acre figures, the average yield was 1200 lbs/acre. The highest-yielding accession, which came from New Mexico, gave an extrapolated figure of 3040 lbs/acre.[5] Sabine ranked third with 2124 lbs/acre. When we compare these figures with yields obtained with an annual crop like the soybean, we see much potential in developing perennials like Illinois bundleflower for seed production. (The Kansas Board of Agriculture reported soybean yield for Saline County's district in 1984 to be 18.5 bushels or 1100 lbs/acre.) Yields of Illinois bundleflower are especially promising when one considers that they came from wild accessions that have not undergone any selection.

This spring I assumed responsibility for the Illinois bundleflower plot, now in its second year. My work consisted of selecting and marking individual plants from each accession for seed collection. Near year's interns will plant the collected seed for further observation in an on-going process called "recurrent selection" to identify the best yielding and most vigorous accessions and individuals. I am also obtaining second-year yield data from the same plants Martin harvested last year. Will second-year yields be as high as last year's? Will this year's top yielders be the same or different from last year's top yielders? What will be the average productivity of the accessions over a five-year period? The answers to these questions will provide insights into the potential yields that can be obtained with perennials.

My work with Illinois bundleflower has also involved obtaining more information on its seed and its potential as a food for humans and livestock. In February our interest in Illinois bundleflower heightened when we received results on the seed's nutritional composition (proximate

analysis) from Dr. Lynn Bates at LSB Products, Manhattan, Kansas. Illinois bundleflower, on a dry basis, contains 38% protein, 34% carbohydrate, and less than 1% fats or oils (averaged figures from Table 1). Its protein content compares favorably to that of the soybean, which is 40% on a dry basis.[6]

Based on protein content, Illinois bundleflower looks like a good candidate for a food or feed crop. But what else should we know about Illinois bundleflower seed in order to evaluate its potential as a food or feed? What should we know about any new or alternative food source before it is used in the diet of humans or other animals? To help answer these questions, I enlisted the help of researchers and extension agents at several different universities and USDA offices. Many of the researchers I contacted were not familiar with The Land Institute, but after I explained our research program, they invariably responded with great interest. I believe that their interest reflects concern over soil erosion and a recognition that perennial crops have the potential to reduce erosion.

The first step in evaluating any new food source is to check for the presence of toxic compounds. Information on the safety of Illinois bundleflower foliage was already available in the 1983 Knox City Plant Materials Center report on Sabine.[7] The report, which indicated that Illinois bundleflower is grazed by livestock and highly sought by deer, cited studies by Dr. M. Coburn Williams at the USDA Poisonous Plants Research Laboratory in Logan, Utah. Dr. Williams had tested Sabine Illinois bundleflower plant clippings for such poisonous substances as oxalates, cyanides, nitrates and alkaloids. He reported that the plant clippings did not contain the toxic compounds at levels that would be hazardous to livestock, birds or humans. Dr. Williams also reported that plant clippings were nontoxic when fed to chicks. Safety of the foliage, however, does not rule out the possibility that the seed could be toxic. Obviously, we must find out whether poisonous compounds exist in the seed before we can begin to judge it as an acceptable food or feed.

This year The Land Institute sent bulked Illinois bundleflower seed to the USDA Poisonous Plants Research Laboratory for toxicity testing and chick feeding trials. Dr. Williams reported that Illinois bundleflower contained no toxic levels of the poisonous compounds mentioned above. In the feeding trials, chicks showed no signs of toxicity and thrived when fed ground Illinois bundleflower seed for ten days at 1% of their body weights. (Chicks had as much chick mash and water as they wanted during the study.)

These favorable laboratory tests indicate that both seed and foliage are nonpoisonous. Considering its nutritious qualities, one would think that the seed would at least be a good food for wild game. This does not seem to be the case. Leroy Korschgen, a researcher recently retired from the University of Missouri Department of Conservation, rarely found Illinois bundleflower seed in the digestive tracts of wild game birds in the food habit studies he conducted for over thirty-five years.[8] While this might have been due to low availability of seed, food preferences of the birds could have also played a role. Food preferences of bobwhite quail in captivity were studied in 1963 by the Department of Forestry and Conservation at Purdue University. These studies showed that the bobwhite quail would not eat Illinois bundleflower seed even if it were the only food offered to them.[9] This report concluded that there was some undesirable characteristics about Illinois bundleflower seed that caused the birds to reject it. Other studies at the Kansas State University Division of Biology in 1984 showed that captured mourning doves ate very little Illinois bundleflower seed when it was the only food offered to them.[10] Under the same conditions, however, the doves ate very little buckwheat, so there may have been factors other than safety or palatability that led to the birds' refusal. Although we know that Illinois bundleflower foliage is grazed by wild deer, it looks as if wild game birds do not eat significant amounts of the seed. In pursuing Illinois bundleflower as a potential food or feed for other animals, we should find out why these birds do not choose the seed for food.

TABLE 1. PROXIMATE ANALYSIS OF ILLINOIS BUNDLEFLOWER SEED ON A DRY BASIS*

Nutrient	Accession 415	Accession 391
Crude Protein	38.9%	36.7%
Carbohydrate	33.3%	35.5%
Crude Fat	0.3%	0.8%
Fiber, ADF	22.9%	21.0%
Ash	4.6%	6.0%

* Undried seed contained 11% moisture.

Even though Illinois bundleflower seed contains no hazardous amounts of expected toxic compounds, we would still expect it to contain anti-nutritional factors commonly found in many raw legume seeds. These factors, such as digestive enzyme inhibitors and blood agglutinating compounds, interfere with the digestion and absorption of the nutrients present in the seed. Such factors, however, can be destroyed on heating, which is why beans should be cooked adequately so that their proteins can be more completely digested.[11]

With proper processing, therefore, Illinois bundleflower could be a valuable feed compound for livestock. Its calcium and phosphorous contents are 0.28% and 0.46%, respectively, on a dry basis. Dr. Al Adams, Extension Specialist at Kansas State University, reported that ground

Illinois bundleflower seed has potential to substitute for soybean meal in some poultry rations as long as bundleflower's digestibility can be made to match that of soybean meal. Other KSU Extension Specialists, Dr. Jim Nelson and Dr. Gary Kuhl, are evaluating Illinois bundleflower seed as a feed component in rations for swine and beef and dairy cattle.

The most immediate potential for use of Illinois bundleflower, however, is not with the seed but with the plants, as forage for livestock. The Knox City Plant Materials Center reported that clippings of Sabine Illinois bundleflower over a three-year period in Texas had an average of 10.55% crude protein with 46.8% digestibility. Sabine also compared favorably to alfalfa and clover in a legume growth study in Texas.[12]

As a longer term consideration, what potential does Illinois bundleflower seed have in meeting human nutritional needs? In relation to other legumes, it ranks high in protein. But apart from quantity, the quality of the protein depends on the availability of the essential amino acids provided by the protein to the body. To determine protein quality for the adult human diet, we must first know the protein's relative amounts of the eight essential amino acids and the perecentage of protein that is actually digested by the body.

Dr. Lynn Bates determined the amino acid composition of Illinois bundleflower protein. The essential amino acid pattern of bundleflower is compared to the Food and Agriculture Organization (FAO) reference protein, which represents the amino acid pattern required in adult human nutrition.[13](Table 2) Illinois bundleflower protein is unusual among other vegetable proteins in that it is rich in the sulfur-containing amino acids, methionine and cystine. (Note that the amount of these two amino acids per 100 grams of Illinois bundleflower protein exceeds the amount in the reference protein.) However, Illinois bundleflower is limiting in valine, isoleucine, tryptophan, lysine, and threonine. The amounts of these amino acids range from 60-80% of the amounts found in the reference protein.

How much of these amino acids is actually available to the body? The amounts of amino acids given in Table 2 are present in uncooked seed. Yet the uncooked seed is very likely to contain the antinutritional factors mentioned above, which could prevent some of the protein from being completely digested by the body. The percentage of a protein the body actually digests, or the protein's "digestibility," can be determined in the laboratory.[14]

To test Illinois bundleflower's protein digestibility, I sent cooked and uncooked seed samples to Dr. Lowell Satterlee of the University of Nebraska's Food Protein Research Group. Protein from uncooked seed was 69% digestible, while seed boiled for 30 and 60 minutes was 80% and 83% digestible, respectively. Cooking therefore increased protein digestibility and availability of amino acids. The increase in digestibility on cooking indicates that antinutritional factors could be present in uncooked seed.

Knowing the amino acid composition and digestibility of a protein, we can see how it ranks among other proteins in meeting human nutritional needs by determining its computed Protein Efficiency Ratio (cPER). The cPER is a good estimate of protein quality, or the degree to which the protein is utilized in the human body. It correlates well with the Protein Efficiency Ratio, which has been traditionally determined by expensive and time-consuming rat feeding trials.[15] The cPER's of uncooked and cooked Illinois bundleflower may be compared with those of other food proteins.(Table 3) Illinois bundleflower's cPER increased with cooking primarily because its protein digestibility increases with cooking. After boiling for one hour, Illinois bundleflower's protein quality (cPER of 1.8) is close to that of cooked oats. Further boiling or pressure cooking might improve Illinois bundleflower's protein's cPER even more so that it could approach the cPER of cooked soybeans at 2.3.

We need further studies to get a more

TABLE 2. ESSENTIAL AMINO ACID PATTERN OF ILLINOIS BUNDLEFLOWER SEED PROTEIN COMPARED TO FAO REFERENCE PROTEIN PATTERN

Amino acid	Grams of amino acid per 100 grams protein	
	Ill. bundleflower	FAO Standard*
Lysine	4.6	5.5
Methionine & Cystine	5.4	3.5
Threonine	3.3	4.0
Isoleucine	2.8	4.0
Leucine	6.0	7.0
valine	3.2	5.0
Phenylalanine and Tyrosine	10.5	6.0
Tryptophan	0.8	1.0

* FAO/WHO, 1973.

TABLE 3. COMPUTED PROTEIN EFFICIENCY RATIOS

Protein	cPER[15]
Uncooked Illinois bundleflower	1.4
Illinois bundleflower, boiled 30 minutes	1.6
Illinois bundleflower, boiled 60 minutes	1.8
Hard red winter wheat	1.2
Whole corn	1.2
Oats, cooked	1.8
Soybeans, cooked	2.3
Casein (Milk Protein)	2.5

Mary Bruns spreads sunflower seed to dry.

complete understanding of Illinois bundleflower seed's nutritional quality. The seed should also be tested for vitamin and mineral content, as well as for specific antinutritional factors, like trypsin inhibitors.

Illinois bundleflower seed is flat, oval, and consists of a yellowish germ surrounded by a thin, shiny brown seed coat. Even though the nutritional quality of Illinois bundleflower seed looks promising, we must also consider palatability. Unfortunately Illinois bundleflower seed has a bitter aftertaste. The seed should be tested for the presence of tannins and other chemical compounds that could cause a bitter taste. If the bitter taste is localized in the seed coat, it could be eliminated simply by removing the coat. I have asked Dr. Lloyd Rooney of Texas A&M's Cereal Quality Laboratory to find out if the seed coat could be removed from the germ by "decortication" with a machine.

Before Illinois bundleflower seed becomes a good source of feed or food, we will need to improve the harvestability of the plants. The bloom period for Illinois bundleflower accessions at The Land Institute ranges from four to seven weeks. The earlier flowers form pods that mature, shatter, and lose their seed before the later-formed pods mature. In order to obtain all the seed, we now must hand-harvest mature pods several times during the period of pod maturation, which is impractical on a large scale. In the future, plants may be selected and bred for more synchronous flowering or shatter resistance to obtain the most seed with a single mechanical harvest.

By the end of December, I will have determined the second-year yields from thirty accessions. Conditions this year resulted in the development of much lush foliage, and we are curious to see how the heavy production of vegetative material influenced seed yield.

High seed yield is only one of the positive attributes of these wild, unselected perennials. Nitrogen fixation, high protein content, adaptability, and good forage quality are other characteristics that encourage us to continue exploring the potential for developing Illinois bundleflower as a food or feed crop. Such development will need to address the questions of its unacceptability to wild game, harvestability, aftertaste, and cooking procedures. Most of these problems have also been encountered in the development of annual crops. We recognize that the road to polycultures composed of useful perennial plants is long and hard, but we hope to reach our goal by starting with those potential members of a polyculture community that are as highly gifted in the wild as Illinois bundleflower.

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Research Supplement

Ag interns write reports on the results of experiments they have conducted for publication in THE LAND REPORT RESEARCH SUPPLEMENT, edited by Dr. Judy Soule. The 1985 edition will be available in late March. To receive a copy in the mail, send $1.75 with the coupon below to RESEARCH SUPPLEMENT, The Land Institute, Rt. 3, Salina, KS 67401.

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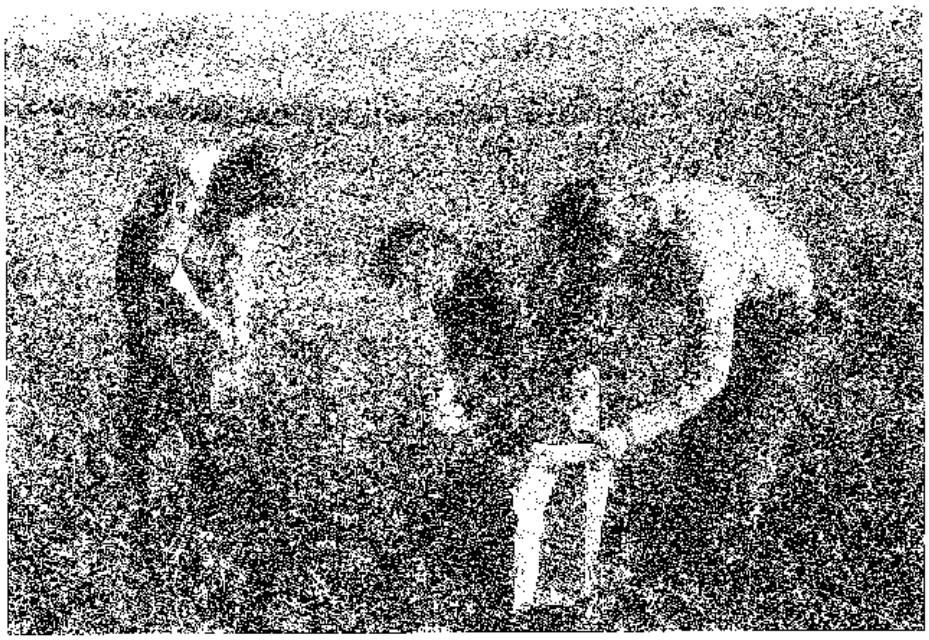
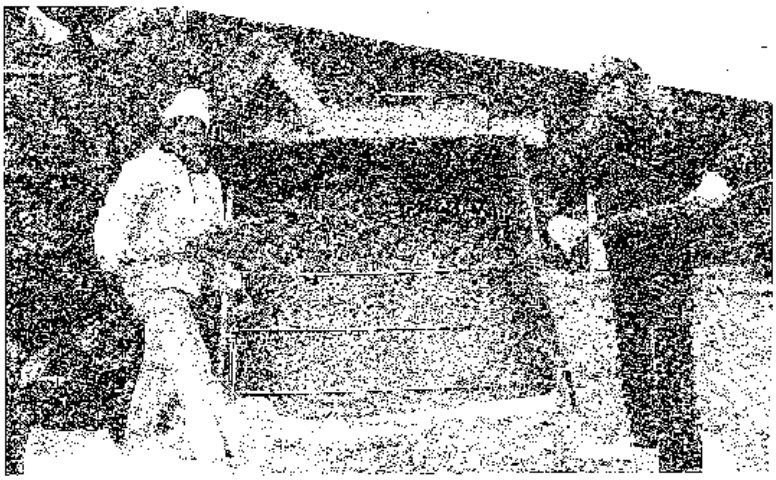
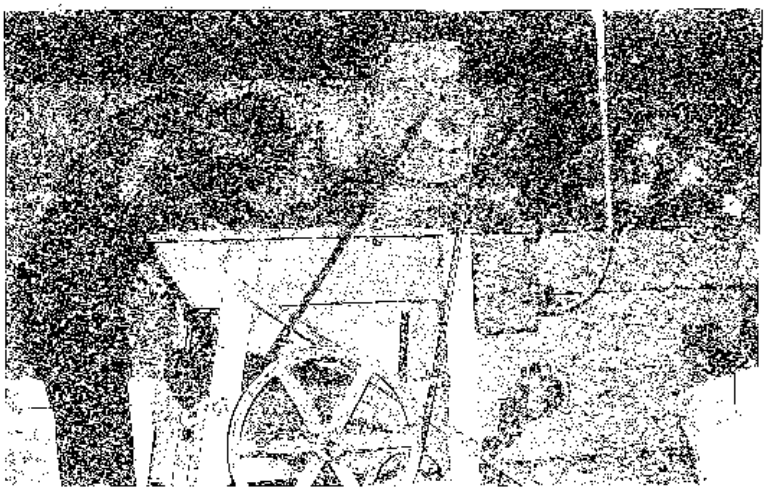
Research Scenes — Fall 1985

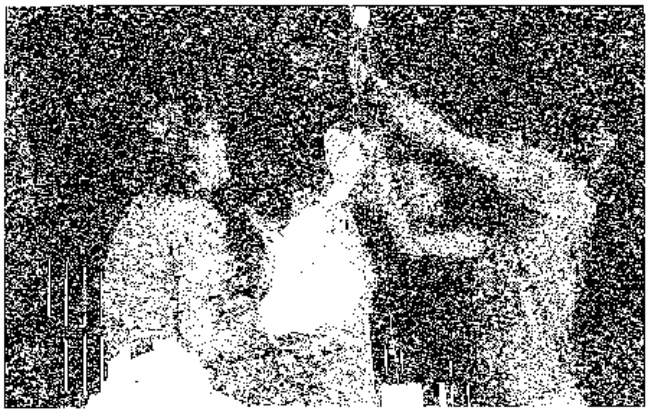


Weeding and watering tasks were over with the end of summer. In the Fall, researchers at The Land focused on getting the data collected, which meant harvesting seed from the experiments, getting it dried, threshed, cleaned and weighed. New equipment helped do it more efficiently this year: two small Clipper cleaners, a second grinder, two food processors for threshing small amounts of seed, two drying ovens and an electronic balance. The new barn served well as a place to dry sacks of seeds.

CLOCKWISE from bottom: Vern Stiefel harvests Maximilian's sunflower; Dana Price and Carol LaLiberte thresh sunflowers in combine; Juli Kois cleans seed in new small Clipper; Jon Piper, Holly Winger and Judy Soule harvest hollyhocks.







CLOCKWISE from top left: Danielle Carre' uses a food processor to thresh small amounts of seed; Rob Fischer and James Henson repair the large seed cleaner; Lois Braun and Steve Ela attach a sack of seed to a metal rod which will be hoisted by pulleys to the top of the barn to dry the seed; a cold November afternoon finds staff and interns happy to be working inside measuring Eastern gamagrass yield and keying out insects collected in the experiments.

CLOCKWISE
from left front:

Jon Piper
Carol LaLiberte
Danielle Carre'
Dana Price
Lois Braun
John Richards-
Laatsch

Successful Farming — Organically

Carol LaLiberte

Chemical-based agriculture began its forty year takeover of farmland in the United States at the end of World War II. John Vogelsberg, a farmer from Marshall County, Kansas, joined the wave of enthusiasm for this new trend in agriculture. Unlike most farmers, it took John only a few years to evaluate his so called "improvements" and to realize that chemical agriculture really brought him more and more costs. So John returned to the farming methods of his father and grandfather--crop rotations, small fields, and no chemical fertilizers or pesticides--and he has worked with variations on the organic theme ever since.

In the early seventies when farmers were convinced that capital-intensive agriculture was profitable and sophisticated and were persuaded to invest in larger equipment, John continued with his time-honored farming methods and smaller equipment. Now with the onslaught of the farm debt crisis, John and his son Joe still farm organically, relatively unaffected by the crisis. All aspects considered, mindful farmers might wonder what style of farming is truly profitable and sophisticated, or if these are even the right measures by which to judge a farming system.

This September, the interns at the Land Institute visited the Vogelsberg family to learn about their farming operation. Their farm is near Home City, Kansas, where the rainfall averages about 36 inches per year. It consists of 300 acres of cropland, 380 acres of pasture and 120 acres of recently purchased land which, for the past four years, Joe has been converting to healthy farmland. When first settled, this acreage supported forty people, but by the 1950's, John, his wife Jean and their six children were the only people left. Now only John, Jean and Joe live there. One daughter, Nancy, with her husband Rick Busch, also farms organically on 160 acres which she rents nearby.

Throughout our visit John, Joe and Nancy continually stressed that soil and water conservation practices are central to their farm system. They are strictly dryland farmers, so they must take advantage of available rainfall. They do this, in part, by planting their crops somewhat later than most farmers, at a time when the seedlings benefit most from the season's rains. In addition, organic farming by itself is a conservation measure. Chemical fertilizers stimulate plants to quick, early growth which results in shallow root systems, and when water becomes scarce the roots dry up. In contrast, the Vogelsbergs' crops are free from overstimulus and able to develop deeper root systems. Managing water retention ultimately leads to maintenance of a healthy soil structure rich with humus, microorganisms, an abundant worm population and proper aeration. Alfalfa, with roots penetrating the earth fifteen to twenty feet, plays an important role in soil structure and composition by fixing nitrogen, contributing to soil aeration and drawing nutrients up from subsurface regions.

The alfalfa, in combination with sensible crop rotations, forms the basis of the Vogelsbergs' farming system. They use a rotation which lasts approximately nine years (see chart), and begins with a series of corn/soybean alternations. An Iowa State study shows that alternating corn and beans in this way actually saves costs, estimating that the cost of producing corn after soybeans versus corn after corn is almost ten percent lower.[1] The Vogelsbergs' corn/soybean rotation starts after a field has been in alfalfa for two years. They plant their corn about eight or nine inches apart, a wider spacing than neighbors use, resulting in bigger ears with similar yields of 100bu/acre. Normally after one year of corn they would plant soybeans, but they found that corn in one field grew better when it was planted the second year after taking a field out of alfalfa. A delayed availability of nutrients from the alfalfa roots might cause this.

After the one or two years of corn, they plant soybeans. The Vogelsbergs took us to see a healthy bean field which was nearly weed free. They spoke of occasionally "walking the fields" to hand weed, but in September when we visited, the canopy was so dense it was nearly impossible to get through the field, despite what was initially generous row spacing. They said that their soybean yields often reach 40 bu/acre, which equal the yields of neighboring farmers. At the end of two complete corn/bean rotations, weeds become more prevalent and soil fertility decreases. Depending on the state of these two factors, they may or may not plant one more year of corn.

Next they plant a field to oats, or sometimes wheat, interseeded with a clover/alfalfa mixture. They use a drill planter, a minimum till method which reduces soil disruption. Oats will bring about 90 bu/acre when planted with the clover and alfalfa, with a hay crop in addition. Off one field they harvested 30 bu/acre of wheat, a hay crop and winter forage. In contrast, conventional farmers will get 56 bu/acre, but they have no hay crop and the soils are left exposed.

At this point the field remains in alfalfa and clover for two years. In the second year they harvest it for seed with a combine set loosely so that some seed remains in the field. In the fall the field is disked and planted to wheat. The following year they harvest the wheat and get a crop of volunteer clover/

alfalfa hay. After one more year of hay the rotation returns to corn.

So, like all other aspects of the Vogelsbergs' farm, the rotation is a flexible one, responding to factors such as soil fertility and marketing needs. In the same manner they deal with insects, disease and weeds. John and Joe were clear to emphasize that they do not intend to eliminate pests; rather, they maintain a tolerable level of pests, in balance with beneficial flora, and fauna. They have insects of all kinds, both desirable and undesirable. Most ears of corn have worms, but then so does the corn of many conventional farmers. Insects often only damage border rows, and the interior of the fields remains undamaged. There are weeds as well, but conventional farmers aren't immune to them either. The inevitable truth is that pest problems will continue whether or not farmers use pesticides. David Pimintel, an entomologist at Cornell University, together with a number of colleages, estimate present crop losses due to pests in the United States at thirty-three percent despite the application of 360 million kilograms (800 million pounds) of pesticides applied to some twenty percent of our crop acreage, including pasture.[2]

Instead of the typical "extermination approach" to insect control, the Vogelsbergs use various cultural techniques. The red clover/alfalfa combination is a way to control alfalfa weevil. The red clover assures them of a hay crop even if the alfalfa is damaged extensively. It is also a benefit because it grows better than alfalfa on poor soil and is, therefore, good for rehabilitating fields which are in transition from conventional to organic methods. The diversity of organisms within their farm ecosystem also helps to control certain pests. For example, there are natural populations of quail and ladybugs which feed on grasshoppers and aphids, respectively. With cooperation from Dr. Ernst Herber, an entomologist at Kansas State University, the Vogelsbergs introduced a weevil which eats the buds of musk thistle, a

VOGELSBERG ROTATION SCHEDULE

YEAR	CROP
1	corn
2	corn (two years of corn is a recent trial)
3	beans
4	corn
5	beans
6	corn (depending on soil fertility and weeds)
7	oats (or wheat) interseeded with clover/alfalfa
8	hay
9	hay

European plant accidentally introduced through imported feed hay. Corn root worm problems are solved by crop rotations, and the Vogelsbergs deal with general weeds and cutworm problems in the corn by a cultivation technique involving a curling machine. Corn is planted in furrows. The cultivator then shovels through the mounds between the rows, pushing soil up against the corn. This severs weeds between rows and smothers weeds within rows. The soil disruption from cultivation controls cheat grass as well as cutworms.

Timing is another critical cultural technique. Different planting times may result in obviously different results, and Joe was quick to back this up with a recent experience. He showed us a field on the new 120 acres where he had rushed the season by planting soybeans on half the field before a rain. Weeds germinated after the rain and he couldn't cultivate them. Adjacent to the weedy field is the area planted after the rain, an area almost weed free. The difference between a few days of planting was amazing. Joe couldn't have provided us with a clearer example of patience as virtue.

There was a marked difference between the well-established organic farm and the 120 acres

Nancy Vogelsberg

John Vogelsberg and Dana Price

which had been farmed chemically until four years ago. Weeds definitely were more of a problem and required more "walking the fields." Last year oats on the 120 acres brought under fifty bu/acre while John's oats brought over ninety bu/acre. They were establishing rotations similar to John's fields and expected yields to increase over time as the soil structure improved and as the seed bank of weeds diminished. I was curious about whether new farmers who didn't have the security of an already established farm could financially carry out a transition to organic methods. In response Joe said that the 120 acres paid for itself by the second year (if he included aid from the Payment in Kind program, the land paid for itself by the first year), and that by the fifth year he expected a good income from the land. Because the Vogelsbergs save all their own seed (except for corn), and because they don't buy chemicals, it is easier for them to make profits than it is for conventional farmers.

The Vogelsbergs' crop system is also integrated with their livestock. They keep around 100 head of cattle and 200 hogs. After corn harvest, livestock glean the leftover cobs from the fields. This simple measure makes use of the entire crop and most importantly serves to spread manure directly on the fields. The cattle are mostly pasture-fed, but both the hogs and cattle are fed corn grown on the farm.

The learning continues, and with each year the Vogelsbergs' farming continues to evolve along the vein of sustainability. Presently they experiment with various combinations of red clover, yellow clover, sweet corn and alfalfa interseeded with wheat, to see how different mixtures might affect the protein content of the wheat. They would also like to include more ground cover in the corn and soybean stubble for overwintering, and are considering the use of red clover, hairy vetch, oats and wheat for this. They continue to add more terraces in their fields for erosion control and would like to get equipment for processing livestock feed from their own soybeans.

The Vogelsbergs are glad to see more universities develop research programs for integrated pest management, crop rotations and other organic methods. I was pleased to learn that more and more neighbors are interested in how the Vogelsbergs farm and are asking for information. The Vogelsbergs cannot, of course, impart their skills for proper farming, skills developed through time and commitment. However, all farmers can experiment with the principles and basic methods which they follow. Joe said he expects to see even more farmers take an interest in organic farming.

The Rodale Research Center in Kutztown, Pennsylvania, does research on the transition stage from conventional to organic methods and offers several recommendations to farmers interested in making their farming system more sustainable:

*evaluate your present farming system and look for ways to reduce dependence on synthetic fertilizers and pesticides.

*Plan changes that will reduce debt load and spread risk associated with uncertain weather and markets.

*While planning the transition to reduced use of synthetic fertilizers and pesticides, keep in mind that conversion will take time as well as fine-tuned management strategies.

*If possible, start the conversion process with small grains and hay crops. Establish the crop rotation before introducing high-value crops.

*Convert a part of your farm, or one field at a time, to gain experience under conditions specific to the farm.[3]

And most importantly, seek the advice of the organic farmers with experience.

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MEETING THE EXPECTATIONS OF THE LAND

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Agriculture Pulls the Plug on the Central Flyway

Vern Stiefel

Within the United States, agricultural and urban expansion are responsible for the drainage of an overwhelming 458,000 acres of wetlands per year.[1] Consequently, populations of shorebirds, waterfowl, and other aquatic life are diminishing. Unless this nation's people and government decide to better manage and conserve what remains of these fragile, highly productive ecosystems, many species dependent upon them may be lost.

The Central Flyway is a major migration corridor comprised of several wetland areas. Lying between the Front Range of the Rocky Mountains and the Mississippi River, it has its source in the Prairie Pothole region of south-central Canada and the Dakotas, and extends southward to the Texas-Louisiana Gulf Coast and northern Mexico. Being one of several migration routes across the face of North America, the remaining wetlands within it provide essential nesting and feeding habitat for waterfowl and shorebirds. Agricultural practices are accountable for virtually all of the wetland destruction and are currently consuming what relatively little remains at a staggering rate.[2]

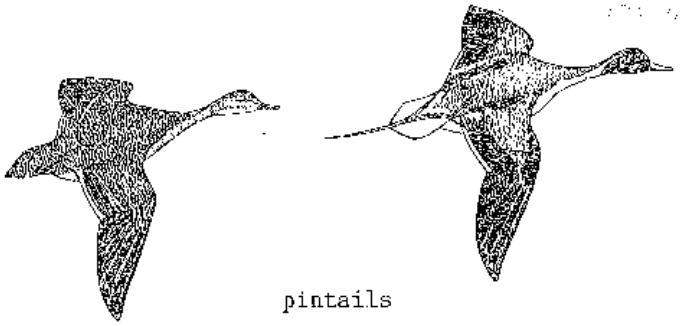
Prairie Pothole country encompasses an area of roughly 300,000 square miles through portions of Alberta, Saskatchewan, and Manitoba in Canada, and Montana, North and South Dakota, Minnesota and Iowa in the United States. Although this area includes only ten percent of North America's wetlands, one-half to two-thirds of North America's duck population breed and nurture their young there. Wildlife biologists have counted up to 185 pairs of game birds alone nesting within a single square mile.[3]

The incredible biological fertility of this wetland complex had its origin some 12,000 years ago, with the ice age epoch coming to a close. As the glaciers melted, millions of lens-like depressions were left behind and subsequently filled with water. In addition to permanent potholes, which endure the dry conditions of summer, ephemeral pools of water serve as breeding and feeding sites for early spring arrivers such as Mallard and Pintail ducks.

Moving south through the corridor into Nebraska, the Rainwater Basin and Platte River are two valuable sources of wetland habitat. Every spring, birding enthusiasts flock to the Platte River between Grand Island and Overton to see one of the most astounding migrational events on the continent. More than 400,000 Lesser Sandhill Cranes use the area to refuel before continuing to their arctic breeding grounds. During this six to eight week period the cranes are busy devouring snails, worms and insect larvae. Additionally, they consume waste corn and overwintering cutworms which benefits farmers. Biologists have concluded that without this nourishment the cranes would probably reproduce with less success later in the spring.[4]

The Rainwater Basin in south-central Nebraska consists of windblown silt deposits forming rolling hills which harbor marshes and shallow lakes. The formation of a hardpan occurred as clay particles were leached and concentrated in a layer six to twelve inches below the ground level. It is the clay hardpan that essentially impedes water from seeping out of the sink-like depressions. Besides providing a suitable environment for 257 species of birds, the wetlands act as a natural means of flood control, recharge groundwater supplies, recycle nutrients, and generate income from recreational activities.[5]

The Cheyenne Bottoms Wildlife Management Area located in central Kansas is one of the most notable wetland areas in the midwestern portion of the Central Flyway. The geologic record shows that the formation of this extensive basin near Great Bend happened about eighty million years ago when a shift in the earth's crust occurred. Since the late 1950's the state wildlife refuge overseers have managed the 19,840 acres comprising Cheyenne Bottoms to control water flow through the basin and promote aquatic plant growth as a food source for ducks and shorebirds.[6] While the total migrant bird population using the area often reaches several million, the Bottoms seem particularly important for shorebirds such as Sandpipers and Phalaropes. Since 1973, people interested in shorebird migration have taken spring population counts at 210 stopover sites and compiled them in the International Shorebird Atlas. The data reveal that 76% of the migrating shorebirds were at either Cheyenne Bottoms or Cape May, New Jersey.[7]



pintails

Since the 1920's, agricultural practices have extensively altered the Central Flyway. Federal and state policies encouraged the draining of wetlands. For instance, the Soil Conservation and Domestic Allotment Act of 1936 made drainage an eligible conservation practice. Thus the Agricultural Conservation Program paid for fifty percent of the cost to drain the land, and the Soil Conservation Service provided the entire cost of technical assistance.[8]

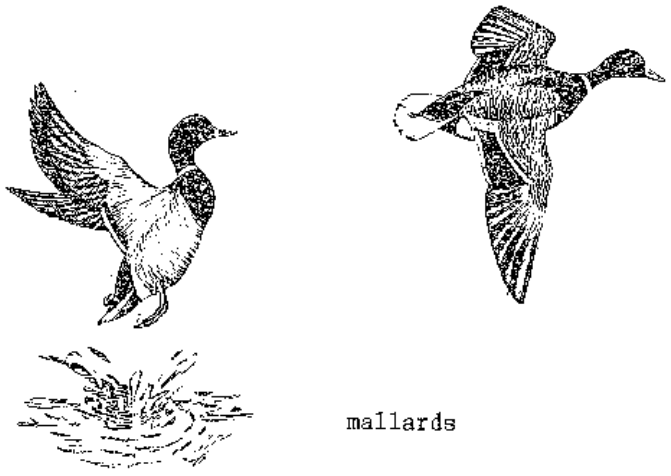
The aforementioned policies and practices have had a similar impact on all regions of the Central Flyway. In North Dakota, where most of the Prairie Potholes remain in the United States, the state government enacted legislation in 1977 preventing the acquisition of wetlands by the federal government, state agencies, or non-profit organizations (e.g. Nature Conservancy) for preservation. It appears that North Dakota officials did this as a means of punishing the Fish and Wildlife service for opposing the Garrison Diversion project. This project, which was denied funding in the mid-seventies, would have diverted water from the Missouri River to eastern North Dakota farms through the channelization of 142 miles of streams. Not until March of 1983 did the U.S. Supreme Court uphold earlier decisions by State District Courts declaring this legislation unconstitutional. Unfortunately, farmers drained 160,000 acres during this eight year period for cropland. It is ironic that potholes were destroyed for wheat production when eighty-five percent of North Dakota's wheat farmers participated in the 1985 Payment In Kind (PIK) program. The PIK program subsidized farmers to keep their cropland out of production.[9]

These decisions, based on political whims, have had a detrimental impact upon aquatic birds and other wildlife associated with the prairie potholes. In a personal conversation with Marvin Kraft, a wildlife biologist for the Kansas Fish and Game Commission located in Pratt, Kansas, he informed me that Mallard and Pintail hens are declining within the Central Flyway. Since both of these species are early nesters in the pothole region, they arrive before much plant growth has occurred. Because most of what was once native grassland is now wheat fields with little cover in early spring, the ducks cannot readily find suitable nesting sites. This results in many hens nesting along fence rows where they become easy prey for predators such as foxes. Biologists estimate that up to forty percent of hen and clutch mortality is due to predation.

Of the original 94,000 acres in the Rainwater Basin, less than ten percent remain, due, once again, to agricultural encroachment. Heavy reliance upon center pivot irrigation for the corn crop in this region coupled with the subsequent lowering of the water table (up to thirty feet in some places) prompted the Nebraska Legislature to enact the 1975 Groundwater Management Act. This act made it mandatory for farmers to collect all irrigation runoff into a re-use pit. These deep manmade pits have steep embankments, which inhibit the growth of seed-yielding wetland or aquatic plants and are thus of little value to birdlife. Another dire consequence of these pits is that they also collect natural runoff, further endangering surrounding wetlands. As the marshes disappear, waterfowl have no choice but to gather in increasingly dense flocks. This proves to be extremely hazardous in years when late winter storms impede the migrational flow. In 1980, an outbreak of cholera was responsible for close to 80,000 waterfowl and shorebird fatalities.[10]

Diversion projects in the Platte River drainage have claimed nearly 70% of the original water volume flowing through it. As a result, the channel width has decreased by eighty to ninety percent in some areas, and much of the former stream beds are occupied by mature trees. Sandhill and Whooping Cranes require broad, shallow channels to roost in. Adjacent wetland meadows, which have dwindled because of the diversions, are essential for feeding, preening, and other activities. Further proposed diversion projects threaten to reduce what remaining habitat, suitable for Sandhill and Whooping Cranes, exists.[11]

Kansas' Cheyenne Bottoms faces a similar dilemma with groundwater depletion and diversion projects supplying water for irrigation. Stan Wood, wildlife manager of the Bottoms, feels that the long-term outlook is grim for maintaining sustainable wetland habitat. In years of average to below average precipitation, there



mallards

simply is not enough water to recharge the basin. This could prove devastating for a wide variety of migrant bird populations, especially shorebirds.

To prevent further deterioration of the remaining wetland areas in the Central Flyway, better management practices and land preservation must occur. While the Federal government subsidized the destruction of wetlands for cropland, it also provided funding to conserve them. In 1961 the Wetlands Loan Act was initiated by Congress. Initially the interest-free loan made available 105 million dollars to the Small Wetlands Acquisition Program (SWAP) for outright purchasing of wetland areas. Congress extended the loan in 1976 and 1983, and also increased funding to 200 million dollars.[12] The loan is being paid back with revenue generated from the sales of Federal "Duck Stamps" to hunters or others wanting to preserve wetlands. (Hunters are required by law to purchase a "Duck Stamp.") Nevertheless, in spite of Federal programs and measures from the private sector (e.g. Ducks Unlimited, Audubon Society, etc.) to preserve wetlands, the trend continues toward more drainage of these biologically-rich areas.

Since there are no National Wildlife Refuges along the Platte River, saving habitat in this extensive river basin has stemmed largely from the efforts of non-profit organizations like the Platte River Whooping Crane Trust. The owners of the Grayrocks Dam and Reservoir in Wyoming agreed to establish the 7.5 million dollar trust fund to comply with the request of the National Wildlife Federation and State of Nebraska. These two groups argued that the Grayrocks Dam would degrade habitat along the Platte River for migratory birds, including the Whooping Crane. In addition to setting up the fund, the owners of the dam and reservoir agreed to release specified amounts of water into the North Platte River.[13]

The diminishing waterfowl populations in the Central Flyway have stimulated the Fish and Wildlife Service, along with Ducks Unlimited, to implement new management techniques in an effort to revitalize waterfowl numbers. For example, in hopes of deterring predation, game wardens are establishing islands, suitable for nesting, in ponds and small lakes. As a means of limiting lead poisoning caused by the ingestion of lead pellets from hunters' guns, Fish and Game officials in some areas of the flyway require that hunters use only steel shot.

Techniques to preserve the Cheyenne Bottoms habitat in Kansas are yet to be developed. Citizens' interest across the state prompted state legislators to authorize funds for a feasibility study to determine effective methods of retaining the water that flows into the basin. One proposal has been to construct smaller ponds with consolidated bottom layers to lessen evaporation and excessive seepage.

Ultimately these management practices may prove to be futile unless we decide to preserve the few remaining wetland areas and allow natural runoff to recharge basins and river valleys, rather than diverting it for agricultural purposes. It does not make sense to increase farm acreage at the expense of wetlands when farmers are being subsidized not to produce crops and elevators are overflowing with surplus grain. Are the people of the United States of America willing to allow such a rich segment of our natural heritage to go down the drain?

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Seasons and Cycles

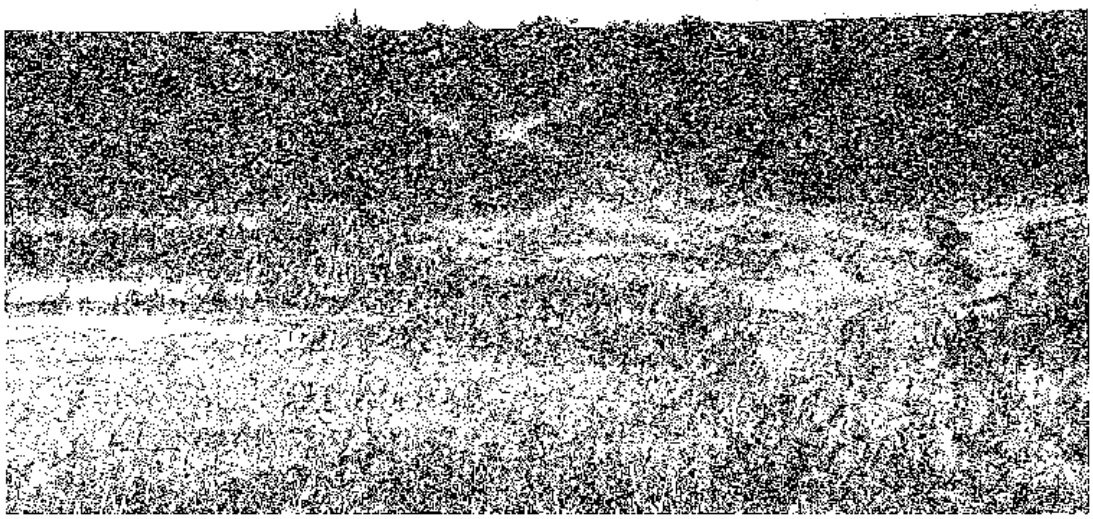
Do you know why spring wildflowers are shorter than fall flowers? When is the best time to hear the booming of the prairie chicken? What month do you start looking for wild strawberries? When do the coyotes howl most frequently?

An informative new nature calendar called Seasons and Cycles: Rhythms of Life in the Kansas River Watershed by Ken Lassman charts the activities of plants and animals throughout the year. Published by the non-profit Kansas Area Watershed Council, the twenty page over-sized booklet provides text and nine beautifully calligraphed circular charts outlining the annual progression of wildflowers, trees, insects, mammals, birds, aquatic life, and crops for the Kansas River basin, an area of over 60,000 square miles in Kansas, southern Nebraska and eastern Colorado. Unlike other calendars, Seasons and Cycles describes the natural cycles that occur each year, so it never goes out of date.

Copies of the publication are available from K.A.W. Council ($6.00 postpaid)
P.O. Box 1512, Lawrence, Kansas 66044.

Photo above by Michael Williams, Eugene, Oregon. Area: Private land within Willamette National Forest about 50 air miles east of Salem, Oregon.

Photo on next page by Jerry Lee, Salina, Soil Conservation Service. Area: south of Troy, Kansas, in the Doniphan Conservation District.



The Fertile Soil Song

Francis D. Hole

Inch by inch, age by age
Granite crumbles. At every stage
Plants build porous, fertile loams
    of a depth that does astound.
Prairie makes a soil that's black;
Forest soil is pale from lack
Of fibrous roots and sunshine pouring
    over the lively ground.

Inch by inch, year by year
Soils of our country disappear.
The work of ages is undone
    by uses that impair.
Topsoil washes, goes to waste;
Crops are grown with too much haste;
Technical fix cannot improve
    a soil no longer there.

Inch by Inch, day by day,
We'll bring the topsoil back to stay;
We'll heal the earth and raise our crops
    according to Nature's plan.
We'll gladly pay a grocery bill
That helps keep soil on yonder hill,
And debt-free families on the farm!
Eden's where it all began!

(Copyright © 1985 by Francis D. Hole, Emeritus Professor of soils and geography, University of Wisconsin. Written to summarize Hans Jenny's chapter, "The Making and Unmaking of a Fertile Soil" in Meeting the Expectations of the Land, these verses can be sung to the tune of the garden song, "Inch by Inch.")

Making Connections

Dana Price

As a woman involved in sustainable agriculture, I recognize a connection between my values and my work. I find that the perspective I have developed from talking with other women is grounded in values which are basic to caring for the Earth.

Feminism and sustainable agriculture are both radical movements, searching for the roots of cultural problems and attempting to base their ideas and actions on fundamental values. Many of these values, particularly nurture, community, and wholeness, are shared. To understand women's work and women's values as experienced by feminists and farm women is to find problems and ideas to struggle with on the way to sustainability.

Urban feminism has tended to overlook farm women, partly because of the stereotype of the conservative farmwife who is uninterested in equality or other feminist goals. Feminists who believe that farm women "only" keep house and feed chickens share some assumptions with patriarchal policymakers who devalue women's work. According to Peggy J. Ross in "A Commentary on Research on American Farmwomen" (Agriculture and Human Values Vol. 11, No. 1), the prevailing view of woman as domestic has kept women on the fringe of public policy. Many studies have not recognized household activities as productive labor. One study reported that wives on successful farms were more likely than "low success wives" to garden and preserve food, but added that such activities were not economically beneficial to the family.

> *I had five brothers and a woman's place was definitely in the house. Dad did call on us to help shuck oats...We thought it was fun, especially since we got out of house work.*
> (personal communication from Manilda Price, author's grandmother)

The amount and variety of agricultural work done by women is of itself evidence that women's concerns must be part of the development of sustainable agriculture. Women's work embodies their values and problems. Traditionally oriented toward family survival, it always includes household tasks and generally extends to gardening, food processing, and care of small animals. But, as Joan M. Jensen writes in "The Role of Farm Women in American History" (Agriculture and Human Values Vol. 11, No. 1), "Women do and did almost every type of work when necessary." Women plow, plant, harvest, nurse

Dana Price cuts her birthday cake.

sick animals (and people), keep finances, and contribute off-farm earnings to the farm's economy. Certain groups of women have done large amounts of field work, particularly immigrant, poor, Black, and migrant workers. While Thomas Jefferson extolled the virtues of the (male) yeoman farmer, his farm work was done by Black slave women.

In the Third World, women's agricultural activities are critical to subsistence. But limited access to land, capital, and education threatens their ability to continue producing food. Title to most land has been transferred to men, as assumed heads of households, through resettlement schemes and land reform. Women have difficulty obtaining credit to purchase needed equipment. Extension services usually assume that men are the producers and address only the homemaking role of women. And women represent only 19% of the world's higher level agricultural students. In Africa, where women grow 80% of the food and contribute two-thirds of all agricultural labor, they make up 17% of this student body.

African women have experienced growing inequality in what Anita Spring and Art Hansen describe as "The Underside of Development" (Agriculture and Human Values Vol. 11, No. 1). Traditional agriculture featured a sexual division of labor into complementary roles, and women had access to land through inheritance rights or family or community ownership. European colonialists, and later development programs, introduced cash crops, plantations, and new techniques to men. In many areas the imposition of cash taxes forced men into wage jobs in mines or plantations. Men's entrance into the cash economy has feminized agriculture, leaving women with a double responsibility for both subsistence crops and cash crops. The informal, subsistence household economy is ofter overshadowed by the formal, extractive cash

economy. The desire for non-local goods has created a dependence on cash income. Men's status relative to women has increased with their greater ability to buy prestige goods, yet their commercial orientation would be impossible without the support of women's subsistence activities.

In both the Third World and the U.S., industrialization has pushed sustenance into the economic margin. Women may respond by seeking paying jobs, even doing "men's work." But with few exceptions, men do not do "women's work." In a study cited in the New Internationalist (No. 150), American men who felt they were contributing a fair share did 10% of the housework.

> *This determination that nurturing should become exclusively a concern of women served to signify to both sexes that neither nurture nor womankind was very important.*
> (Wendell Berry, The Unsettling of America)

Nurture is the basis of women's traditional work. But the industrial economy, which runs on the production and consumption of excess commodities, esteems profitmaking more than homemaking. Nurturing within the household cannot directly generate a profit. So home activities are compressed into the subordinate maintenance role of the housewife. The separation of production leads to consumerism as the household satisfies fewer of its own needs.

Perhaps it took women moving into paying jobs to realize that to nurture is as much a human need as to be nurtured. Wage-earning as a sole activity is dehumanizing while housewifery alone is depleting. The feminist reclaiming of nurture as one of women's greatest strengths rejects the exploitative fragmentation of contemporary society.

Nurture is concerned with health and health with sustainability. Wendell Berry emphasizes that a good farmer must also be one who nurtures. Nurture and exploitation are incompatible. Just as our society has left women the maintenance role of feeding, comforting, and cleaning up, so we take for granted the Earth's service in growing our food, absorbing our wastes, and covering our scars. But women and the Earth are depleted when we exploit without responsible concern for long-term sustenance. The results range from the feminization of poverty to pollution to soil erosion. Environmentalism and feminism teach that we all must nurture, and so come together.

> *The farm family cannot exist in any dignified sort of way without rural community.*
> (Wes Jackson, Land Report No. 23)

As an extension of their nurturing and their own need for support, women have cultivated their communities. For feminists, an important community has been the small group, in which we come together to discover the commonalities of our experiences, develop our ideas, and struggle with our problems. Women's collectives, businesses, and political groups all help fulfill the needs to end isolation, foster change, and affirm each other's efforts.

Farm women, despite their isolation, have extended networks of support for their families and each other into community institutions. Rural women were responsible for their churches' nurturing functions, moving them toward greater concern for community welfare. They were instrumental in establishing and teaching in rural schools for little compensation. And rural women's history of political activity is extensive, as Joan Jensen relates. The first women's political conference, at Seneca Falls in 1848, was called by Quaker farm women. Rural women formed farmers' alliances and abolitionist, temperance, and suffrage organizations. They joined the Grange when it became one of the first national organizations to admit women, and moved the Populist Party to be the first to advocate female suffrage. The nation's first woman mayor was elected in a small Kansas farm town.

Like its people, a farm cannot be healthy in isolation; it requires a viable rural community for exchange of skills, products, and ideas. Associated with the current crisis in agriculture is the undermining of farm communities. Centralization, sponsored by cheap fossil energy, closes rural businesses and banks, cuts rail service to small town elevators, and funnels farm income into large cities and agribusiness interests. Sustainability will depend on revitalized communities to keep resources within rural areas. These communities will be essential to the discovery and teaching of ecological methods appropriate to each area's agriculture. Without them, women's networks of support cannot exist. Nurturing and sustaining are fostered by a community of people and land. Together they reflect an underlying value of connectedness or wholeness.

> *...it come to me: that feeling of being part of everything, not separate at all. I knew if I cut a tree, my arm would bleed...*
> (Alice Walker, The Color Purple)

We exist now as divided people. Human from Nature, mind and soul from body, production from sustenance; the divisions make way for exploitation and violence. Woman's body, separated from spirit and intelligence, becomes an object for possession. Nature, separated from humankind and divided into "resources," is made a commodity for careless extraction. But women are reuniting with ourselves and the Earth.

The strength and challenge of any movement lies in its ability to make connections among people, ideas, actions, and cultural patterns. Women's groups have learned that "the personal is political." Similarly, the personal is ecological. The chemicals sprayed on the land are the food I eat; my consumption contributes to the eroding soil, the mined mountain, the polluted air. Only if we humans are concerned with ourselves as part of our ecosystem can we understand how to practice sustainability. Our rejoining with the Earth means a concern for nurturing and recycling rather than extracting and dumping.

It is when I experience my connection with the Earth that I appreciate the fullness of my womanliness and my humanity. I see feminism and sustainable agriculture as complementary approaches to uniting people and the land.

The Role of Women in a Changing Agriculture

Juli Kois

In mid-November a group of about 25 women gathered at Kansas State University to informally discuss the future of women in Kansas agriculture. The round table discussion, organized by Mary Fund of the Kansas Rural Center and Mary Bruns and Dana Jackson of The Land Institute, brought together women from throughout the state who are actively involved in agriculture, either as farmers, researchers, counselors or citizens trying to influence agricultural policy. The participants, representing a diversity of organizations, included Helen Bausch (Kansas Agri-women), Pat Embers (Kansas Rural Wellness Center), Cheryl Simmons (Soil Conservation Service), Nancy Spiegel (Women in Farm Economics), and Barbara Stowe (College of Human Ecology, KSU). Others attending were farmers Rose Flora, Shirley Shurman, Jean Vogelsburg, and Nancy Vogelsburg-Busch as well as the women of the Land Institute and the Kansas Rural Center.

The purpose of the meeting was to provide an opportunity for women to talk to each other and broaden their perspectives of the current farm problems and their roles as women in agriculture. It was also to inspire them to initiate similar discussion within their own communities.

Dr. Cornelia Flora, Kansas State rural sociologist, began the session with a brief presentation highlighting the historical and current roles of women in agriculture. She identified a few of these as 1) partners/co-workers in decision making and labor, 2) providers of off-farm income and part-time help, and 3) leaders/activists in affecting policy change. Mary Fund followed with an introduction to the questions of how agriculture and women's roles in agriculture are changing. Among the concerns raised were the implications associated with farm women taking jobs in town. We considered whether this trend was, in part, a consequence of women being displaced when family farms became incorporated agribusinesses directed more by the brothers or fathers and sons than the women in the families. We discussed the problem of women's absence from daily farm activities contributing to their removal from the decision-making process and the reluctance of some women to re-invest hard-earned dollars into what they recognize as floundering operations.

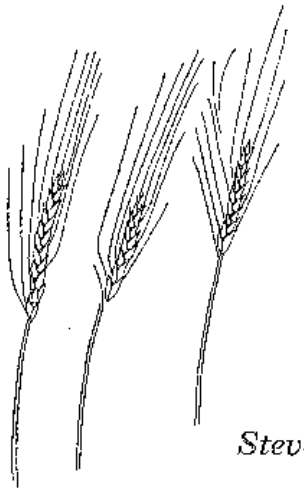
We touched upon stress-related problems in rural communities, like increasing alcoholism, spouse abuse, or pesticide poisoning, but, as Cheryl mentioned, being able to cope with these problems is for naught if farm families can not pay off their debts. Pat Embers added that many farm women do not even have time for reflection on their personal needs and goals, much less take action on their problems.

Education is the most promising tool for implementing changes. Women first need to be clear about their own values and the issues affecting their lives. Then, some can set examples for their communities by using farming methods and technologies which do not harm the land or people. Others may prefer to take advantage of established institutions (schools, churches, extension, farm organizations) to disseminate information on matters such as converting from conventional to organic farming, land ownership, or drinking water contamination. Women can further be effective activists, influencing policy making through lobbying and letter writing. Helen Bausch predicted that women, city women in particular, will have a major impact on the future of agriculture through their concern for the health of their families.

One part of the discussion focused on the role of the agricultural university and the home extension units in educating rural women. The programs often reflect the interests and choices of women, but do not necessarily help women make important contributions to the family farm enterprise.

By no means are these problems of a changing agriculture just women's problems, nor are they, at the heart, limited to agriculture. Most of the economic crisis in farming is symptomatic of a greater societal crisis, which itself can be traced back to the moral and spiritual problems of individuals. At all levels, communication between concerned parties is very important.

The round table discussion concluded at noon, and the participants ate lunch together in the student union at Kansas State. Although the women made no plans to meet again as a group, all felt the discussion would continue.



Agricultural Development — or Intrusion?

Steve Ela

"It is we who are the intruders." David Brower, former head of the Sierra Club and founder of Friends of the Earth, was talking about the human's place in wilderness areas, and more broadly, the overall environment. Today many people believe that humans can control the environment, mold it to our own needs, and then solve the environmental and social problems with human ingenuity and technology. Brower, and other environmentalists, disagree. They cite our brief existence in an old world. Ecosystems have had millions of years to develop, to change, to adapt. It is human arrogance to believe that in the past several hundred years we have been able to improve on the adaptations created over millions of years. Because of our arrogance, Brower believes that man is out of balance, "way out of balance," with the environment. He says, "the land won't last, and we won't."[1]

One symptom of human imbalance with the environment is the number of hungry people around the world. In the United States our historical response to a hungry world has been to increase food production.[2] In the 1940's we helped to set up several international plant breeding centers, two of which are the Centro Internacional de Mejoramiento de Maiz y Trigo (Center for the Improvement of Corn and Wheat or CIMMYT) and the International Rice Research Institute (IRRI). Scientists in these centers focused on increasing crop yields by increasing seed production, decreasing stem lodging, decreasing disease and pest losses, and increasing responsiveness to high fertility and moisture conditions. They assumed that inputs, such as chemical fertilizers, irrigation and pesticides, could (and would) accompany the use of high-yielding varieties. The scientist's success was demonstrated as seed yields dramatically increased in some areas.[3] Most farmers in the United States now plant only high-yielding seeds on their acreage, as do an increasing number of farmers in many Third World countries.

The problem of hunger, however, cannot be solved by the simple technological solution of increasing seed production.[4] Agricultural systems are part of cultural systems. A technological solution must be compatible with the culture in which it is used. The breeder's ignorance of the cultural aspects of agricultural systems has caused many social and political problems. Just as David Brower believes that man is an intruder in wilderness areas, I believe that scientists promoting the use and distribution of high-yielding seeds are intruders in Third World agricultural systems. We should realize that our ideas of the past forty years may be simplistic and detrimental when applied to traditional systems that may have developed over hundreds of years.

MEXICO'S EXPERIENCE

In the first years of CIMMYT, scientists focused on developing high-yielding corn and wheat varieties to be used in Mexico. Several researchers spoke out against this exclusive focus on production: one of these was Dr. Carl Sauer, a Berkeley geographer. Sauer placed considerable value on the accumulated knowledge and skills of the Mexican peasantry. He stated that the Indians of Mexico needed to be encouraged that their ways were good and that they needed protection against exploitation. Sauer believed agricultural research in Mexico was directed away from subsistence agriculture to the needs of industrialized Mexico. The emphasis on standardizaton of product and yield encouraged commodities which only the privileged fraction of the population could absorb. Researchers ignored Dr. Sauer and distributed the seed throughout Mexico. From the breeders' perspective the results were fabulous; they called it the "Green Revolution."[5] From the perspective of feeding people, scientists would have been wise to heed Dr. Sauer's advice.

Kathryn Dewey, a nutritionist at the University of California, found that in Tabasco, Mexico, the high-yielding varieties replaced indigenous crops. Land once planted to a diversity of fruits, vegetables, legumes and grains was planted to one or two high yielding varieties. Cultivators began to sell their production for cash. If crop prices were low, if cash were only available at a few times a year, or if cash were spent on non-food items, the replacement of food with cash led to dietary deterioration. Families were unable to purchase expensive fruits and vegetables which were once common in their dooryard garden.[6] The high-yielding seeds, designed by scientists to feed people, led to hungry people.

Angus Wright, an historian at California State University, Sacramento, has also studied the effects of the Green Revolution in Mexico.

He writes:

> while no one in or out of Mexico contests the fact that American-financed agricultural research has led to impressive production gains in some crops, in some Mexican regions it is widely believed that these gains themselves have led to unfortunate economic distortions that make the solution of other problems more difficult.

He goes on to say that some Mexicans believe that the basic political and cultural structure of their country has been profoundly changed by the results of American-sponsored research. Wright sums up his feelings in one sentence: "It would have been a miracle indeed had the 'miracle seeds' provided a national panacea in a country of such diversity."[7]

THE UNLEARNED LESSONS

Scientists at CIMMYT and IRRI, however, continued to develop new and "better" high-yielding varieties. The production "success" in Mexico was followed by a drive to distribute the seeds worldwide. Carl Sauer and others continued to warn scientists of the social problems; the scientists continued to ignore them or give their advice only token notice. Finally, in the 1970's, after high-yielding seeds had been distributed through Asia and much of Africa, a flood of criticism concerning the use of the varieties forced people in the international breeding centers to acknowledge the social problems.[8] They added sociologists, economists, and anthropologists to their staff. To some people it appeared that breeders were finally encompassing social considerations in their research. As the 1980's approached, however, observers realized that the new staff members were not affecting the recommendations being sent to farmers. Edmund Oasu and Bruce Jennings, two researchers who have reviewed the history of CIMMYT and IRRI, found that the scientists there continue to be preoccupied with greater production through technology. The scientists "are not given to examining its consequences."[9]

It is not surprising, therefore, that the criticisms of the Green Revolution raised in the 1970's are still valid. The breeders' distribution of the high-yielding seeds continues to reinforce farmers' lack of self-determination, social inequality, labor problems, the erosion of genetic resources, and the reliance on non-renewable resources.

Farmers purchasing the "package" of high-yielding seeds and inputs must have money, which they must either borrow or earn through sales of goods. The farm begins to come under the control of profit and loss and the direct needs of the farm families come second.[10] The farmer's external dependence on inputs and grain sales subjects him to fluctuations in the industrial economy.[11] R. S. Loomis, professor of agronomy and range science at the Univ. of California, Davis, notes that agriculture and our food supply are now dependent upon social stability in the larger society for a continued flow of goods and services. Government officials make international trade and war decisions that affect the farmer's ability to grow food.[12] The farmers can no longer weather a crisis by resorting to their own stores of seed and their ingenuity to live off the land. In the United States, farmers are going bankrupt because grain sales, which are subject to worldwide market demands, do not produce an adequate income. If the farmers were producing mostly for themselves or their community, world market prices would affect them less.

As farmers become integrated in the national and international markets, social inequalities tend to be reinforced. Farmers with experience in dealing with governmental and distributional bureaucracies can gain access to a steady supply of inputs and use government programs to their advantage. These are usually the large landowners, the farmers who already have an advantage over small farmers. Small farmers must pay higher prices for inputs. They lack the ability to withhold grain until market conditions are better, and they may become indebted to large landowners for cash to buy inputs. The wealth derived by greater production falls to the already wealthy farmers. The small farmers, who are often the hungriest, receive little. They remain hungry, even as world grain production reaches new highs.[13]

Labor requirements are also a problem with the high-yielding varieties. Increased labor is required for weeding, fertilizing, spraying, irrigating and harvesting the larger yields. In parts of Africa, woman perform much of the farm labor. They are responsible for growing the family's food and also for working in the men's fields. Women are forced to work even harder, often for little or no pay, when high-yielding seeds are planted.[14]

In Asia, shorter maturation times for high-yielding rice varieties allow farmers to grow two crops a season.[15] To do this, however, fields must be quickly harvested and replanted. Farmers may require more labor than is available. Mechanization is an alternative for farmers, but this leads to increased labor inequality and unemployment problems during slack periods.[16]

GENETIC DIVERSITY AT RISK

Finally, as breeders intrude on traditional agricultural systems, they place their own work in jeopardy, along with the farmers they advise. Breeders rely on the genetic diversity of plants grown in different areas for the initial sources of new, desirable traits. Plants grown in specific areas develop site-specific qualities that allow them to survive. These qualities include tolerances to low soil fertility, specific strains of local diseases, or climatic conditions.[17] Many of these traditional varieties, however, lack high yields.[18] Researchers advocated the replacement of traditional seeds

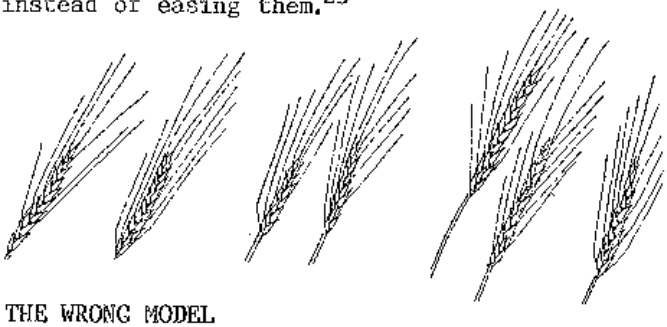
with high-yielding seeds, and the genetic adaptations of the traditional varieties were lost as they were replaced. Garrison Wilkes, a corn breeder with an avid interest in the evolutionary history of corn, stated the problem in a vivid manner:

> Quite literally, the genetic heritage of an entire millennium can disappear in a single bowl of porridge.[19]

Ironically, as breeders search for new genetic material, their successful breeding efforts reduce the variety and quantity of material available. The United States relies on worldwide genetic stocks for crop improvements. The replacement or destruction of traditional genetic stocks by high-yielding varieties is a serious problem. Dr. James B. Kendrick, vice-president for agriculture and natural resources of the University of California, stated that if we had to rely on the genetic resources in the United States for the genes to minimize genetic vulnerability into the future, we would soon experience significant crop losses, and those losses would accelerate as time went by.[20] Do we dare recommend that Third World farmers emulate our system?

Instead of encouraging farmers to replace traditional varieties with high-yielding varieties, scientists should encourage farmers to preserve the genetic diversity of an area. Farmers should save their own seed and replant that seed the following year. When breeders do develop high-yielding varieties, they should not assume the availability of non-renewable inputs, and they should keep in mind the environmental and social constraints of the area in which they are to be used. Moving scientists out of the international breeding centers and into national and local centers would encourage the development of seeds that are better adapted to local conditions. If farmers are also allowed to have input into breeding programs, their acceptance of new seeds might be enhanced.[21] If farmers can remain separate from the industrial economic system (by planting their own seeds and using locally derived inputs), they can retain their decision-making power and their independence from corporate and government control.

If food production becomes a problem, researchers should first look for solutions within the traditional system. Miguel Altieri, professor of entomology at Univ. of California, Berkeley, and a proponent of tradional cropping systems, notes that farmers in traditional systems have developed the ability to bear risk, the knowledge to plant complementary species together, an idea of the dietary requirements of that area, and methods of meeting labor requirements.[22] Why abandon the wisdom developed over hundreds of years for concepts (with known problems) developed in the past forty years? Hoyt Alverson, professor of anthropology at Dartmouth College and an award winning writer about rural communities in Botswana, Africa, has found that with minor changes in management practices, indigenous agricultural systems are capable of considerably greater production. In contrast, the government's transfer of technology into an indigenous system aggravated production problems instead of easing them.[23]



THE WRONG MODEL

The United States agricultural system is a dangerous example for Third World farmers. We have a system that is dependent on high energy inputs and a system that depletes aquifers and erodes soil faster than the replacement rate.[24] Our farmers face low prices and debt crises because of overproduction. They complain about their inability to affect government policies. Dr. Sauer perceived the problems of United States agriculture in 1941. He said:

> Mexican agriculture cannot be pointed toward standardization on a few commercial types without upsetting native economy and culture hopelessly. The example of Iowa is about the most dangerous of all for Mexico.[25]

The problems of U.S. farmers are also problems Third World farmers can expect if they continue to focus only on production.

Finally, scientists must realize that they are working with human beings. Farmers have feelings as well as economic motivations. Farmers can be poor and happy. A group of Costa Rican subsistence farmers told me last summer that they are poor, but as long as they have enough food to feed their families and guests, money is unimportant. In our zest to feed the people of the world we must keep in mind that both the producers and consumers of food have individual problems and feelings. As Henry Wallace, one of the first proponents of hybridized and standardized seed, said: "Neither man nor corn was meant to be completely uniform."[26] A single solution to the problem of world hunger, such as high-yielding seeds, ignores the variation in individual desires and needs.

Agricultural scientists who advocate the use of high-yielding varieties in Third World countries, in spite of cultural changes the seeds create, are truly intruders. Science is not objective and neutral: the values and political biases of research are ultimately reflected in social results. It is arrogant to ignore the beneficial properties of other systems and promote agricultural methods and technology deemed best by United States scientists, especially when our own system shakes around us. If we continue to blindly follow this course, David Brower's comment will come true: "The land won't last, and we won't."

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Roots of African Famine

John Richards-Laatsch

What does African famine have to do with The Land? Our ultimate goal is to create an agriculture that yields enough for our needs on a sustainable basis. In most cases, traditional agriculture in Africa did meet needs on a continual basis. The loss of these traditions is the central reason for famine in Africa. Reintegrating sustainable ways is a key consideration for long-term plans to stop hunger.[1]

Control of Africa by European powers began in the nineteenth century, setting off a spiral of environmental degradation resulting in hunger.[2] Today Africa has the highest population growth rate of any continent, and is the only continent to register a decline in per capita grain production over the last twenty years.[3] But African hunger is not just the result of low production or too many people, and this must be understood to avoid production-at-all-cost solutions that overlook sustainability.

TRADITIONAL FOOD PRODUCTION

The East African countries of Ethiopia and Sudan both have severe famine and will be used to illustrate some specific points about the African situation. One way people of Sudan and Ethiopia maintained food production was through animal herding. Pastoralists used large areas to support their herds of cattle, sheep and camels. The direction and timing of travel depended on the needs of the herd, condition of pasture, exact location of rain and physical limits of the animals.[4] By following the rains, food could be produced from a seemingly useless area. Northern Sudan nomads utilized the Zebus cattle variety and camels, both very drought tolerant.[5] Cattle graze on grasses while camels can browse on shrubs so together they more fully used the environment. Camels also served as insurance during severe drought when many cattle would die.[6] The animals produced milk products, meat and functioned as a bartering tool. Some nomadic herders carried on a symbiotic relationship with sedentary farmers. Animal products and fertilizing manures were traded for grains, utensils, etc.[7]

Pastoralists are no longer able to endure for a number of reasons. Colonialism brought in a money economy which gave herders a use for more cattle. Herders in French colonies had to pay a tax in French currency that they could only obtain by enlarging their herds and selling the excess. Larger herds eventually grew beyond the land's capacity, resulting in desertification and a series of other problems. Boundaries between countries, drawn up by colonial powers, often cut across the migratory routes of nomads. This, as well as large agricultural plantations, kept herders from moving to fresh pasture and water.[8] In Sudan, a few pastoralists have survived only where passageways around agricultural developments have allowed them some free movement.[9]

Traditional farming also produced food on a sustainable basis before colonialism. Parts of Africa contain the world's oldest soils that are extremely difficult to manage for agriculture.[10] Africans dealt with poor soils in forested areas by shifting cultivation. An area would be cut and burned to provide a nutrient rich crop base. After a few years of planting, the area would be abandoned, allowing forest regrowth to rebuild fertility, while a new section was cycled into use.[11] Younger, more fertile soils could support a permanent agriculture. Whether shifting or permanent, agriculture was diverse, consisting of tree, root, grain and legume crops.[12] Diversity provided insurance in case one crop failed, while decreasing the epidemic spread of diseases and pests.[13]

DECLINE OF TRADITIONAL AGRICULTURE

Most customary agriculture has been lost due to outside influence. In 1913, the British government initiated a series of large irrigation projects to convert Sudan's best lands into cotton production for British textile mills. Peasants were moved off their land, creating a large labor force that had no employment besides growing the cotton.[14]

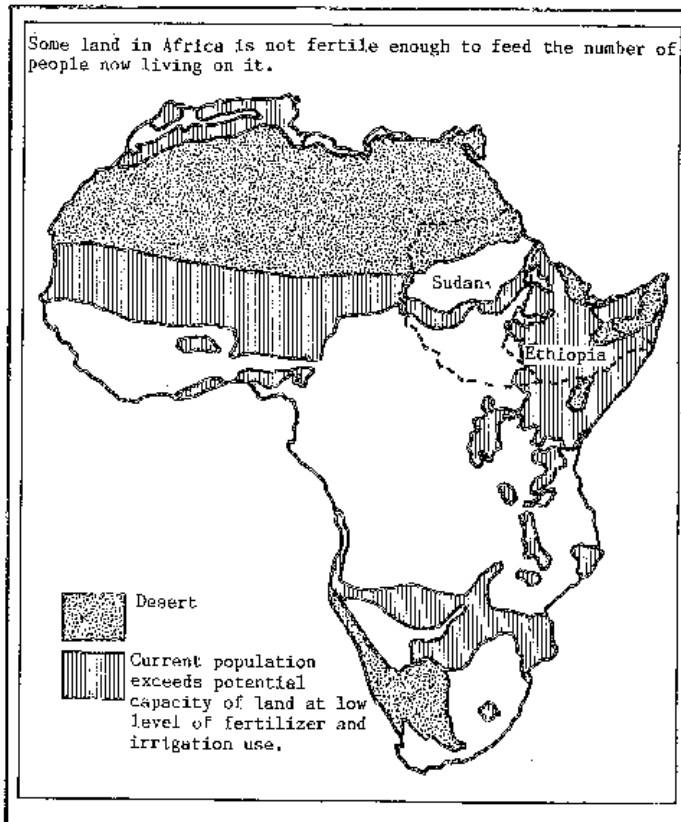
Ethiopia is one of only two African countries never to have been a long time colony. Yet the tenant-landlord system and the existence of export production had the same destructive effect as colonialism. Under Emperor Haile Selassie (1916-1974), the Ras (land holding class) became very powerful.[15] Peasants remained poor and were reluctant to increase their output, because up to 75% of their crop was lost as payment to demanding landlords.[16] Confusing land ownership traditions and large rent payments discouraged peasants so much, that considerable amounts of land were left untilled.[17] Landholders looking for better markets contacted outside investors with the help of Emperor Selassie who was anxious for foreign trade. In the early 1970's, Selassie made a deal allowing an Italian company to grow alfalfa on unused land and ship it to Japan for cattle feed.[18] Selassie was overthrown in 1974, partly because he continued to export grain and beans while many Ethiopians died in the famine of 1972-1973.[19] Even after the overthrow, the bias toward exports remains. State farms formed from pre-coup plantations received 60% of the nation's agricultural aid in 1983, although peasants produce 90% of the nation's food.[20]

The pressure to increase animal herds and the crowding out of subsistence farming by export crops caused the loss of resilient food products in Africa. Shifting cultivation fallow periods were shortened, resulting in deforestation and declining soil fertility. Trees no longer pulled plant nutrients up from deep soil layers. (At one time, 75% of Ethiopia was forested while only 4% is today[21].) Fewer trees meant crop residues and animal manures were used for fuel rather than returned to the soil. This further lowered soil fertility and caused greater erosion. Less fertile soils make crops more susceptible to failure in slightly dryer years. Disease and insect vulnerable monocultures replaced the diverse plantings. Greater animal populations stressed dry grasslands which became desert from overgrazing.[22] Less vegetative cover resulted in greater water runoff and less water transpiration by plants. Experts feel this reduces rainfall, making normally-occurring drought unusually severe.[23] This cycle of environmental destruction has made it difficult for Africans to produce food, especially during dryer periods.

Colonialism left other patterns that contribute to the current famine. Universities were founded by Europeans and patterned after colonial interests. This resulted in little support or research for local food production.[24] Males have priority over women for the limited student openings, although women produce the majority of subsistence food.[25] Education of women is also important, because it gives them other options for work and fulfillment besides child raising, and thus can be a major population control measure.[26]

THE POPULATION FACTOR

Population growth is a major force behind environmental decay in Africa. Birth rates have been extremely high for a number of decades. As colonial governments and relief agencies provided disease control, death rates declined. This allowed high birth rates to produce tremen-



Source: FAO World Food Report 1985;
FAO Food Production Yearbook 1983.

dous population increases (3% annually, the highest on any continent in history.)[27] Even if birth rates dropped to replacement level now, population would continue to increase for fifty years due to the great percentage of people under fifteen years of age who will reach reproductive age shortly (all sub-Saharan countries have at least 45% of their population under age fifteen).[28]

Besides the education of women, decreased child mortality and greater economic equality could help reduce birth rates. Lower infant mortality insures parents that their children will survive to help work and support them in old age, reducing their need to have more children to obtain the same benefits.[29]

Economic inequality is derived mainly from colonial days. Colonial taxes forced extra production and colonial plantations demanded extra labor. This provided a greater reason to have large families--to provide extra labor and income (peasants were paid very little for their work and produce). Lowering death rates created more people than traditional food producing methods could support. This short fall was compounded by export crops crowding out subsistence agriculture. Peasants became poorer while the few in power benefitted from their labor.[30]

THE LEGACY OF COLONIALISM

Colonialism ended at least twenty years ago, but the experience left Africa's economy hooked into the international market. Needed and wanted goods (televisions, autos, oil and technical equipment) must be obtained on the international market. Usually agricultural products are used to gain the international trade. This has continued the bias toward export agriculture since the end of colonialism.[31]

The great development problems faced by inexperienced governing bodies have created overwhelming situations resulting in corruption, mismanagement, and mistrust, which in turn, creates public unrest. Urban areas are most prone to rebel, so domestic agriculture prices are kept low to keep urban citizens pacified with cheap food.[32] This reduces incentive for the already crippled domestic food production. Sudan exemplifies this unrest as former President Gaafar Nimeiri endured fifteen attempted coups before being overthrown in April of this year.[33] Nimeiri prevented a successful coup for sixteen years only by continually switching military and government high positions to stop cohesive blocks of resistance from forming. The resulting transient government created more inefficiencies due to inexperience.[34]

When staking colonial claims, European countries divided areas of Africa up without regard to language, cultural or religious differences. Diverse people are often controlled by one central government, causing many of today's internal conflicts.[35] Northern Sudan has a Middle Eastern background with a strong Muslem tradition. Former President Nimeiri imposed a harsh set of Islamic laws that was resented by the Christian and animist peoples of south Sudan. Rebels of the south have been fighting against the northern-dominated central government despite a 1972 peace accord.[36] Ethiopia is also composed of diverse peoples. Currently civil war continues between the central government and liberation movements in northern areas of Tigray and Eritrea. After independence from Italy in 1941, a United Nations resolution placed Eritrea under Ethiopian control. Eritrea's rebellion began when this control was formalized in 1962.[37] Conflict diverts government resources away from famine problems. At the same time, fighting disrupts food production and creates more refugees who cannot generate their own food.

MILITARIZATION

Beyond internal conflicts, Africa has become a major battleground in the East-West cold war. Ethiopia's Marxist government only received famine relief from the United States after strong public and congressional outcry.[38] Because of Ethiopia's strategic position bordering on the Red Sea near Middle East oil fields, the United States has heavily armed Ethiopia's neighbors, including Sudan. In fact, two-thirds of all the United States' aid to Africa goes to Egypt because of its strategic importance, although hunger is far less severe there than the rest of Africa.[39]

Under the Reagan Administration, the situation is becoming much worse. From fiscal year 1981 through fiscal year 1986, development assistance to sub-Saharan Africa has increased 11.7% while military assistance has increased by 176.9%.[40] The Soviet Union also gives aid based on military priorities. Ethiopia owes four billion dollars to the Soviets for military hardware.[41] Arms are used by Ethiopia to fight the Civil War and to provide protection for Soviet air bases in Ethiopia.[42] Increased militarization only reinforces the famine.

FOOD FOR THE FUTURE

Famine in Africa is the result of severe ecological destruction, the end result of colonial exploitation. As colonial plantations, taxes and boundaries were imposed, the cycle started. Pressure to produce more on less land resulted in overgrazing, deforestation and increased population--the start of the self-reinforcing pattern. Although colonists started the cycle for most African countries, Ethiopia has shown that when control of the land is limited to a small native group, the same destruction can take place. Military conflict keeps the problems from being addressed.

The long-term solution lies in recreating sustainable agricultural systems, not for export, but to feed Africans. This does not necessarily mean bringing back widespread herding and shifting cultivation. The greater number of people and abused environment will not

allow this. Yet certain aspects of traditional agriculture such as a diversity of crops and the recycling of nutrients could be utilized. Sustainability must be integrated into any future development, if Africa is to break the cycle of environmental decline.

Finally, and most importantly, we must not become caught up in the figures (120 million affected in 24 of Africa's 54 nations, 9 out of 43 million in Ethiopia alone). As Frances Moore Lappè points out, figures suggest that the solution is also in numbers (tons of grain, hundreds of transport trucks).[43] We must not forget that the changes needed to create sustainable agriculture and alleviate African famine are changes only possible when motivated by a deep commitment to better the lives of all people.

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Pesticides are Poison for Workers in Mexico

Holly Winger

In and around the irrigated crop fields of Sinaloa, Mexico's richest agricultural state, migrant field laborers from poorer regions work, bathe, eat, and sleep in continuous contact with high levels of toxic agricultural pesticides. This sad story is part of what Land Institute staff and interns learned during a seminar on August 8 by visitor Angus Wright, a Latin American historian in Environmental Studies at California State University in Sacramento. Wright's presentation was an excerpt from his nearly completed study of pesticide poisoning among field workers in Mexico, based on observation trips he made during 1983-84 under a Fullbright Senior Research Fellowship.

Using a slide show, Angus described his findings about careless over-application of pesticides on over 100,000 acres of export crops, such as tomatoes, bell peppers, cucumbers, melons, and squash, in the northerly-located state of Sinaloa. Much of this harvest is destined for sale to consumers in the United States during our winter season. In response to the lucrative export market, managers of this cropland order repeated applications of pesticides, such as parathion, in quantities which may be double that needed for adequate control levels. Along with targeted crop areas, toxic spray falls on hired field workers and their families, settling on skin, clothing, and housing, as well as on food and water supplies.

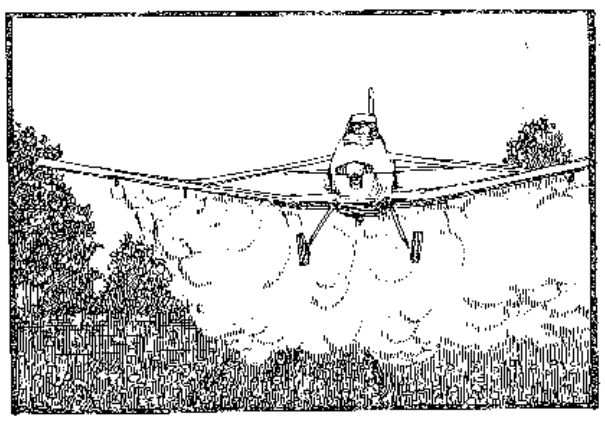
Angus summarized the history leading to the allowance of these unhealthy working conditions in Mexico, which still professes to operate under the mandate of its 1910-20 people's revolution. Since the agriculturally rich state of Sinaloa was expected to make

Mexico self-sufficient in grain production, it became a major beneficiary of investments following the revolution. For example, World Bank funds built large dams in the Sierra Madre Mountains to allow controlled irrigation of the valley. The Sinaloan capital, Culiacan, is now a pre-eminent world agribusiness center.

In another post-revolutionary action, Mexico divided 50% of its land area, including much of the farmland in Sinaloa, into landholding communities, called "ejidos." Intended to be managed at the village level and farmed by residents, many ejidos today are run by a few individuals who hire day laborers mostly from poorer outside regions. In Sinaloa, many of the export-crop plantation workers are Mixtec descendants from the poorer southwestern states of Guerrero, Puebla, and Oaxaca. Since agriculture dominates Mexico's economy, 40% of the nation's 76 million people are employed in agricultural jobs.

Today, many of the Mixtec people, along with millions of other farm workers in Mexico, are experiencing serious health problems, even early death, due to exposure to toxins from the pesticides they work and live with. In the two-year period when Wright traveled in Mexico, he saw no safety precautions of any kind used with the application of pesticides, many of which, like parathion, are highly toxic organophosphates. These pesticides cause damage by inhibiting the production of aceto-cholinesterase, an enzyme which transforms the electric pulses in our central nervous system into useful messages over nerve gaps, or synapses, in nerve pathways. Lack of this enzyme leads to a kind of "information overload," causing over-excitation of the nervous system and its eventual collapse.

Another chemical commonly used in the Sinaloan valley and elsewhere is the herbicide paraquat, which causes perforated lung tissue from even skin contact over a period of two to three years. Angus observed workers mix these chemicals, along with others, and put them into back-pack tanks for hand spraying. Workers' responses to questions showed they have no idea what the chemicals are, and though they see others become sick and even die, they wear no protective clothing such as masks, gloves, aprons, or boots. One worker told Wright: "You have to be careful." But he was handling the chemicals with his bare hands. In the field, the men do the mixing and spraying, often spilling the liquid on their feet and getting spray on hands, faces, and clothing.



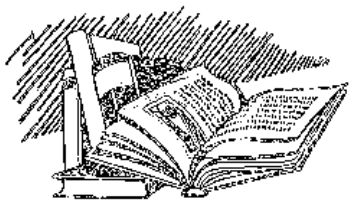
Not surprisingly, Angus Wright has found evidence of high rates of poisoning in workers exposed to these chemicals. He has also found evidence of efforts to cover up the true cause of reported illnesses and deaths traceable to chemical exposure. Nationally, government statistics show a thousand cases per month listed as "other illness." There is no category in these reports to account for poisonings from exposure to pesticides. Wright suspects that clinically treated cases represent only 1% of the actual number of poisonings. Assisting in this "cover up" are private doctors who provide field foremen with "atropine," an antidote to organophosphate poisoning, which is administered to sick workers in the field. Even worse, some workers Wright interviewed said that those who complain about pesticide use, other than seeking clinical treatment, may be shot.

Far from exploring alternatives to this sickening pattern of pesticide abuse and worker illness, the Mexican government is instead promoting the use of agricultural chemicals to employ 60-70% in unused chemical production capacity. Fertimex, a state-owned chemical production corporation, produces 128 different trade names and formulations of pesticides, including DDT and parathion, for use in other regions of Mexico and Central America. In addition to Fertimex, there is a huge network of ejido-owned formulation plants also functioning with large excess capacity. Seeking to bolster foreign exchange as a major regional supplier of agricultural chemicals, Mexico has little incentive to promote a reduction in chemical inputs to agriculture.

Citing ominous statistics (e.g., that 70% of pesticide use in developing nations is for export crops, or that only one in fifteen shipments of Sinaloan vegetables are checked for pesticide residues), Angus stressed that, as consumers of export crops, we must not be satisfied with only understanding how pesticide use affects us. The damage to native people from the use of pesticides encouraged by our consumption should be a primary concern.

Angus Wright is currently preparing his findings for public presentation in documentary form.

EDITOR'S NOTE: This new Perspectives section on Third World Agriculture appears because students are concerned about the U.S. role in worldwide food production. U.S. policy promoting high production "to feed the world" has hurt American land and rural people. Efforts to help third world nations feed themseves have hurt their land and people when based on inappropriate methods and technology. The search for sustainable agriculture must be international, yet local.



Declaration of a Heretic

by Jeremy Rifkin
Routledge & Kegan Paul
Boston, London, Melbourne and Henley
140 pages, $7.95

Reviewed by *Michel Cavigelli*

> I have been accused of being opposed to scientific inquiry, academic freedom and, worst of all, the march of progress. I have been castigated as an obstructionist, a spoiler, a man dedicated to slowing, retarding or halting the further advances of the human race. Occasionally a scientist, corporate leader or policy maker will cast doubt on my temporal sanity, insisting that my real desire is to turn back the clock of time; how far back is often determined by the ire of the assailant.

So begins Jeremy Rifkin in his eighth and latest book, Declaration of a Heretic. His accusers have included Stephen Jay Gould, prominent paleontologist and scientific writer, David Baltimore, Massachusetts Institute of Technology biologist and Nobel Laureate, Kenneth Boulding, economist and former president of the American Association for the Advancement of Science and Alexander Capron, former executive director of the presidential genetic engineering ethics commission. Why does a man who is criticized by such a range of prominent people attract our attention at The Land Institute? Who is this man?

As president of the Foundation on Economic Trends, Rifkin focuses his attention primarily on halting biotechnological research and development. Important questions need to be asked and addressed before we leap into yet another area of technology, the effects of which we know very little, he contends.

Rifkin brings his battles into the courtroom where he has succeeded in temporarily stopping the spread of the first genetically engineered organism, a bacterium which protects agricultural plants from frost. This landmark case has prompted the White House to assign an interagency task force to address government regulations as they pertain to the biotechnology industry. He has also successfully sued to keep the United States Army from building a biological warfare (based on genetic engineering) research facility in Utah. In October 1985 he again brought suit against the U. S. government. Along with a variety of co-plaintiffs, he is demanding that the U. S. Department of Agriculture be prohibited from inserting human growth hormone genes into the genetic structure of domestic livestock. The plaintiffs contend that such manipulation violates the naturally occurring distinction between species and thereby "undermines existing environmental relationships and poses a threat to genetic diversity."

Rifkin believes the implications of genetics research are far-reaching and require a look at the underlying assumptions of scientific inquiry. He does so in this book by framing the issue in the context of a history survey of Western, Judeo-Christian people. Ever since God banished Adam and Eve from the Garden of Eden, he begins, humans have been burdened with the anxiety of inevitable death and have consequently been searching for one thing: security. The Enlightenment marked a change in the perceived means by which security can be realized. Francis Bacon stated the new paradigm succinctly: knowledge is power, power is control, control is security. This shift set the stage for the transition from an agricultural to an industrial society in which efficiency became the ultimate value by which we measure, not only our technology, but ourselves.

The ideas of the Enlightenment continue to permeate contemporary society. In the scientific arena this worldview dictates that all scientific knowledge must be pursued so as to achieve societal security. Both the decoding of DNA and the splitting of the atom were inevitable steps in this endless pursuit of knowledge. Rifkin uses the worldwide insecurity spawned by the development of nuclear weapons as an analogy to the current development of biotechnology. It holds the same, if not greater, destructive potential as does nuclear technology. The power inherent in biotechnology leads Rifkin to proclaim "The transition from the Age of Pyrotechnology to the Age of Biotechnology is the most important and disturbing technological change in recorded history." He explains five problems with biotechnology.

First, biotechnology allows an increase in the rate at which solar energy is converted into economic commodities. In the short term this is tenable, but a look at the long term shows that living resources are as exhaustible as nonliving resources since they depend on the nonliving life support system of the Earth. Such a program favors efficiency and productivity at the cost of sustainability.

Second, the products of biotechnology are far more unpredictable in the environment than petrochemical products because they can reproduce and grow. Introducing a foreign organism into any environment has the potential of severely disrupting long-evolved patterns of interaction. One need only look at the damage that introduced species such as water hyacinths,

> The transition from the Age of Pyrotechnology to the Age of Biotechnology is the most important and disturbing technological change in recorded history.
>
> Jeremy Rifkin

starlings and pigeons have inflicted to understand the ecological and economic costs of such tampering. Doing a meaningful environmental impact statement on such organisms is nearly impossible. It is on these grounds that Rifkin has won his major court battles.

Third, Rifkin notes that the potential ability to freely interchange bits and pieces of genetic material between organisms has already set the multinational corporations on a worldwide germplasm collection drive. Ninety-two percent of the world's stored germplasm is being held in those countries that are leaders in the field of genetic engineering. The new technology will offer these powerful nations one more means of exerting control over poorer countries (where much natural biological diversity exists) by extracting their biological resources.

Fourth, the military has expressed a renewed interest in biological warfare now that they see the potential for devastating other countries with anthrax, diptheria and a myriad of other genetically-engineered pathogens whose cost of production would be a fraction that of our current nuclear arsenal. Questions of the legality and morality of such defense systems have been forced back into discussions on national defense by Rifkin's law suits.

Finally, the implications of genetically engineering humans is perplexing. Elimination of birth defects is the primary justification of such research. The implicit assumption in using the term "defect" is that there is some kind of perfection which can be achieved. How can we be sure that the definition of defect will not begin to include large noses, brown hair or whatever other attributes are seen as undesirable? Who will determine which traits are desirable? Will these tools not be ideal for a Hitler-type eugenics (the use of genetics to make "better" organisms) program in which one phenotype is favored over all others? Rifkin insists that the mere use of genetic engineering is eugenic in nature.

To prescribe a route to security which does not involve biotechnology is to deny that knowledge and power and control are the root of security. This scientific paradigm has been so deeply ingrained that challenging it is considered heresy. Hence, the title of Rifkin's book. He insists that a nuclear and biotechnology free future can only be reached via a radical redefinition of security. He offers an alternative: knowledge is empathy, empathy is participation, participation is security. We must empathize and participate with both humans and, most importantly, Nature. To follow this path we must "reconceptualize" knowledge, "redefine" our relationship to technology and "rethink" our economics.

In evaluating technology, the question of appropriateness is central. All tools increase the user's advantage over other people and the planet: the more powerful the tools, the greater the advantage. Nuclear weapons and biotechnology are examples of tools which are too powerful, because by simply using them we threaten the survivability or sacred quality of life. Appropriate tools are geared toward participation with the environment in which they are to be used. Developing such tools requires an understanding of the environment from an empathetic viewpoint. As in any relationship, that between tools, environment and people must be one of give and take, not mere exploitation.

An economic structure conducive to this type of progress must recognize that all life is based on solar energy and a limited pool of resources. Sustainability requires the maintenance of this pool at as large a size as possible and the recognition that any draining of the pool is borrowing against the future. The borrowing rate should not exceed Nature's reproduction rate.

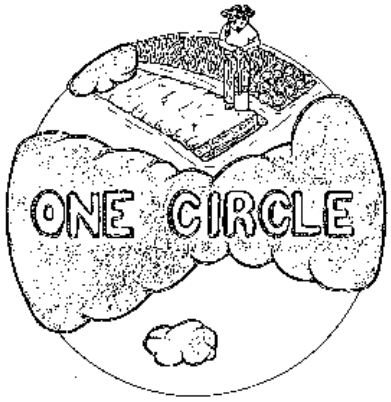
It is important to note that the pursuit of such knowledge can be as challenging, invigorating and stimulating as the pursuit of controlling knowledge, if not more so. Therefore, such a route is not contrary to scientific inquiry, academic freedom nor the march of progress. It is a redefinition of these terms which recognizes limits to humans' capability to control.

Rifkin admits that such changes are a lot to ask for, but he insists that the road to permanence requires such changes, since it is apparent that the conventional scientific paradigm has only decreased our security. Rifkin also points to areas where empathetic knowledge is slowly beginning to gain support: preventive medicine, some areas of applied ecology and solar and wind power engineering. While the changes may be slow, Rifkin stresses that each act which is not guided by a need to control or exert power is important in the process. Only by practicing a rejection of the power paradigm in our everyday lives will it be overcome.

This answer may seem trite to some people. If this comment were made by a desk-bound think tanker, I would agree, but Rifkin is actively challenging conventional wisdom in ways that force a public recognition of potential limits to current methods of scientific inquiry and technological control. While he may be chastised by many scientists and viewed with skepticism by some of my fellow Land interns, I commend his actions and his ideas, as presented in Declaration of a Heretic. I think he incites such anger amongst established people because he is successful in challenging the status quo. Those who have disagreed with him tend to have their own personal security rooted in the prevailing paradigm, believing that humans can control the use of technology.

I must, however, criticize Rifkin's presentation of his thoughts. Repetition is his forte--a skill which can be effective in lecture halls but quickly drains a reader's energy. At the same time, he does not adequately develop some of his ideas. For example, he devotes less than four pages to the section in which he discusses a rethinking of economics, and even this is not succinct. There are many examples throughout the book where adjacent sentences state the same ideas only with different wording. Fortunately Rifkin also supplies the reader with an extensive reading list which includes many more complete works.

The strength of his short book lies in Rifkin's ability to summarize and synthesize the writings of many environmentalists, peace activists, social critics and other thinkers and to integrate biotechnology into this developing worldview. Those concerned about the future of agriculture should seriously consider Rifkin's ideas during these times of unquestioned faith in biotechnology's power to "better" agriculture.



How to Grow a Complete Diet in Less Than 1000 Square Feet

by David Duhon
with special sections by Cindy Gebhard, John Jeavons, and Gary Stoner
Ecology Action, 5798 Ridgewood Rd., Willits, CA 95490
199 pp with charts and tables

Reviewed by *Lois Braun*

As someone who desires to be "politically correct" in what I eat, that is, to avoid foods grown by exploitation of other human beings or of this earth, I often find that my choices of food in a supermarket are all but eliminated. If I can't buy foods transported long distances, especially from places like South Africa or Central America, or out of season, or sprayed with chemical pesticides, or requiring stoop labor, or highly packaged, or containing chemical additives--and the list goes on--what can I buy? Moreover, how do I know for sure that food which appears to be okay by all of the above criteria really is so? Though buying food through a cooperative, or directly from the farmer are options which deal with some of the above issues, the only way to completely stop being part of our exploitative food system is to become independent of it by growing all of my own food. And yet that too seems to have its problems, namely that I am basically landless. I have available to me only 400 square feet of backyard and possibly a 600 square foot community garden plot. Surely that is not enough to grow a complete, nutritionally-balanced diet which includes the starchy staples not usually grown in a home garden.

One Circle: How to Grow a Complete Diet in Less than 1000 Square Feet is David Duhon's effort to disprove the assumption of people like me that we are incapable of self-sufficiency in food. "You do not have to wait until you move to the country...," he says, you can "free (yourself) by reclaiming responsibility for (your) own food production" now, with whatever limited resources you have.

Self-sufficiency is not the only inspiration for the book: in a chapter entitled "A Challenge," John Jeavons reports that current trends towards elimination of farmland through desertification and urbanization may combine with population growth to leave only 2100 square feet of arable land per person worldwide by the year 2000. By comparison, a typical diet in the U.S.A. today requires between 45 and 85 thousand square feet. A vegetarian diet in the U.S. requires 10,000 square feet. From reading this, one can conclude that justice demands that we learn to live on no more than our share of the earth's resources.

One Circle is not a gardening book. It refers the reader to John Jeavons' How to Grow More Vegetables for details of the Biodynamic/French Intensive gardening method on which it depends. Instead, One Circle is a tool to help you decide what to plant in your garden on the basis of your nutritional needs. In the section "Nutrition Reconsidered," the derivations of U.S. Recommended Daily Allowances are questioned, and lower amounts are set for several nutrients. But what makes One Circle unique is that it combines nutritional analysis with crop yield potentials. Whereas traditionally a food has been classified as a good source of a given nutrient if it has a high concentration of that nutrient in a weight of the food normally eaten, One Circle classifies a food as a good source only if it has a high ratio of the nutrient to the land area required to grow it.

Of course foods must also be fairly concentrated in nutrients on a weight basis, or else we would strain the limits of how much we can eat in one day. For example, onions, while being one of the most efficient foods in terms of calories per land area, such that a woman subsisting on onions alone could derive 2,000 calories a day for a year on only 530 square feet, are so weight-inefficient that one would have to eat almost twelve pounds of onions to

get 2,000 calories! The most food a woman can comfortably consume in one day is considered to be only 5 1/2 pounds!

Most vegetarian diets focus on protein as the hardest nutritional requirement to fulfill. But when the limit of land area is added to our physiological limit for weight of food consumable, calories become the limiting nutrient, because crops which are efficient both in terms of weight and of area are very rare. Grain and beans, the staples of most vegetarian diets because of their protein complementarity, are very efficient in calories and protein on a weight basis, but very inefficient on an area basis. Root and tuber crops, like potatoes, are much more efficient when land area is considered, and thus form the basis of the One Circle diet.

To simplify the puzzle of designing a minimal-area diet, the authors have chosen fourteen crops which show both weight and area efficiency for at least one limiting nutrient. They are collards, filbert trees (culture of which would require community cooperation), garlic, leeks, and onions, parsley, parsnips, peanuts, potatoes and sweet potatoes, soybeans, sunflower seeds, turnips, and wheat. Cindy Gebhard profiles each of these in a section called "The Crops." By no means are these fourteen crops meant to be an exclusive list: substitutions may need to be made in different climatic regions and further research may uncover new crops which qualify. And if there is extra space in the garden, a few not-so-efficient crops may be included to provide variety. But this variety is a luxury and must be recognized as such. As John Jeavons says, "Individuals truly committed to this effort may have to make difficult choices as to what their true needs are."

The final section of the book guides the reader through the mathematics of designing a minimal area diet. With tools such as area- and weight- efficiency tables and nifty little slide rules to aid with multiplication, the authors have done an excellent job of making a complicated process clear. Four sample diets are given, two of which are truly minimal in the area required--550 square feet for a woman and 855 square feet for a man. But these barely supply the minimum requirements for linoleic acid, pantothenic acid, Vitamin E, and riboflavin. Moreover, because only five or six crops are included, there is little dietary variety and little room for crop rotations to prevent insect and disease problems and to build soil fertility. The other two prototype diets--men's and women's averaged to 1400 square feet--are not nearly as ambitious to conserve space and thus have enough slack to allow for crop rotations. Duhon acknowledges that a diet which has as its goal merely to reduce area probably neglects the nutrition of the soil. Considerations of soil sustainability may suggest crops totally different from those we would use when considering only human nutrition. It may be that legumes and grains, though area inefficient in terms of nutritive yield, may contribute invaluable nutrients to the soil in the form of nitrogen and organic matter. Duhon thus concedes that, though it is possible to grow a complete diet on about 700 square feet per person, a more sustainable agricultural system requires about 2100 per person: 700 for food, 700 for non-food crops, and 700 for fallow under soil-improving cover crops. Twenty-one hundred square feet is the projected per capita land allotment, and this model does not even consider space for living quarters and other miscellaneous needs such as for food storage!

One may ask whether the authors of One Circle seriously advocate a one circle diet and garden, or whether they merely intend the book as an exercise in consciousness-raising. While it may have real applicability for those people of the world already suffering hunger due to local land scarcity, David Duhon is modest about its ability to end starvation in an overpopulated world. He acknowledges the problems in what he proposes, not least of which is that it does nothing to correct the inequitable distribution of land maintained by political boundaries and economic injustice. Duhon constantly reiterates that it is an incomplete solution; it may merely be an exercise for practitioners who live in countries with more than their share of arable land. But it is the start of a solution, and we must start somewhere. Duhon suggests that people begin slowly, perhaps by providing for their eating one day a week from a minimal-area garden and adding a day per week each year. Progress is slow, like learning about gardening. "Gardening has its own biases. It stimulates a slow approach to declaring what is true, for the awe that comes from working with nature, the soil, and plants will not let us easily declare truths from an organized collection of data that is only a faint shadow of reality."

Lake Wobegon Days

By Garrison Keillor

Viking; 336 pages; $17.95

Reviewed by *Bruce Colman*

Garrison Keillor, a tall person, writes short fiction and personal journalism for The Atlantic, The New Yorker and other periodicals; 29 of his comic pieces and stories were collected in 1982 as Happy to Be Here.

Keillor is better known--a virtual cult figure, in fact--as the founder, host, writer and house baritone of "A Prairie Home Companion," the phenomenally popular live radio program that originates in St. Paul, Minnesota, on Saturday evenings. "Prairie Home" features acoustic music, skits, satirical commercials and

Keillor's comic monologues. It is heard live nationally on the American Public Radio network (check local listings for time and station).

In reality, Keillor hails from Anoka, Minnesota (population 15,600). For the purposes of the radio program and of his first novel, here under consideration, he claims to come from Lake Wobegon, Minnesota (population not given, but by inference, tiny). This fictitious burg has one grain elevator, two parking meters, one traffic light, one police cruiser (with two constables), two car dealerships, and two churches: Lake Wobegon Lutheran and Our Lady of Perpetual Responsibility, a Benedictine Mission.

Keillor writes in Lake Wobegon Days that the town name comes from an Ojibway phrase meaning, "the place where (we) waited all day in the rain" (the brackets are the author's; he also translates the phrase as "patience"). Lake Wobegon has one bar (the Sidetrack Tap, site of the rastiest bar scenes this side of Mike Royko's Billy Goat's Tavern) and one cafe, the Chatterbox, where most of the town hunkers down two hot-beef sandwiches when the one-man municipal-works crew and fire department blows the noon whistle.

This review won't summarize a plot, because in a front-to-back, dominant-character sense, Lake Wobegon Days barely has one. Rather, it sketches a history, tells brief, interlocking stories, draws the reader close to a wonderful array of characters--teachers, farmers, small-town tycoons, ministers, short-order cooks, old women, nuns. Their hopes, resentments, memories, satisfactions, fears create the effect of a place like Dickens's London, teeming with life.

If you screw up in Lake Wobegon--drive your car onto the lake ice too late in winter, say, so it sinks--guys will tease you about it forever. Screw up bad--miss crucial free throws in a high school basketball game--and they'll leave you alone. It's the kind of town that the ambitious and able--and the weak, Keillor suggests by several examples perhaps including himself in the category--have left "to realize themselves as finer people than they were allowed to be at home." (Despite this assertion, Keillor's classmate has returned to be pastor at LW Lutheran. Other departees return at Thanksgiving, bringing new diets for their parents, or at Christmas, bearing wildly inappropriate gifts, as we all have done.

The people who have remained in Lake Wobegon may not be especially smart, but they have survival value. The laughs that Keillor derives from their predicaments, their obsessions, their adventures aren't won by slapstick or by showing us failure or hypocrisy or folly. Keillor's laughs come dear, not cheap, emerging from shared virtue and good character, from reassuring us of our neighborliness and strength. This is a rare thing in American humor; it accounts far more than does nostalgia, I think, for "Prairie Home's" popularity, and it makes this novel work.

Keillor's true subject is how daily life is shot through with grace.

Keillor writes a prose that can be turned to laughter, to tears (a chapter about the loneliness and steady toil of 19th century pioneering is heartbreaking), to compassion or satire, to a hundred effects. He is a brilliant parodist: of liberalized liturgies and scripture translations; of amateur history and old newspapers; of the kind of student poetry that creative writing teachers love. One character writes a set of "Dorm Songs," including this stanza: "A hard diamond of light/In the middle of the dark glass./Then 'Leave It to Beaver!'" His professor amends the last line to read: "Then a boy named for a small-boned creature!" and gives him an A.

My favorite effect of Keillor's is this one-sentence walk through desire and acceptance: "Some luck lies in not getting what you thought you wanted but getting what you have which once you have got it you may be smart enough to see is what you would have wanted had you known." (Keillor likes the line so much that Lake Wobegon Days uses it twice.) It aptly suggests the confidence that enfolds this book: confidence that the kid who is "forming a grudge against the world" will get over it, that the man crawling through a blizzard will arrive at the farm house safe and unfrostbitten.

This is a novel with a strong sense of weather--of hundred-degree summer days, 30-below winter nights. It stays close to small-town cycles of planting and harvest, gardening, spring cleaning, sports, school, holidays, civic rituals, revival meetings.

Keillor is in the most wonderful touch with his own childhood, and does lovely things with a boy's make-believe worlds; with the rituals and puzzlements of a fundamentalist upbringing; with a "belief in yourself" at age 14 "as a natural phenomenon never before seen on this earth and therefore incomprehensible to all"; with the irresistibility, at a certain age, while weeding the garden, of hitting your sister with an overripe tomato, regardless that Mother is watching and you're sure to get it; with the earnestness and daring of first love. This is not a child's book, but in part it's a great grownups' book about growing up.

"Prairie Home" fans may recognize much of the material in Lake Wobegon Days from Keillor's radio monologues. Reworked here, it has a harder edge. It's often more sexual and scatological than what he presents on the air, and this represents a considerable risk: what if it alienates all those listeners? But this is a risk well run. Inhabiting ground between pure fiction and autobiography, Lake Wobegon Days is a book to read with close attention, a ready smile, and a full heart.

Reprinted from the San Francisco Chronicle by permission of the author. Bruce Colman was an editor, with Wendell Berry and Wes Jackson, of Meeting the Expectations of the Land.

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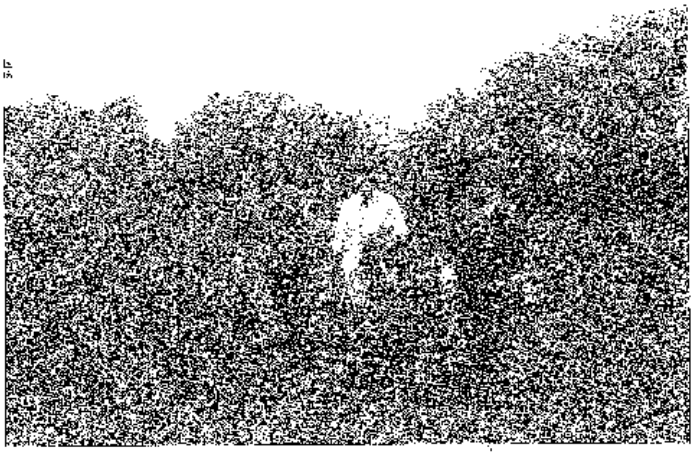

Michel Cavigelli and Juli Kois, ag interns, and James Henson, post doctorate in plant breeding walk through alfalfa field near research plots.

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