

THE LAND REPORT

Number
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Summer
1985



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Photographs in this issue by Danielle Carre', Michel Cavigelli, and Dana Jackson with special help from Bob Soule.

On the Cover

Dick Courter, member of the Board of Directors of The Land Institute, drew the cutleaf Silphium on the front cover in late July, after it had been blooming for a few weeks. He also sketched the back cover illustration of our sign in the 90 acre prairie pasture owned by The Land Institute. Though overgrazed in the past, this prairie has never been plowed. The Land Institute manages the area as a prairie reserve and is trying to re-establish a diversity of native forbs and grasses.

At The Land-----

What's the Story with This Place?

Juli Kois

The following is an interview between a generic visitor and a composite ag intern. It highlights the more common questions brought up by guests during a typical conversation or tour with one of the students.

G.V. Where do you all live, here at The Land?

A.I. That has to be the most frequently asked question by visitors. No, we live in town. Starting at the north end of Salina, Vern and Elisa live just around the corner from the co-op; Michel and Steve are about three blocks away, conveniently close to the city library; a couple of blocks from downtown is Mary and Holly's place, and then five blocks further south, Carol, Danielle, Lois, and Juli share a house. John, Lynda, and their son Logan live within easy walking distance of the best milkshake place in town, which is a favorite hangout of the interns, especially on Friday afternoons.

G.V. What goes on in the classroom?

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A.I. As you probably know, in the mornings we have "warm-up" at 9:00, although we're experimenting this year with having our twice weekly summer "warm-ups" at 1:00 p.m., to free up the cooler morning hours for field work. Warm-up is, for instance, Dana J. updating us on legislative action, Wes and Carol leading the debate on if, when and what parents should tell their children about the threat of nuclear war, or Holly describing her past work on biomass fuel production.

In the classroom this spring, the emphasis was on ecology. Beginning at 10:00 a.m., Judy led us through many scientific papers including "The Evolution of Life-History Traits" by S. Stearns, "The Physiological Basis of Crop Yield" by L. T. Evans, and "Intercropping--Its Importance and Research Needs" by R. W. Willey. One of the more intriguing questions to come out of our readings was "What constitutes a polyculture? Different species spaced alternately within rows? Spaced in alternate rows? Mixed swards? Small blocks of monocultures?" In anticipating future experiments, we hashed out the necessity of having many biculture trials versus establishing multi-species trials, and whether the observed interactions of a biculture could be used to predict the interactions of a polyculture. Judy is a strong believer in learning being fun, so one morning she facilitated a lively debate on the null hypothesis approach to competition in which pairs of interns assumed the roles of Drs. Hutchinson, Roughgarden, Simberloff, Strong, and Connor. The nebulous nature of the whole

argument was such that people kept coming out of character and then arguing against themselves as if schizophrenic.

There was also time devoted to the literature which focuses on a sustainable society. Many thoughtful comments were generated from our reading of Donald Worster's Nature's Economy. His statements in the epilogue on the need for changes in modern-day values led to a digression about the professionalism in the environmental movement and the need for knowledgeable membership in environmental organizations. We read essays from Meeting the Expectations of the Land, and again Worster had some valuable insights. I particularly liked his radical notion from "Thinking Like a River" of a "new homestead program...that would encourage many western farmers to relocate in more humid areas and learn the best practices for those places." This summer we had three class sessions to discuss Seven Tomorrows by Paul Hawken, James Ogilvy and Peter Schwartz.

G.V. *But surely, not everything is as serious as that sounds?*

A.I. No way! Joyful craziness abounds. Birthdays are celebrated with much enthusiastic singing, and Dana J. always manages to find time to make a couple of delicious cakes. We feasted on ice cream in honor of Carol's half-birthday since we won't be together when her true one comes in late December. Danielle has developed a reputation, not totally unwarranted, as an organizer of practical jokes, but she has

A summer "warm-up" in the children's area. Clockwise from 1:00: Mary Bruns, Vern Stiefel, Brian VanNess (visitor), Lois Braun, Carol LaLiberte', Judy Soule, Wes Jackson, Terry and Beth Percival (visitors), John Richards-Laatsch, Danielle Carre', Steve Ela, Weeden Nichols, Michel Cavigelli, Juli Kois.



plenty of support in Juli and Mary. Steve and Michel are most often the recipients because they take it so well--with wide-eyed innocence and broad smiles--but we have discovered that, while they are slow to reciprocate, they can be equally clever.

G.V. *What do you do when you're not in class or working on experiments?*

A.I. Classroom and field activities do make up most of the daily schedule but there is some variation. At least one person a day signs up to help Weeden with routine and oddball maintenance. Routine ranges from tool repair, loft construction in the new barn, to changing the composting toilet barrels. Oddball tasks, such as digging up the garden to repair a leak in the irrigation system or pruning trees along the fenceline of the 160, seem more the norm. Weeden also assigns us our unglamorous weekly chores like cleaning the classroom, kitchen, sawshed, or truck which we do on an individual basis.

Then we take turns helping Dana J. go through the legal page size list of things to do in the garden. Now, as the summer-time drought has set in, so too has the familiar pattern of watering and weeding. We share not only the garden work, but also the garden produce. Grazing in the garden is truly an educational experience. Many of us have learned, from the harvesting "mistakes" of others, the correct time



Lois Braun does an "oddball task."



Holly, Steve & Danielle enjoy a potluck lunch.

and method to enjoy the fruits and veggies of our spring labor.

One other but large crew job we do is help Dana P. keep the Herbarium looking good. The hand weeding is as tedious as any, but the tedium is relieved by the joy of spotting the species which are flowering.

G.V. *Do you go on any field trips?*

A.I. At the end of June, we went on the third annual field trip to the tallgrass prairie in the Flint Hills. Dana P., Lois, Michel, and Carol biked all or part of the 115 miles to our camp site. (Even though nearly all of the interns bike the seven miles out to The Land daily, most of us were not prepared for such an endurance ride.) After a refreshing swim in the nearby lake, we mingled around the campfire for a potluck supper and songfest. Birdwatchers delighted in the sight of egrets, herons and nighthawks and in the sound of bobwhites and whippoorwills. The next day we did an empirical study of the grasses and forbs of the prairie, noting how the species mix and numbers changed as we walked from lakeside to hilltop.

Now and then, some of the interns take trips on the weekends to visit other organizations. This past weekend, in fact, Mary and several other students drove to West Point, Nebraska, for the Center for Rural Affairs Annual Meeting. Earlier in the summer, John and Lois attended a Saturday farm tour of the Kansas Organic Producers.

G.V. *With all that, do you have any time for community involvement?*

A.I. Many of the staff and interns are active in the food co-op, the peace coalition, and/or the Audubon Society. Not long ago

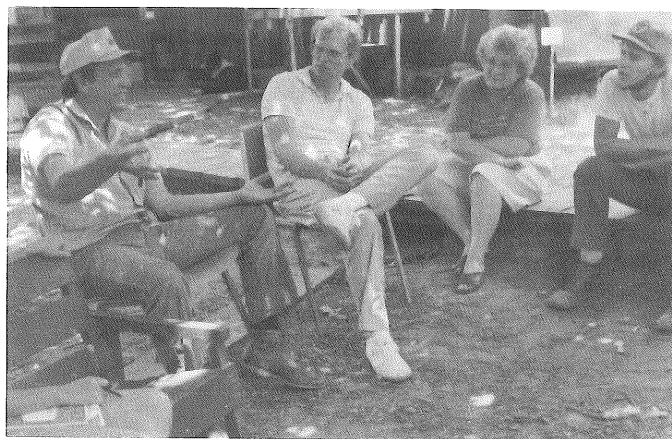
a bunch of us worked shifts in the co-op food booth during Salina's Smoky Hill River Festival. Several people have participated in demonstrations downtown on U.S. policy regarding Nicaragua. On June 6, a number of us traveled to Lindsborg to attend the public hearings sponsored by the Kansas Corporation Commission. Walter and Weeden presented their views opposing the increase in utility rates as a result of the Wolf Creek nuclear power plant going on line.

There isn't much free time left over after a full day at The Land, and nobody can take advantage of all the possibilities to get to know the community. But each person chooses an activity that is of particular interest to her/him; for instance, playing in a jazz band, tutoring in the adult literacy program, or taking a photography course.

G.V. *You must have many other visitors to The Land?*

A.I. Oh, yes. They run the gamut from bus-loads of local fifth graders to college freshmen. More distant folk often pop their heads in the door just in time to sit in on a "warm-up" discussion and sometimes we recruit them to help out nailing joists in the barn or transplanting in the plots. Among our ever-increasing number of visitors are the family and friends of interns, prospective interns, and former interns. We do ask that people who want to visit call ahead of time and make arrangements.

We've also had some very distinguished guests. For example, Michaela Walsh, of Women's World Banking, and Russell Phillips, of the Rockefeller Brothers Fund, came together and spent a day here. When Terry and Beth Percival, both psychologists from the University of Prince



Wes, Terry & Beth Percival, John R.-L.

Edward Island, attended our warm-up, they described to us their research on the development of morality in people.

Earlier this spring we were treated to a seminar by Gary Nabhan (Native Seeds/S.E.A.R.C.H.) on desert cropping systems which would feature columnar cacti, agave, and mesquite in addition to chiltepinos, tepary beans and squash. Some of the advantages he listed of domesticating wild species of these plants were that they have a "built-in" cultural acceptance, are already drought/heat-tolerant, and a wide range of economic products can be derived from the same plant. Gary emphasized that scientists experimenting with these "new" crops should not make the mistake of growing them in monocultures rather than polycultures.

Then in mid-June, Elroy Rice (Professor Emeritus at the University of Oklahoma) gave a formal presentation about some of his work on allelopathy. He pointed out that in low concentrations allelo-chemicals are often stimulatory, but that these same compounds in high concentrations become inhibitory. He believes the stimulatory effects will be of great importance in agriculture in the future and should not be neglected. He also stressed that other factors like plant variety, density, and soil type influence the degree of reduced competition by allelo-chemicals. The same day Dr. Rice spoke, members of the Research Advisory Group arrived to tour the plots and offer criticism of design or execution of our experiments. Paula Bramel-Cox, Orville Bidwell and Frank Barnett of the Kansas State University Agronomy Department helped us clarify our goals with their questions and comments.

In early August, Angus Wright from California State University, Sacramento, gave a slide show and seminar on the misuse of pesticides in Mexican agriculture.



Interns study species mix in the Flint Hills.

G.V. *How is this place financially supported?*

A.I. We are funded through individual contributions and grants from private foundations. If you want more information, you should talk to Dana or Wes Jackson.

And so it goes! Every student gets a turn leading a tour and doing this interview at least once during the term. Fortunately, our visitors are often people involved in interesting work themselves, and they also answer questions asked by the tour guides.

Ag Intern Program

Each year, The Land offers ten internships in sustainable agriculture to students at the graduate or upper-level undergraduate level. Interns receive full tuition scholarships and stipends of \$93 a week. They are part of the program from mid-February until mid-December.

The Land admits students of any race, color, national or ethnic origin.

Persons interested in applying can write The Land for the intern brochure which explains application procedures. Applications for the 1986 term should be postmarked by December 1, 1985.

Staff Changes

Weeden Nichols resigned from the job of operations manager at The Land Institute in August to become coordinator of the Salina Food Bank. During his year at The Land, Weeden supervised construction of the new barn, kept field equipment in good shape, and established some regular maintenance procedures which have been very beneficial to daily operations. Although not part of the job description, Weeden also served as "poet in residence."

Judy Soule, research associate in ecology, will be moving to East Lansing, Michigan, in August, but returning for certain blocks of time during the fall to teach and assist the interns in analyzing data from the 1985 experiments. She will also edit the 1985 Land Report Research Supplement. Judy has been a valuable member of the research staff since September 1984. The program benefited from her organization and scholarly thoroughness. We shall miss the fun Judy and Bob and their children, Jacob and Bethany, brought to the potlucks and other social gatherings of The Land Institute.

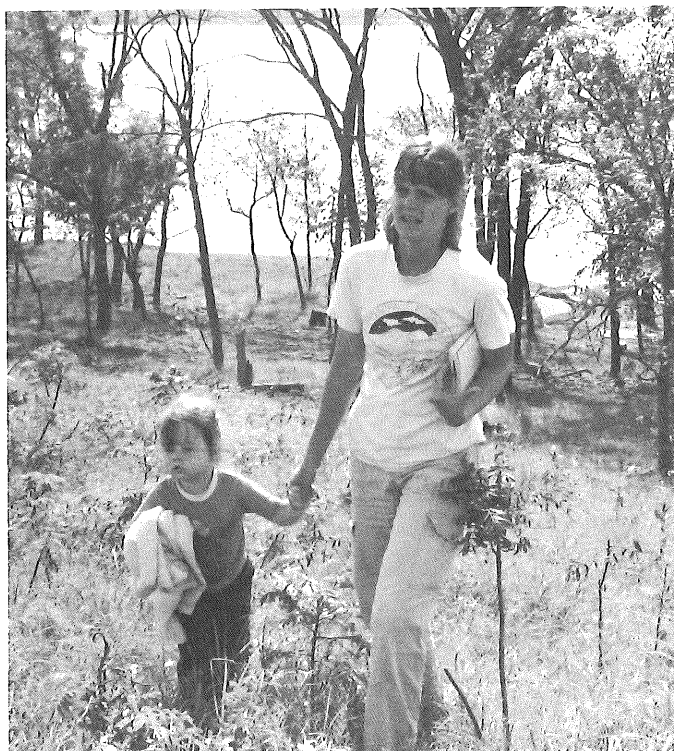
Jon Piper has been hired as the new research associate in ecology and will begin work at The Land in September. He received a Ph.D. in plant ecology from the Department of Botany, Washington State University, Pullman, in 1984. Jon is married to Mary Elizabeth Brown and has a son, Joshua. We look forward to having the Pipers in Salina.

Board Approves Development Effort

At a special meeting on March 30, 1985, the Board of Directors began to explore the possibility of longer-term financial stability for The Land Institute. Currently, the co-directors, Wes and Dana Jackson, raise money for each year's budget by seeking foundation grants and individual contributions. Although such support has been achieved successfully for nine years, the year-by-year budgets do not allow for long-term planning or program development. Research to develop perennial polyculture cropping systems modeled after the prairie must be done over at least a decade before significant results can be achieved. The Board agreed that The Land Institute needed some security in the yearly income to insure the continuation of the research program.

Karen Black presented a resolution at the annual meeting of the Board of Directors on June 29, 1985, to create an endowment fund. This would enable The Land to designate gifts, bequests and other contributions as "endowment principal" to be held, managed or invested by the corporation. Income would be available for The Land's general operating and/or capital expenditures. The Board unanimously approved the resolution.

The Land Institute has hired Joan Scott of Palo Alto, California, as development director. Joan has been researching the field of endowment fund raising and consulting with Wes and Dana Jackson and the Board of Directors on strategies for investment management.



Judy Soule & daughter Bethany on field trip.



Board members Karen Black and Bernd Foerster listen to Joan Scott, new development director.

Steve Burr—Special Friend of The Land

After serving nine years on the Board of Directors of The Land Institute, Steve Burr decided at the annual meeting on June 29, 1985, not to run for another term. Steve said that it was time for The Land to involve new persons with different backgrounds and fresh viewpoints on the Board.

Over the years, Steve Burr has been a special Friend of The Land. In 1976 when the first classroom building burned down, Steve contributed time and energy to help rebuild. Steve took responsibility to lead special programs: he gave a lecture on Aldo Leopold in a winter series on famous American naturalists, he did a Saturday afternoon workshop on wood burning, and he led a riparian habitat nature walk at a Prairie Festival. He shared his experience and expertise in rural real estate transactions when we purchased the 160 acres. As a farmer and a wildlife biologist with a special interest in land stewardship, Steve has been mentally engaged in our explorations about sustainable agriculture.

At the annual meeting, the Board thanked Steve Burr for his loyalty and service. According to the by-laws, Steve will remain as a Board member until a successor is elected. He has promised to continue being an interested participant in Land Institute activities even though he is not on the Board of Directors.

Calendar

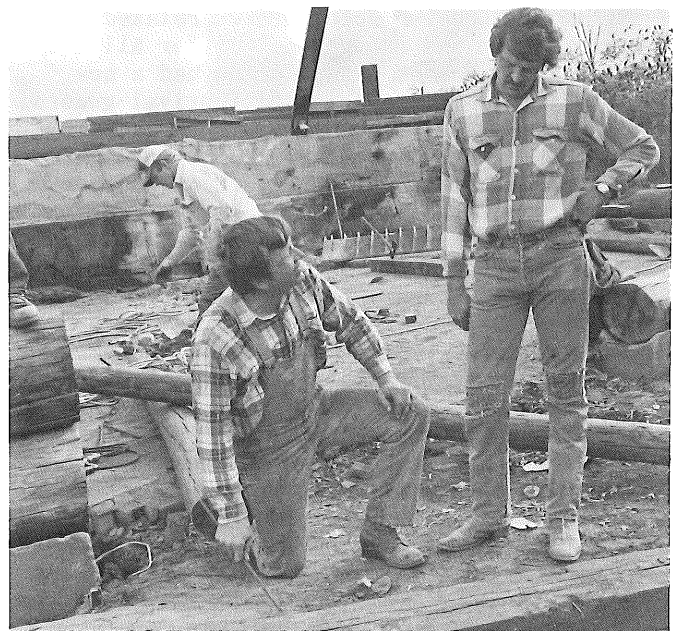
September 9 ----First day of Fall Session
 October 13 ----Visitors' Day
 December 1 ----Applications for the 1986 Ag Intern Program should be postmarked by this date.
 December 20 ----Last day of Fall Session
 February 10 ----First day of 1986 Term

Visitors' Day

Everyone from the mildly curious to the dedicated Friend of The Land is invited to attend our annual Visitors' Day on October 13.

This is a Sunday afternoon event, the program beginning at 1:30 P.M. and concluding at 4:30 P.M. We invite visitors to arrive early, to bring their own picnic and eat lunch on the grounds with staff and students of The Land if they wish.

The program will begin with a general introduction to The Land Institute, its work and the people who do it. Then there will be tours of the facilities and the experiments, followed by refreshments. The program will conclude with a talk by Wes Jackson and a discussion.



Wes Jackson & Steve Burr (Ken Baker in back).

Gary Snyder to be on Honorary Board of Directors

Gary Snyder agreed to become the fourteenth member of the Honorary Board of Directors of The Land Institute. Like Gary, each of the other members has visited The Land, has made a public presentation sponsored by The Land or has been on a Prairie Festival program. All are persons known for their views and their work in areas which reflect the interests and values of The Land Institute, and most have authored books. The first person named to this honorary board when he visited in 1977 was E. F. Schumacher, author of Small is Beautiful. The other members who honor The Land by associating their names with us are listed on the masthead (page 2) of every issue of The Land Report.

Prairie Festival 1985

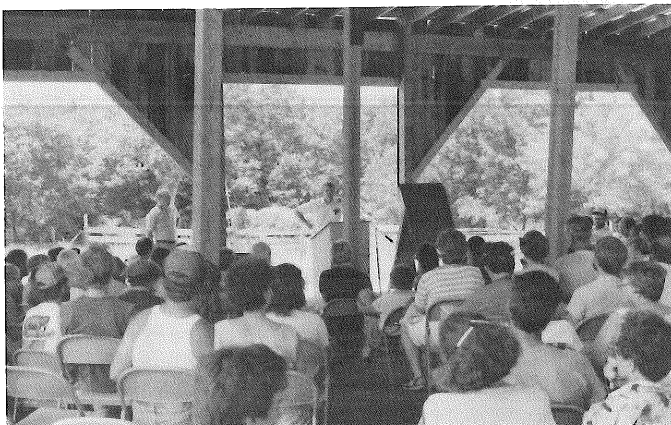
Patterns and Traditions for a Sustainable Society

Lois Braun

The weather forecast has always been a major concern to organizers of the Prairie Festival. Last year, rain necessitated moving part of the program indoors--indoors to less than adequate space. This year we relaxed, knowing that we had enough shelter for all the activities in case of rain, for we had a new barn that could hold all of the festival guests. The barn's main purpose is a place to store The Land Institute's farm equipment, for good stewardship of all resources is a part of sustainable agriculture. It is also a natural auditorium with three levels built to accommodate the hillside upon which it sits.

Getting the barn into shape was one of the major activities of the last week before the Prairie Festival. All the farm implements normally stored under its roof had to be hauled to the pasture, while smaller tools were put up in a loft hurriedly constructed for that purpose. Weeden Nichols strung wire so that we could have lights and an electrified sound system. Steve Ela and John Richards-Laatsch rototilled, raked, scraped, and packed the earth floor smooth, so that the 4-5-6 Speed-Up dance troupe would not trip. Finally, on Friday, as guests were beginning to arrive, the interns unloaded borrowed chairs and set them up in the barn.

This year, guests arriving on Friday were given a musical welcome and served refreshments



Wes introduces Gene Logsdon in new barn.



beside a campfire. Saturday morning activities were an extension of that welcome to the prairie, which, after all, is what the Festival celebrates. Guests chose between a self-guided tour of the prairie across the road, which, along with the herbary, was in full bloom for the occasion, or a tour of the grounds, or a bike tour to a prairie dog town. Those who chose the latter experienced in a physical way what is as much a part of the prairie as the prairie grasses, the never-ceasing wind.

The theme of this year's Prairie Festival was "Patterns and Traditions for a Sustainable Society." Gene Logsdon's opening lecture, "The Wisdom of Tradition," (see page 11) emphasized the importance of old solutions to old problems, especially as found in traditional agriculture.

The afternoon's program, "Toward a Sustainable Agriculture," featured many people who are working to develop more ecologically-sound ways of farming. Besides the traditional tour of The Land Institute's research plots, led by the staff and students, and the tour of The Land's organic garden, led by Dana Jackson, there were four other programs: a discussion of traditional organic grain farming by farmers John Vogelsberg, Martin Eddy, Raymond Meier, and Gene Logsdon; a program on prairie permaculture by Ira Harritt; a discussion of the changing roles of women in agriculture by Mary Fund of the Kansas Rural Center and farmers Nancy Vogelsberg-Busch and Rose Flora; and a presentation about Malachite Farm School, which teaches traditional farming, by Stuart Mace.

Saturday afternoon was also a time for art. Harley Elliott and Steven Hind read their poetry, and Terry Evans and Robert Regier introduced their art exhibit, "Prairie Transformations." Laura Clark performed the play, "Planting in the Dust," written by Nancy Paddock for the Land Stewardship Project. Laura played a farm woman who, with a strong sense of her historical roots in the land and her responsibility to it, is frustrated with her neighbors' poor stewardship of the land.

The evening was set off to a good start with music by Ann Zimmerman and Mike Mattson. Then Dana Jackson exercised another tradition of Prairie Festivals, introducing the audience to

the main speaker. By recognizing guests associated with the many organizations working for peace and justice, clean and renewable energy, soil and water conservation, alternative agriculture, etc., Dana reminded us that the wisdom shared at the Prairie Festival is not the exclusive domain of those giving programs. An important benefit of the weekend is the opportunity for people of diverse experiences to get together and discuss common concerns.

Gary Snyder was the speaker that evening, speaking on "Reinhabitation: Cultural Strategies for the Long Run." Snyder emphasized the importance of people living in a place long enough and sensitively enough to know it, to inhabit it. This continent must be reinhabited to attain a sustainable society, he said (page 12).

Snyder outlined several practical steps one can take towards reinhabitation. One is to learn to play an instrument, skill being more valuable than possessions. The skill of people who brought their guitars, penny whistles, castanets, and vocal chords to the campfire that night was certainly valued by all who joined in the song and dance.

Sunday morning turned cool, and many people unprepared for this change in weather could be seen walking around wrapped in sleeping bags.

While Saturday's program emphasized steps towards a sustainable agriculture, Sunday's program broadened the focus to a sustainable society. Programs were organized around the three concluding pieces of advice in Gary Snyder's poem "For the Children": "Stay together, learn the flowers, go light." Programs of the first theme, "Stay together," stressed that

Kelly Kindscher teaches edible and useful prairie plants to chilly, but interested Festival participants.



though we may fight different battles, we are all fighting the same war. Fred Bentley and Ed Reznicek, of the Kansas Rural Center, talked about rural communities. Mike Martin and Jeff Beach of the Sierra Club, Jerry Gillespie of the Salina Peace Coalition, and Mary Harren of Kansans for Peace and Justice, discussed the potential for a Green Movement in the U.S.. Liz and Steve Metzger, farmers, and Terry Shafer of Kansans for Safe Pest Control discussed how farmers and environmentalists are finding common ground. And Marsha Marshall and Mari Peterson, of the Kansas Natural Resource Council, told how non-environmental politicians can sometimes get involved in environmental issues.

The second theme, "Learn the flowers," emphasized appreciation of the natural world. Vicky Foth showed slides taken during her walk across the tallgrass prairie. Kelly Kindscher taught edible and useful prairie plants. Judy Soule, plant ecologist at The Land, led a prairie walk, encouraging people to think from the perspective of a prairie plant. Ken Lassman talked about the seasons and cycles of life in the Kansas Area Watershed, while John Firor, of the National Atmospheric Research Center, spoke on human manipulation of the atmosphere. And environmental folk art was presented by members of the Kansas Grassroots Art Association.

The third theme, "Go light," presented some practical ways to live in a more ecologically-sustainable manner. Gene Logsdon spoke on organic orcharding, Kelly Kindscher talked about community gardening, and Elisa Stiefel discussed diet in a sustainable society. Wes Jackson talked about the loss of rural cultural information with the depopulation of farmers.



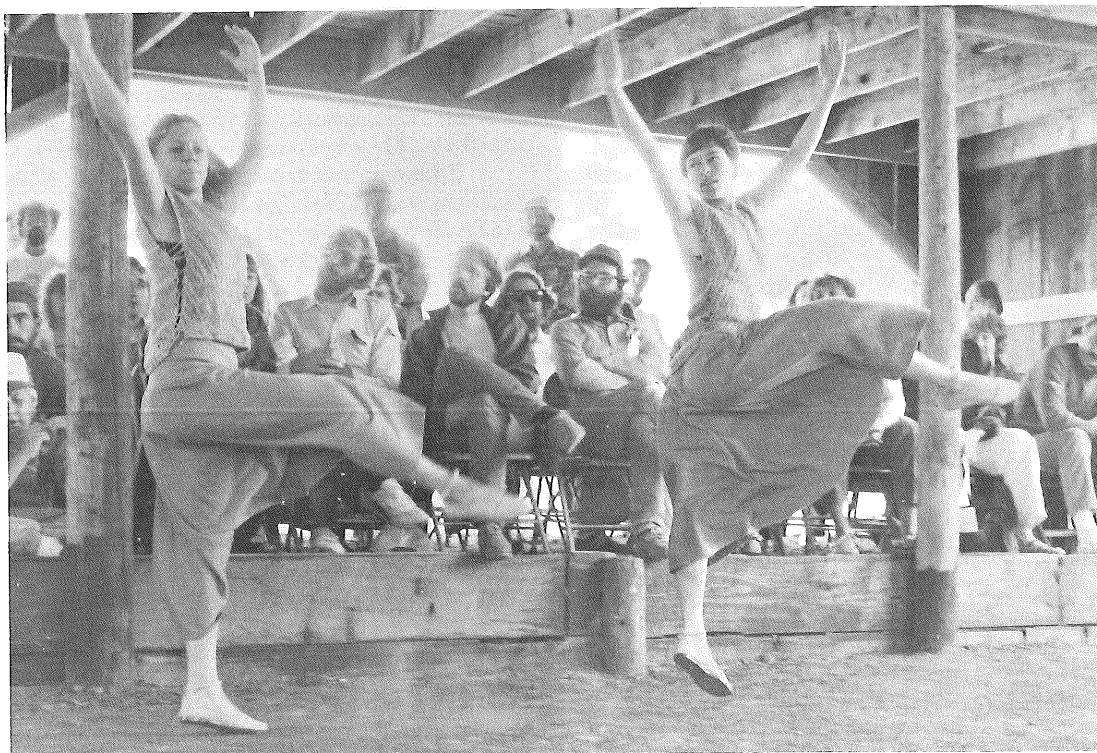
Laura Clark performs "Planting in the Dust."

The closing program was a real celebration, with two very special artistic performances. Joan Stone and the 4, 5, 6 Speed-Ups from Lawrence, Kansas, treated us to "Sunflower Symphony in Blue and Yellow," a dance in three movements, inspired by the wind, sunflowers, and grasses of the prairie and by the paintings of Vincent van Gogh. The first movement was set to the sound of ceramic wind chimes, tossed in a capricious wind. The trio of dancers were alternately caught in this wind, twisting and leaping, and becoming entwined with each other, and then let go, their large bell-shaped skirts momentarily hanging straight before being whipped into a frenzy of life by another gust. The second movement was set to words that Joan Stone read from Van Gogh's letters. As the words described a series of paintings van Gogh was doing of sunflowers, in gold and blue, Joan Stone danced his conflicting emotions of ecstasy and frustration at not being able to express his feelings about the sunflowers completely. The third movement, a quartet, was reminiscent of a field of wheat or corn growing. The dancers, in green and blue pantsuits, shades of young grass and old, hardly swayed from the vertical as rhythmical music sent them trotting briskly about, intent on the business of growing.

Gary Snyder brought the festival to a close with a reading of his poetry. In a gentle, soothing voice, he described the world as perceived by an artist--the beautiful and the ugly together, nature and society, deer and the Alaska pipeline, pausing frequently to let us soak in the love and humor of his images. The sun by this time had emerged to warm us on the outside as Snyder warmed us on the inside.



Joan Stone



The Wisdom of Tradition

Lois Braun

Gene Logsdon began his lecture, "The Wisdom of Tradition," by quoting David Pye, an English master cabinetmaker, speaking on the absurdity of attempting to redesign the chair: "Where the problem is old, old solutions will nearly always be best because it is nearly inconceivable that all the designers of ten or twenty generations will have been fools." Logsdon went on to say that if this is true in the design of a chair, then it will be even more true in agriculture, which is biological, for biology is out of control of humans and is older than they are.

To illustrate that old solutions are usually best, Logsdon mentioned the problems with some of our new agricultural solutions, like the cows that give double or triple the quantities of milk of ordinary cows but are extremely susceptible to mastitis and cannot calve without the help of a vet. There is a cost involved in our attempts to upgrade biology through genetic manipulations, and the cost is not always balanced by the benefits. Logsdon cited U.S. Department of Agriculture figures for agricultural productivity (1967 dollars) which showed that the revolution in agricultural technology of recent decades has not paid for itself. In 1984, net farm income was 10 billion dollars. In 1930-34, considered the worst period in agriculture, economically speaking, it was 7.5 billion only 2.5 billion less. In 1940 it was 10.7 billion, more than in 1984!

Gene Logsdon took issue with those who complain about the farm problem. "We do not have a farm problem in this country," he said. "We know exactly how to raise crops, technologically and ecologically. We have a money problem here." The farm crisis is a result of trying to make "biology dance to the tune of money, ever multiplying itself by high rates of interest." Economists do not seem to understand that biology doesn't change very much, and that "an ear of corn grows at the same rate whether the interest rate is 5% or 15%."

To illustrate how traditional wisdom has been forgotten by modern agribusiness, Gene Logsdon compared two 200-acre farms, one a modern farm and the other a traditional farm. The characteristic that distinguishes the traditional farm from the modern one is diversity. The modern farmer, with only one or two crops is extremely vulnerable. If the weather is bad he loses everything. So he hedges his bets and uses all the fertilizers and pesticides the banker recommends to reduce the risks. The traditional farm is also more versatile. Having both livestock and field crops on one farm mean that there is more cycling of nutrients within the farm, with manure going to the fields and feed going to the animals. Sheep can clean the feed rows of weeds, eliminating the need for herbicides, while hogs can glean for dropped grain after the corn harvest. The modern

industrial farmer does not have these options.

The 1984 corn production budget for the State of Ohio lists production costs for the modern farmer at \$396 per acre. Assuming that modern technology delivers the promised yield of 150 bushels per acre, and prices of \$2.40 a bushel, that comes to \$360 per acre, a loss of \$36. The traditional farmer probably has yields of only about 90 bushels per acre, giving \$216, but, according to Logsdon's calculations based on his own farm, the traditional farmer still makes a profit of \$154 per acre because of lower expenses. Logsdon did not include land and labor as expenses, but his assumption in excluding them is valid: with a higher profit per acre, the traditional farmer is able to make a living farming less land, and thus does not need to hire labor, buy bigger combines, or buy additional acreage at usurious interest rates. So the agribusinessman gets into debt while the traditional farmer, in his/her humble way, makes a living.

But the wisdom of traditional agriculture lies not only in its ability to provide the farmer with a living in these days when the modern farmer is getting deeper and deeper into debt. It lies in the wealth of relationships that it nurtures. While the 200-acre corn field is sterile, practically void of any life but corn and pests of corn, the traditional farm is a haven for wildlife. An abundance of life centers around even the humblest cowpie. The traditional farm is also hospitable to humans. While the modern farmer sits isolated in his steel and glass cab, on the traditional farm, people work in crews, interacting with each other. There is plenty of work for children and teenagers, who thus are able to earn a little money and learn what life is all about. Vandalism is reduced because youth, seeing a place for themselves in the local economy, have no need to act out their alienation. There is also a place for grandparents on traditional farms. They can be of immense help there, instead of being shunted off to retirement and obsolescence. The mixing of three generations is essential for the continuation of tradition.

Other people are always coming onto the traditional farm to buy produce or handiwork. These people see first hand how food is produced. They begin to worry with the farmer about whether it is too wet or too dry. The farmer, by close association with consumers, realizes more fully his/her responsibility to them. This farmer's milk is safe to drink because the farm family drinks it. This farmer's meat is safe to eat because the family eats it.

Logsdon closed by taking issue with the most common argument given against a return to traditional agricultural systems, that plainly the work is too hard. "Haymaking is hell," people say. Logsdon countered, "Haymaking is not hell...Haymaking is only hell when you make too much hay, which is what you have to do when farming is an industry."

Gary Snyder on Reinhabitation

Bob Soule

June 1st, a hot day, a warm evening. Most of the 400 participants in the 7th Annual Prairie Festival slowly shift in their folding chairs on the three-tiered dirt floor of The Land Institute's new barn, as they eagerly wait for Gary Snyder to speak on REINHABITATION AS A CULTURAL STRATEGY. Speaking out of the last rays of the setting sun, Snyder brings greetings to the audience from his "Mediterranean California Summer Dry Ponderosa Pine Mixed With Oak Bio Region" stating, "It's nice to meet." He then begins to outline his notions concerning sustainability through what he calls "reinhabitation."

Snyder told of a community meeting he attended for which the purpose was to set goals for forest management. As the meeting progressed, a silviculturist stated that the Forest Service had made plans for sustained yields for the next three hundred years, and that that should be sufficient. Snyder objected, saying that he expected "to be here for a thousand years." Although this seems like a long time, perhaps too long to fully comprehend, it is this long-term mindset that must be adopted in order to speak for the earth and all its organisms. As Snyder stated, we are "laying ground now, for what will be a long residence on this earth."

This residence, this long term stay on the planet will be determined, in his view, by people's ability to be "reinhabitants." A commitment must be made to a society and culture which will be sustainable. To do this one must look first to the past, to the history of some "inhabitory" peoples of the world, then to the future for ways to apply these histories to the struggle for sustainability on the earth.

From his background and training as an anthropologist, Snyder brought to the talk examples of sustainability in several "old way" cultures. Included was the warning not to confuse "old way" cultures with post agricultural societies. Tradition is sometimes a good teacher, but not all traditional cultures were sustainable; therefore it is necessary to look deeper into the belief systems of these cultures and beware any that devalue the natural world.

A lesson one can learn, Snyder said, is that of the humility of the expert towards nature as reflected through the use of language. He spoke of the Alaskan fisherman who, before embarking on a fishing trip, stated that he probably wouldn't catch much. And of the bear hunters who never mentioned the word "bear," but rather called it the "brown one" or the "big fella." This use of language today is a remnant of cultures as old as 60-80,000 years, in which the value system reflects not a superiority

towards nature, but a gentleness corresponding with skill and empirical knowledge.

He also told about the Inupiaq spirit revival, in which they are attempting to revive the culture and values of the old ways. Included in their list of values are such things as humor, humility, knowledge of family tree, household skills, knowledge of their language, hunter success, generosity, knowledge of their land, respect for elders, spirituality, love of nature, and gratitude. Interestingly enough, the worst vice to the Inupiaqs is that of stinginess. According to Snyder these values can be found in any old way culture. These are values of sustainability.

Snyder then spoke of the values of the Vhajji people of India, Fifth Century B.C. These include gathering for conferences, acting and gathering in unison, no rules without precedents, respecting elders, no confining of women, respecting holy places, protecting and defending the wise. These values correspond closely with those of the Inupiaq.

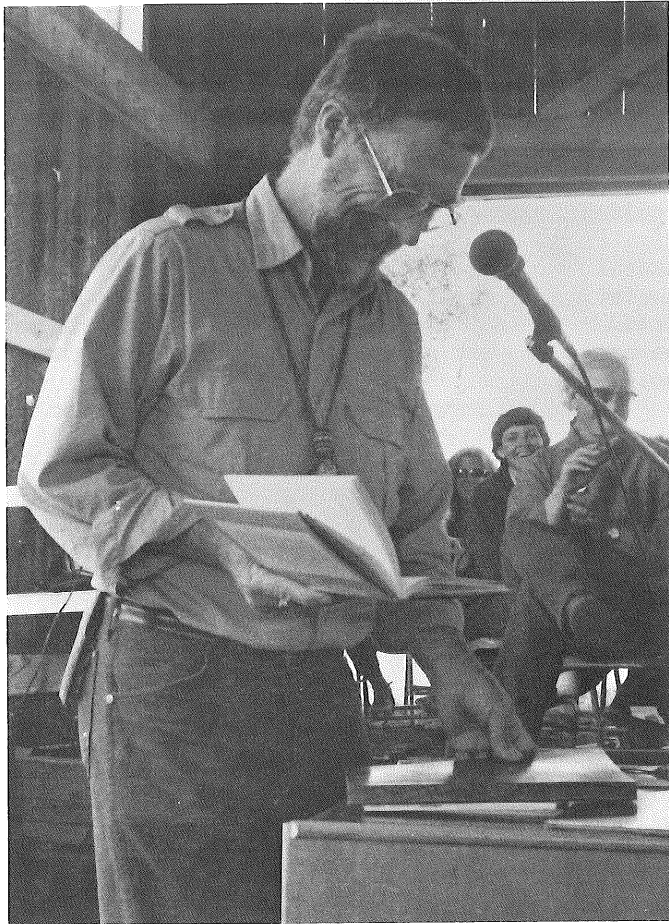
Finally, speaking now from his role as a poet, Snyder maintained that Art can connect culture to the land. He tells of the East Asian Wet Rice Agricultural Planting and Fertility Songs, better known as singing and dancing while planting seed. As the Japanese poet Basho stated in this haiku: The source of aesthetics: rice planting songs of the peasants in spring. Art can also be the signature of a region, as in the different ways of tying knots on the top of the thatch in Japanese villages, each one signifying a different place. Art can also help people become spokespersons for animals or plants as in the Corn Dances and Buffalo Dances of the Native American cultures.

"We have won, at some expense, a certain sense of freedom and autonomy in the modern world. Now we are looking for ways to find the webs and connections that can remake culture, remake a fabric of society to live in without necessarily reconstituting certain kinds of traditional cultures that were very binding."

Snyder, then, spoke about the future, a future where he envisions people as "reinhabitants," knowing where they come from and liking where they are.

First, he said, people will need to reinhabit themselves. This involves getting to know the self as a real biological creature, as a wild part of nature. Snyder made the strong point that humans are not domesticated beings, because they breed randomly and "wildly." Part of this knowledge of self rests in his belief that both language and consciousness (mind) are also wild systems. He stated, concerning consciousness, that "we don't have the capacity to make ourselves think what we think we ought to think."

Next, he emphasized that it is important to learn one's place. Don't get caught up in political boundaries as definitions of where one



Poetry Reading Concludes Festival

Bob Soule

"Being known as a Pulitzer Prize Poet is at least better than being known as a Beatnik poet," stated Gary Snyder as he took the floor of The Land Institute's new barn, following a sparkling performance of Sunflower Dances by the 4, 5, 6 Speed-Up Dance Company.

Noting that sunflowers are one of the first North American cultivated crops, Snyder launched off with several, as he called them, food chain poems: "Song of the Taste" and "Shark Meat." The latter relates the story of a Japanese fishing village which accidentally catches a shark and then feasts upon it. He followed this with "Love," an example of an "east Asian wet rice agricultural and fertility song"—a term he used in his Friday night talk.

Most of Snyder's reading, however, was of poems from his latest book, Axe Handles. He began by reading the frontispiece of the collection, a folk song from Fifth Century B.C. China, which is the inspiration of the title poem "Axe Handles." Following the poem, Snyder told of the connections between the folk song, his poem, and modern China—"how we go on."

Other poems from Axe Handles included: "For/From Lew"—which came to him, Snyder said, in a dream some five years after his friend Lew Welch committed suicide; "Changing Diapers"—at which time his son Gen, who accompanied Snyder to the Prairie Festival, disappeared (Gen was the changee); parts of "Little Songs for Gaia"—one of which, "Dead doe lying in the road," Snyder actually sang; "Three Deer One Coyote Running in the Snow"—which led to the comment that a major problem with education these days is that students are not allowed to see the thing first, then read about it, which is what happens in the poem:

"I walk through where they ran
to study how that news all got put down"
and "For All"—which led to the reminiscence by Snyder of he and his friends reciting this
"Pledge of Allegiance" at meetings:

"I pledge allegiance to the soil
of Turtle Island,
one ecosystem
in diversity
under the sun

With joyful interpenetration for all."

Finally, Snyder concluded the reading with two poems reflecting his interest and study and travel in the East: "At White River Road House in the Yukon"—in which he remembers his time spent studying the Buddhist monks; and "The Persimmons"—written in China and set in the area of the tombs of the Ming emperors, where persimmon trees abound, the last line a summation of the hope Snyder has for the earth—"people and persimmons prevail."

is or ought to be. Learn the plants. Don't mention any names that have political reasons for existence when describing home.

Finally, he said, make a vow not to move. The commitment to community and ecosystem must be over time in order to make a difference. Then, learn to play an instrument, so a playful contribution can be made to community. And lastly, practice a lot. This enables a focus of energy on skills rather than possessions.

Corresponding to these reinhabitory steps, Snyder gave some practical advice: don't try to do too much, leave lots of interesting and unfinished projects, assume there are many more creative angles to explore in the long run, and keep entertainment local.

Snyder finished his talk with a poem, "Night Song of the L.A. Basin," in which he described chaparral reinhabiting the city and freeways of Los Angeles, a reflection of the urban reinhabitation work of Nancy Morita, who has mapped out presettlement elk herds, salmon streams and the like in San Francisco.

*It's dark now, the sun has been long gone
over the trees and past the Smoky Hill River.
The guitars are tuning up out by the fire and
lingering in the air are Snyder's words from a
Madagascar poem describing stages of late
night: "the halving of the night, frog croaking,
colors of camel can be seen."*

-----Alternatives in Agriculture -----

Mid-Summer Research Report

Walter Pickett

This year, the agricultural research at The Land is distinctly different from previous years. Look down from the hilltop, and our plots in the valley are lush and green. Walk down among the plots, and the plants look vigorous, productive, and uniformly spaced. The Land's research area looks as it should.

All this did not happen by accident. This year the Research Staff built on our experience in previous years. For example, when it was time to plant in 1984, we found that weevils had destroyed much of our seed, and that mold had infected other seed. Both problems lowered germination rates and gave us problems in 1984. But we learned how to properly dry the seed, then stored much of it in a freezer, so this year we generally had good seed. Even with such precautions, the interns did repeated germination tests, identified some sacks of poor seed, and discarded them.

Soil preparation was better this year. In 1984, we worked the soil when it was too wet. This made it dry into hard clods, which did not get broken up by repeated discing and harrowing. We worked the soil when it was too wet partly because of our impatience and partly because we were not accustomed to that soil type. This year we waited and worked the soil at the right time. It paid off in better seedling establishment.

This year there were some improvements in experiments before they were even planted in the field. First, Judy Soule calculated how many replications we needed per experiment to get significant results, assuming the same experimental error as last year. She found that we needed twice as many replications as in 1984. Orville Bidwell and Wes Barker did soil tests so we could lay out experiments in such a way that soil variation was minimized.

Luck has been involved, too, in our work this year. While we were preparing the soil, the rains came at just the right times. After planting, we had moderate temperatures and well-spaced rains for germination. Cool weather extending through June and into early July helped the plants get established. On June 25, we hit a near record low temperature of 49° F. When July's blast furnace heat suddenly hit us (we recorded 110° on July 10), most plants were well established.

We have already learned many things this summer; some conflict with what we thought we had learned earlier. I had concluded that Maximilian's sunflower, Illinois bundleflower, and wild senna should be planted quite early, so the cold, moist soil could help break seed dormancy. This year's results suggest that Maximilian's sunflower should be planted early, but Illinois bundleflower and wild senna may be planted later, in warm soil. Perhaps early planting would have been necessary if the seed had not been frozen all winter; we do not know.



Danielle Carre',
Mary Bruns, Carol
LaLiberte' and
Walter Pickett
transplanting
sunflowers.



Michel Cavigelli harvests Illinois Bundleflower.

In the past, we have dealt with a trade-off of planting seeds 2" or 3" deep, where they will have plenty of moisture, versus planting seeds 1" deep where the plants have less soil to push through but they may dry out. Wes Jackson's brother suggested that we plant with a ridge over the row, then check for germination every day. As soon as the seeds start to germinate, we rake off the ridge, leaving the germinated seeds nearer the soil surface. We tried this successfully when we had to replant part of two experiments.

Even with the improved techniques, we did not get completely uniform stands. We decided to transplant until the densities were perfect. We discovered that Maximilian's sunflower and Illinois bundleflower transplant extremely well, and re-establish quickly. On the other hand, Dana Price found that different plants of wild senna break dormancy in the spring at quite different times. Possibly in 1984, the interns filled gaps in the wild senna-Illinois bundleflower biculture where plants were just slow to break dormancy.

An unintended experiment was carried out when we tried to destroy some of last year's research plots. Maximilian's sunflower, wild senna, and Illinois bundleflower survived being plowed once and disced twice. I was surprised that they were so tenacious, because they are all native here, and they have never been a weed problem.

Two things we have already learned are that F1 Sorghum bicolor (milo) X S. halepense (Johnson grass) hybrids will survive some win-

ters here, that Maximilian's sunflower and Eastern gama grass can establish themselves without any weeding and produce seed in their second year.

Something we still need to learn is how to improve our sunflower threshing. When threshed, Maximilian's sunflower stalks break into seed-sized pieces, which are very difficult to separate from the seed. We planted some experiments, knowing that we would have to improve our threshing technique.

From a mid-summer assessment, this has been an outstanding year for research. I cannot say it is the best ever, because this year's successes are built on knowledge gained both from previous successes and failures. I can say that this year is a turning point, because several experiments which we established will run from two to five years; at least one will last longer. This means that much of the time we spent in 1985 preparing the soil, testing seed germination, laying out rows, and planting can be used for other work in 1986. Even weeding will be reduced because the year-old plants will come up early and cover the ground. We will not increase the number of experiments because we have reached the limit of what we can harvest and thresh before the interns leave in December.

What our research staff has learned about proper seed storage, tillage, and planting will be applied again next year, with further refinement.

Eastern Gama Grass Experiment

Laura Jackson

As part of my graduate research at Cornell University, I set up an experiment on Eastern gama grass at The Land early this summer. Elisa Stiefel has been carrying it out and gathering data.

Elisa and I want to find out what influences seed yield in Eastern gama grass. In particular, we are interested in how timing (phenology) and position on the plant (architecture) affect flowering and seed set. To do so, Elisa has been marking on fifteen plants each flowering stalk as it appears. Several inflorescences are born on each stalk; each of these is given a number when stigmas emerge from the flowers. Then she inks a number on the thick, bony seed coat which indicates its position on the inflorescence. Elisa ties a small square of light green nylon net material and a rubber band strip to the developing inflorescences and collects them in paper bags when the seeds begin to snap off.

After the work is completed, we will know when the major period of flowering is and when the flowering is most successful (when most seeds are set). We will also find out where



Elisa Stiefel works in Eastern gama grass.

flowers are most likely to produce seed, due to a more favorable position on the reproductive stalk or on the inflorescence itself.

This information is important for two reasons. First, it helps to understand the limits to seed production in a perennial grass. Phenology and architecture may be just as important as energy constraints. Second, by knowing when and where flowering is most successful, we can select for plants which concentrate their reproductive effort in these areas.

New World Agriculture Group

Judy Soule

"...the recurrent problems of the human condition, including hunger, poverty, disease and war, result from power differences between classes."

"...solutions to agricultural problems are neither wholly technical nor wholly social..."

"...we reject approaches to science that pretend to be politically neutral."

"...we strive to consciously direct our work in alliance with the oppressed."

Reading more like a political manifesto than the typical scientific society's goals, these principles are the guidelines of a group

of scientists from universities across the U.S. and Canada called the New World Agriculture Group (NWAG, pronounced new-ag, for short).

NWAG members include ecologists, agronomists, entomologists, rural sociologists and agricultural economists. They are engaged in a variety of ecological agriculture research projects, from development of low-input agricultural systems in Nicaragua, to demonstration of yield advantages due to reduced herbivory in polycultures in Mexico, to a search for pesticide-free, high-yielding tomato intercropping systems in the midwestern United States.

The group is loosely organized like a scientific society. It functions primarily as a forum and communication network for scientists with common interests. NWAG puts out a newsletter (but no journal) and holds meetings twice a year for exchange of research results and ideas. Regional meetings in the West, Midwest and East are held each Spring. The 1985 national meeting will be at Cornell University, Ithaca, New York, in October. NWAG also sponsored for the first time a session of papers at the 1985 annual meeting of the Ecological Society of America.

Although now spread across the United States and Canada at several universities, NWAG's nucleus began in the early 1970's as a study group of professors and graduate students at the University of Michigan. They were grappling with the problems of integrating their interest in "basic science" with their desire to promote progressive social-political changes towards a more equitable and sustainable society. One of these professors, John Vandermeer, remains at the University of Michigan, actively promoting the goals of NWAG through his students and his own research.

A number of graduate students from the original core study group have dispersed across the continent to positions in other universities and seeded new groups (for example, Steven Risch at Cornell, Doug Boucher at University of Quebec in Montreal, David Andow at University of Minnesota). Other sub-groups have arisen spontaneously at other schools where similar interests developed (for example, Richard Levins and Richard Lewontin at Harvard, and Ron Carroll at SUNY Stony Brook are NWAG supporters). It is curious that only two of these schools house state agricultural colleges (U. of Minn. and Cornell U.), but even this number is encouraging. Perhaps when NWAG's current graduate students disperse to other universities, they will increase this representation in ag schools, and the current agricultural research structure will begin to take notice of this new wave of ecological agriculture.

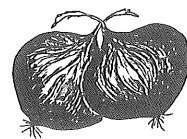
For further information, the midwest region's contact person is:

NWAG
c/o Dr. John Vandermeer
Biological Science Division
Natural Science Building
University of Michigan
Ann Arbor, MI 48109-1048



A Community Garden Experience

Vern Stiefel



Nurturing a garden in the fertile soils of central Kansas was a top priority for my wife Elisa and me upon arriving in Salina. In January, we shared the desire to savor a succulent carrot fresh from the soil or a vine-ripened tomato. Also, our canned good supplies from the previous year were almost gone, making it essential to establish "roots" yielding edible vegetables and fruits.

We had hoped to raise our garden in the backyard which usually comes with a rental house. However, the house we moved into lacked a yard, which forced us to look elsewhere for gardening space. This problem proved to be minor, as soon thereafter The Salina Journal advertised the availability of recently-established plots adjacent to the community garden started in 1984. The thirteen-dollars-fee would rent a tilled 20 X 30 foot area with straw for mulching and water provided. The site was only a couple of miles away, so after a brief enthusiastic talk, we decided to rent a plot.

A couple of years ago, the Kansas State University (KSU) Extension Service offered a course on gardening in Salina. Those who completed the course had the distinction of being called "master gardeners." Some graduates of the program wanted to teach others about growing their own food. As a community service project, the master gardeners, City of Salina Parks and Recreation Department, and KSU Extension Service cooperated in developing a community garden program. The city acquired land, an area behind the vacated Stimmel School. On a voluntary basis, the master gardeners spent time organizing the project. The extension service helped plow the soil, put up the fence, and gave advice during the planning process.

In 1981, they established thirty-two plots. Public response was so positive that in 1985 the project developers opened up thirty-one more plots directly east of the initial site. It is evident that much forethought and careful planning went into the design of the area. There are pathways, two and five feet wide, located between each 20 X 30 foot plot for easy accessibility. Buried pipes, with spigots arising at intervals, transport water to the plots. Hoses, wheelbarrows, and pitchforks are located on the site for gardeners' use. Such enticing features certainly attract persons with gardening interests who have limited space at home.

Elisa and I decided, after some research, that we could effectively use the space in our plot by companion planting in raised beds. With a newly-purchased shovel and rake, I set out on a cloudless day in early April to construct three 5 X 20 foot beds and one 5 X 8 foot bed. The job took six hours to complete, but I left confident that I had prepared excellent seed

beds for our future crops. The bed farthest east was devoted to a triculture of corn, beans and winter squash. During our spring classes at The Land Institute, we read papers on this type of intercropping in the tropics, and I wanted to see what the outcome of such a planting would be in Salina. So far the corn has fared the best; the squash is coming on, but the bean leaves are being eaten by insects and may yield little.

From our readings on companion planting, we seeded the remaining three beds with those fruits and vegetables thought to derive some benefit from one another. For instance, in the middle bed we planted rows of carrots, beets and onions on both sides of a central row of green peppers. In the westernmost section, we interspersed onions among a row of parsnips, potatoes and alternating broccoli and cabbage plants. Finally, in the smallest of the raised beds we put in five tomato plants (one on each corner and one in the middle) and two rows of onions between them. The yield from these three beds has been satisfying, although it may have been better with less dense spacing.

After we planted the beds, we still had an 8 X 10 foot section left for peas, pickling cucumbers and watermelon. A common practice that is used by Dana in The Land Institute's garden is to seed canteloupe between rows of peas. This efficient use of space prompted us to plant likewise, and so we put in five, eight foot rows of peas with two hills of pickling cucumbers, and one of watermelon between them. The cucumbers, for the most part, have done poorly. This may be due to inadequate soil nutrition or competition from the peas. Another possibility is that a bacterial wilt was transmitted to the plants by striped cucumber beetles, or it may be a combination of these and other factors. Since the peas have tapered off, the watermelon, which seemed to be stagnating in its development, has responded favorably and is branching out.

In assessing the growth of our garden thus far, we probably should have taken into account the relative lack of soil fertility before planting at the densities we chose. This is the first year that the area has been prepared for gardening. The soil is very cloddy, not at all friable, and the humus content is low. The effects of low humus were made evident by poor drainage during the heavy rains in early June. Were it not for the raised beds, much of our garden would have been inundated with water as the plots adjacent to ours were.

One might argue that the problem of soil infertility could be solved by applying fertilizer. We have chosen not to use synthetic NPK but rather animal manure, a resource which is all too often forgotten. This may have resulted

CONTINUED ON PAGE 22.

A Sense of Place

Nature's Creative Partner—

Emiel Christensen

Mary Bruns

"PaWiTo" is the name given to thirty acres of bluffs and canyons at the edge of the Platte River flood plain south of my hometown, Columbus, Nebraska. Unlike the adjoining bluffs, which are overgrazed and gully-scarred, PaWiTo is dense with wild plum, dogwood, mulberry, hackberry, willow, and maple. This special place abounds with hundreds of different species of plants, many of them put into place and cared for by a Columbus man known throughout Nebraska, Emiel Christensen.

This spring Emiel celebrated his 90th birthday with family and friends at PaWiTo. For the past thirty years, his family has opened PaWiTo to anyone who wishes to experience the peace, beauty, and diversity of this rich reserve. PaWiTo, with its network of trails, footbridges, and earthen shelters, is intended to provide a stimulating natural environment for the people of the rural community.

PaWiTo is also an example of land renewal and stewardship. When Emiel and his friend Elmer Bradley purchased PaWiTo in 1954, the rough bluffs, dotted with a few sumac and plum, were overgrazed and unsuited for agricultural use. Shortly after the Bradley and Christensen families acquired the land, they lost six hundred of the evergreens they had planted there. The evergreens had died for lack of water, so the families put in a well to water new plants. Eventually the land became cloaked with vegetation, and it began to retain rainfall. Watering became unnecessary.

In 1969 Emiel and Mary Christensen wrote:

When this tract was closed to grazing and cultivation fifteen years ago we were pleasantly surprised to note how quickly the scars of land abuse began healing. Birds and animals bring in plants almost as rapidly as we do...Although plant life on much of the thirty acre tract has been allowed to seed and spread according to its nature we have inserted trees, shrubs and vines here and there to determine what species thrive or survive...We have found that wild fruits and nuts do very well in these rough areas and that they add much to the recreational and educational value. Walnuts, filberts, chestnuts, wild gooseberries, chokecherries, raspberries, elderberries, grapes, mulberries and plums all thrive here. (From A 30 Acre Tract Dedicated to the Creative Use of Leisure Time by Emiel and Mary Christensen, 1969.)



Emiel Christensen

In a 1983 update on PaWiTo, Emiel wrote:

Now, almost thirty years later, signs of erosion have largely healed. A hurried plant inventory reveals sixty species of trees, thirty species of shrubs, fifteen species of vines and uncounted numbers of grasses and forbs, all vying for space, sunlight and moisture. Complementing this array of plant life are mammals, from shrews to deer, and insects almost beyond description.

All in all this small tract of once abused land has, in thirty years, shown an amazing capacity for recovery of its life support powers. And thereby, demonstrates mankind's opportunities to seek understanding, and ways of cooperating with, the Earth's creative potentials.

PaWiTo has always been a family enterprise. The name "PaWiTo" came from the first names of the Christensen and Bradley children, Paul, William and Thomas. Throughout PaWiTo, one can imagine the love and satisfaction the families felt as they planted, built and made repairs. PaWiTo became a family gathering place as well as a haven where other interested souls could surround themselves with nature's beauty.

The families made hiking trails to follow the natural contours of the ridges and canyons. The trails and look-outs blend into the land—

scape rather than interfere with it. A professional architect, Emiel used his knowledge of local soils to build shelters nestled into the bluffs. The underground shelters contain fireplaces and seating carved out of the earth and covered with a plaster made from PaWiTo clay. The shelters are the reason why people in the Columbus area refer to PaWiTo as "the caves."

PaWiTo expresses Emiel's life-long belief that we must renew our relationship with nature in order for our own species to survive. Emiel has been disturbed by the reactions of some visitors at PaWiTo, and he once wrote that many of them "tend to show much more interest in being entertained than in being enlightened." Emiel's concern about the separation between people and nature is closely linked to his concern about the conflict and division between peoples.

During World War I, Emiel served in Europe with both American and British armies. Emiel's war experiences gave him what he described as "a deep-seated conviction that mankind in the development of its cultural interrelationships took a wrong turn toward species destruction." Recently Emiel told me, "World War I blew the bottom out of everything I believed about people." The war experience moved Emiel for the rest of his life to think, read and write about why people do not get along with each other. For years he has contemplated ways by which human beings can learn to cooperate.

Emiel's search for a key to harmony is firmly grounded in his observations of nature. As a child, he was fascinated by the "collective efforts" of birds, animals and insects:

I watched blackbirds that would light in the cottonwood trees and then suddenly all take off. I marveled at the way they banked right, left, then rose and fell in unison. These blackbirds are indicators of how humans can act as a species. We just don't know how this collective action forms and operates.

Emiel believes that a human being can only reach his or her potential as part of a healthy community, which should be intimately integrated with its natural physical environment. The community should teach its members how to interact in a creative way with each other and with nature. "Communities are the seedbed of personal character," Emiel has said. Thus his personal and professional life has revolved around community planning.

Emiel was born near Blair, Nebraska. His parents, who were Danish immigrants, moved to an Omaha Indian reservation when Emiel was very young to rent land for farming. After he served in World War I, Emiel studied architecture at Washington University in St. Louis. He worked as a draftsman in various parts of the country before returning to Nebraska. When he was in his early thirties, Emiel settled in Columbus and established an architectural and community planning practice.

I asked Emiel why he chose Columbus, which had 6500 inhabitants at the time. One of his main reasons was that there was no one dominant religion. Emiel believed that Columbus would provide a more open environment than other towns having a dominant religion, because domination often leads to intolerance.

At first Emiel stayed in Columbus for six months to see if it would be a suitable community. A colleague from Cleveland came to visit and asked Emiel what in the world he planned to do in Columbus. Emiel replied that he was going to be a part of the community and that his job was environmental enhancement. Emiel laughs now as he says, "I haven't had enough money to get out of town since!"

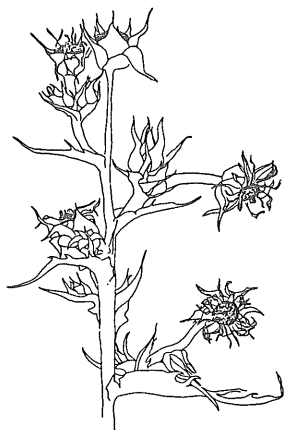
Emiel campaigned throughout Nebraska for people to improve their communities by enriching their physical and cultural environments. The Dean of the College of Engineering and Architecture at The University of Nebraska-Lincoln encouraged Emiel to develop a course in community planning. Emiel started teaching one of the country's first community development courses at UNL in 1949, when he was fifty-four years old. He wrote a text, provocatively entitled Created Pawns or Creative Partners, to accompany the course. Students worked on assignments that were unconventional for the time. They went into communities to observe and research problems with the goals of understanding and making suggestions for improvement.

Emiel continues to be recognized for his work to develop Nebraskans' consciousness of their environment. Every year the Emiel J. Christensen Environmental Award is given by Keep Nebraska Beautiful to a community which has done outstanding work in community beautification.

I feel especially fortunate to know Emiel Christensen, because he offers a rich part of the heritage of my hometown. Many rural communities like my hometown are being reduced to one bland common denominator of a "culture" made of television, fast-food outlets and franchise stores. Rural communities are losing much diversity, and young people are no longer open to their cultural heritage. In my discussions with Emiel, I could see a parallel between the lack of diversity in the physical environment and the lack of diversity in human communities.

Nurturing physical and cultural diversity is critical to preserving the environment and cultivating social harmony. Emiel Christensen has promoted such nurture throughout his life, at PaWiTo, with his teaching, and in his writings and speeches. Emiel has said, "The hardest thing for a human being to do is to remain open." My own understanding of my home community has been greatly enriched by merely opening my eyes and mind to the heritage of one of its elders, Emiel Christensen.

Anyone who would like to visit PaWiTo may do so by first contacting Emiel Christensen at his home in Columbus, Nebraska.



Prairie Birthday

Dana Jackson

"Every July I watch eagerly a certain country graveyard that I pass in driving to and from my farm. It is time for a prairie birthday, and in one corner of this graveyard lives a surviving celebrant of that once important event.

It is an ordinary graveyard, bordered by the usual spruces, and studded with the usual pink granite or white marble headstones, each with the usual Sunday bouquet of red or pink geraniums. It is extraordinary only in being triangular instead of square, and in harboring, within the sharp angle of its fence, a pinpoint remnant of the native prairie on which the graveyard was established in the 1840's. Heretofore unreachable by scythe or mower, this yard-square relic of original Wisconsin gives birth, each July, to a man-high stalk of compass plant or cutleaf Silphium, spangled with saucer-sized yellow blooms resembling sunflowers. It is the sole remnant of this plant along this highway, and perhaps the sole remnant in the western half of our county. What a thousand acres of Silphiums looked like when they tickled the bellies of the buffalo is a question never again to be answered, and perhaps not even asked.

This year I found the Silphium in first bloom on 24 July, a week later than usual; during the last six years the average date was 15 July.

When I passed the graveyard again on 3 August, the fence had been removed by a road crew, and the Silphium cut. It is easy now to predict the future; for a few years my Silphium will try in vain to rise above the mowing machine, and then it will die. With it will die the prairie epoch."

When Wes and I discovered several Silphium plants on the site we purchased for our home in

1970, we felt privileged and blessed. We protected these plants during our building phase, and when lawns were established beside the buildings, we mowed around the Silphium. The most prominent plant grows "man-high" in front of our classroom building, where it has little competition and some benefits from garden and grass waterings. This year it began blooming the last of June (I always mean to keep exact records as Aldo Leopold did). On July 2, we celebrated its birthday by standing around it and reading aloud what Aldo Leopold wrote about Silphium in the "July" segment of Sand County Almanac, part of which is reprinted above.

The whole of Sand County Almanac has been a constant source of inspiration and guidance since we first discovered it. When we decided to take a real vacation in the summer of 1984 and attend Shakespeare plays performed by the American Players Theatre in Spring Green, Wisconsin, we noticed on the map that the Leopold shack near Baraboo, Wisconsin, was only about an hour's drive away from Spring Green. Wes wrote to Charles and Nina (Leopold) Bradley asking for permission to make a pilgrimage there. To our delight, they not only gave permission to visit the shack, but also invited us to have lunch with them at their home.

The Bradley's beautiful house was built with stones from the area and logs from pines which needed thinning on the Leopold property. Nina and her family had planted these trees in the thirties as part of the restoration of the worn-out farm Aldo Leopold loved so much. Charles, a retired professor of geology at Montana State University, and Nina, with the help of Madison architect Henry Kanazawa, designed a house that employs practical energy conservation and solar principles. Charles keeps the three wood sheds in the yard full with a year's supply as back-up for the combination passive and active solar energy systems heating the house. They also installed a Clivus Multrum, the Swedish waterless toilet, as part of their resource conservation commitment. The house sits unobtrusively in the natural setting, and is, in fact, outbid for attention by one huge white oak tree (prairie oak) in the front yard. In the back, or south side, additional plantings of fruit trees, an impressive grape arbor, and the large vegetable garden made of beds edged with railroad ties, alongside a restored native prairie and a pond, create a comfortable blend of wild and domestic.

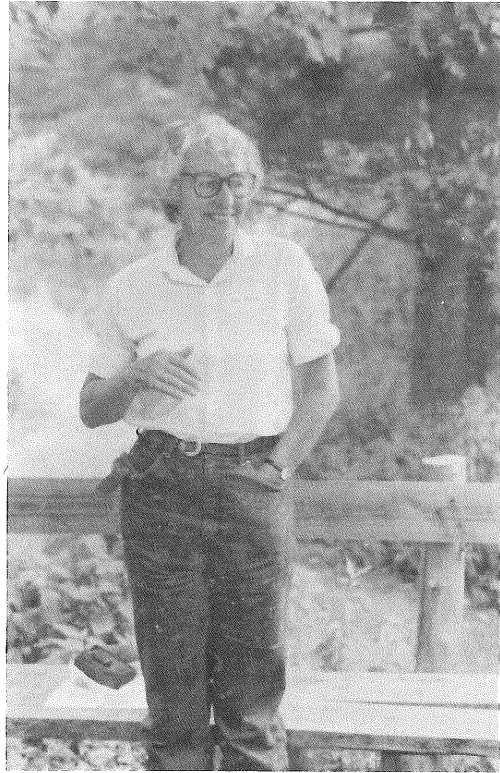
Nina and Charles are justly proud of the prairie restoration project. By turning over spades of earth and throwing in seed, Nina has established many species of prairie forbs and grasses on this three-acre plot. When we were there on July 12-13 of this year, the area was speckled with the bright colors of many prairie flowers. Nina pointed out with special joy the blooming Silphium plants. Such success in establishing these many prairie species from seed made me certain that this prairie was meant to be, that it was somehow a predestined Leopold tribute.

This place is more than a private home. It is actually the Bradley Study Center, the hub of research activity for the Leopold Memorial Reserve. The Reserve is a 1300-acre "private-landowners' cooperative venture in wildland rehabilitation and management." It was established fifteen years ago as a memorial to Aldo Leopold and is funded by private grants and donations. Frank Terbilcox manages the reserve, burning the prairie areas, maintaining the trails and guiding tours. Charles and Nina Bradley have directed the research program since 1976, and they coordinate activities for graduate students in the Leopold Fellowship Program.

The objective of the fellowship program is twofold: (1) to provide qualified graduate students with an opportunity for professional advancement while gaining broad environmental insights; (2) to develop information and understanding of the history, environment and ecology of the Reserve useful to management of this and similar areas.

There are from three to six graduate students and two undergraduate research assistants, mostly from the University of Wisconsin in Madison or Stevens Point, at the Reserve each summer. They live in the Mary and Jackson Burke Cabin adjacent to the Reserve, and use a laboratory in the first floor of the Bradley residence. When we were there July 13 for Wes and Wendell Berry to do a seminar at the shack, the research fellows and assistants were bustling around registering people, setting up chairs, serving lunch, etc., in much the same manner as our agricultural interns at Prairie Festival time.

Each summer, the students and invited guests are treated to a series of seminars held at the Leopold shack. Nina and Charles described the setting of the shack, a former chicken house, and how it appeared when the family began spending weekends there in 1936. Where one now sees abundant, shady trees, the Leopolds saw a worn-out field dotted with corn stubble. The Leopolds added a lean-to and built a fireplace, but otherwise did not modernize the shack. A hand pump in front and an outhouse back in the woods are still in use by those attending the seminars.



Nina Bradley

During our first visit in 1984, Nina and Charles told us that the Silphium, also called compass plant because of the north-south orientation of its leaves, was again growing in the Sauk Prairie Cemetery referred to in "Prairie Birthday." Five years ago, students in the Leopold Fellowship Program instigated the idea to restore compass plant to that cemetery triangle. Those in charge of the cemetery wouldn't consider it. Then three years later, after the supervisors were familiar with the passage from Sand County Almanac, they agreed to the request. Nina and the students not only planted Silphium, but also Liatrus, lead plant, and the main prairie tall grasses, big bluestem and Indian grass. Charles gave us directions to the cemetery after the seminar at the shack on July 13, and Wes and I, with Wendell and Tanya Berry, stopped there on our way to Spring Green. Sure enough, there along an iron fence is a young Silphium, or compass plant, its leaves dependably north-south as they are in our own plants at The Land.



July 13, 1985 at the Leopold shack seminar.

"The Highway Department says that 100,000 cars pass yearly over this route during the three summer months when the Silphium is in bloom. In them must ride at least 100,000 people who have 'taken' what is called history, and perhaps 25,000 who have 'taken' what is called botany. Yet I doubt whether a dozen have seen the Silphium, and of these hardly one will notice its demise. If I were to tell a preacher of the adjoining church



that the road crew has been burning history books in his cemetery under the guise of mowing weeds, he would be amazed and uncomprehending. How could a weed be a book?

This is one little episode in the funeral of the native flora, which in turn is one episode in the funeral of the floras of the world. Mechanized man, oblivious of floras, is proud of his progress in cleaning up the landscape on which, willy-nilly, he must live out his days. It might be wise to prohibit at once all teaching of real botany and real



history, lest some future citizen suffer qualms about the floristic price of his good life."

The young compass plant in the cemetery will not have a prairie birthday for another couple of years. But one day, motorists coming along the highway will again see the yellow flowers behind the iron fence. I wish that many would notice the *Silphium* and understand its historical significance as they drive by, but I doubt that they will. Yet, it is pleasant to know that the compass plant grows there again, and that the Leopold Reserve and Bradley Study Center exist to teach "real botany" and "real history."

GARDEN EXPERIENCE, CONTINUED FROM PAGE 17.

in short-term sacrifices in crop yield compared to the other plots using commercial fertilizer, but there will be long-term gains in tilth and fertility. Nevertheless, we have harvested plenty of peas, potatoes, carrots, beets, corn, onions, broccoli, peppers, and tomatoes.

Insect problems have not been too severe, considering that we don't use pesticides. Cucurlio beetles reached epidemic proportions on the cole crops, but tapered off drastically when the hot weather arrived. Other foraging pests (e.g. potato beetles, striped cucumber beetles, squash bugs, mites and a variety of worms and caterpillars) do have an adverse impact on yield, but have remained at endemic levels.

A satisfying aspect of the community garden is the chance to interact with others. Besides encouraging and helping one another, we talk about ideas for raising a successful garden and

observe each other's techniques. For example, one individual grows tomatoes around heaps of composting material. The fence enclosure supports the tomatoes, and at the end of the growing season he will have a cheap source of fertilizer to put on his plot for near year's crops.

Being involved with a community garden has been very worthwhile. In addition to decreasing the amount of food we buy at the supermarket, we have gained first-hand gardening experience. Salina's "master gardeners," KSU Extension Service, and the City of Salina Park and Recreation Department have provided an invaluable community service, which seems to be more in demand each year. Recently The Salina Journal reported that a new community garden area will be established in southwest Salina for the 1986 growing season. It is encouraging to find such projects being made available to the general public.

-----Considerations for a Sustainable Society-----

The Information Implosion

Wes Jackson

Though conventional wisdom holds that we are in the midst of an information explosion, a more objective perspective must surely convince us that the opposite is true. Think of what has happened to the world in the last fifty years, since 1935. There is little argument that there is less information of the biological variety. Species extinction at the rate of 1,000 species a year or so, especially in the tropics, coupled with the genetic truncation of the major crops, is undeniably a major loss of biological information. The new varieties released by plant breeders do not represent more information. "Variety" is a legal term and reflects a selection of biological information already present. Selection for a single gene for an entire population can result in a named variety.

Species extinction and genetic narrowing of the major crops aside, there is reason to believe that the loss of cultural information due to the de-population of our rural areas is far greater than all the information accumulated by science and technology in the same period. Farm families who left the land, people who practiced the traditions associated with planting, tending, harvesting and storing the produce of the agricultural landscape, gathered information, much of it unconsciously, from the time they were infants: in the farm household, the farm community, and in the barns and fields. They heard and told stories about relatives and community members who did something funny or were caught in some kind of a tragic squeeze from which an agronomic lesson was learned. But there was more. There was the kind of information carried by a farmer who looked to the sky and then to the blowing trees or grasses and made a quick decision as to whether or not to make two more rounds before quitting to do chores. Much of that kind of information has already disappeared and continues to disappear as farmers leave the land. It is the kind of information that has been hard won over the millennia, from the time agriculture began. It is valuable because much of it is tuned to the harvest of contemporary sunlight, the kind of information we need now and in the future on the land.

A friend of mine, a distinguished professor in a major university, is terribly alarmed about species extinction in the tropics. He is a leader in the fight to save rain forests everywhere. As a person who has joined the fight to preserve the biota of the planet, he gives numerous talks each year about the problems of over-population, resource depletion, pollution, etc. He heads the library committee for his university and is much impressed with the "know-

ledge explosion," how much we now know, and how much better educated graduate students are than they were when he was a student. As do most Americans, he sees Silicon Valley and the computer industry as representing this expansion of knowledge. I suggested that there is less total cultural information in the U.S. today than fifty years ago. He would not agree. I was thinking about the cultural information just mentioned, the information that has left the countryside, the kind of information that is a necessary basis for a sustainable or sunshine agriculture. What we had in 1935 was, of course, not adequate for saving the soils or preventing the countryside from being chemically contaminated. There was too much rural ignorance, cruelty, and xenophobia in 1935, and no one would want to romanticize that side of humanity or culture. Nevertheless, where we were in 1935 was a better "take off" point for where we need to be than where we are now.

My concern here is the serious reduction of people on the land who can pass on to future generations the skills, the traditions, the passion and the values, which they will need to farm well on an energy budget consisting of "contemporary" energy. Contemporary energy is that which arrives from the sun and is harvested in a horizontal manner by plants and then humans. Today we are dependent upon old energy, extracted vertically through fossil fuel shafts and wells. Although contemporary energy has a low density, its supply is assured. But it requires high cultural information to harvest and store it safely for future human use. The information now piled up due to scientific discovery of how the world works pales by comparison. Even though most of this scientific knowledge is likely to stand after the fossil fuel glut is over, the technological array put in place to exploit this knowledge is less trustable, for it will have occurred in a fossil fuel-based infrastructure and will likely not be appropriate for a sun-powered future.

The culture seems to believe we are in the midst of an information explosion because of the status granted the knowledge accumulated through formal scientific methods. In contrast, knowledge accumulated through tradition, daily experience, and stories, mostly in an informal setting, has little status. We have taken this "folk knowledge" for granted, I suspect, for however complex it might be, it was not all that complicated to internalize. It was achieved second nature, woven in with the rural setting, the daily work, the values and moral code. It is more the legacy of the dead than the living. The more respected body of knowledge, learned through formal discovery or revelation of discovery in classrooms and textbooks, is of a different order. More discipline is involved both in the discovery and in learning about the

discovery. And though most of this information is not all that complex, it is more complicated for us to learn and internalize. Maybe this is the reason we assign such knowledge greater value than that which we picked up through tradition. There has been an explosion of the formal knowledge. But what was necessary to make it accumulate so fast led to a destruction of the other older, less formal knowledge. We have cut the sacred groves to build temples.

Species and individual organisms spread across the land surface of the planet, tuned to local environments, with potential to renew the earth and run on sunlight, are more or less special creations for the spaces they inhabit. The loss of such diversity from the landscape is very serious. Like my professor friend, I worry about this loss of genetic stock, for it is a loss of the most important form of information on the planet. But the loss of cultural diversity across the land surface, cultural diversity which was just beginning to be more tuned to the local environments of our recently-discovered America, is now rapidly disappearing too. I suspect that we pay this disappearing diversity such little respect because of the illusion that knowledge overall is more plentiful. Species diversity was hard won. Numerous deaths stand in the background, in the evolution of the current life on earth. Cultural information, including agricultural information was hard won, too. Countless deaths stand behind this information, as does lots of anguish and hurt. That is why rural places have traditionally been the source of the lasting values of a culture. The human war against the tropics is the same war that is being waged against agriculture and rural culture.

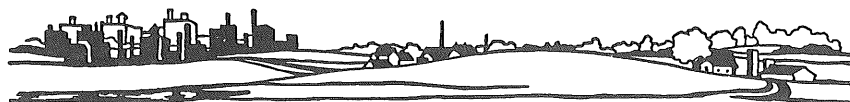
Part of that war against rural culture can be seen in the negative attitudes in our larger culture about rural places and rural people. They are as deep as the worst form of racism. A reviewer of the film Country in the New York Times said that Jessica Lange was too beautiful to be a farm woman. A reviewer of a recent book by Wendell Berry said that although Mr. Berry was a farmer, he was "an intelligent farmer." People who would be outraged if they heard a black called "nigger," or a woman a "little girl," make such statements and see nothing wrong with them.

A biologist friend at another major university, who is very concerned about species extinction, revealed his prejudice against rural places and rural people. During an exchange of family gossip, I mentioned that our son was a student in Lawrence, at the University of Kansas. He said, "Too bad" and that he was sorry he was in Lawrence. I said that my son liked it there, and he replied, "Well, I guess it is better than Salina." What I suspect was at work in the mind of this professor was a combination of cultural

snobbery and boredom with the unglamorous Kansas landscape. Salina, Kansas, is a town of 40,000 people, most of them of rural origin, descendants of those who possessed information about the farms and ranches on which they had been raised and from which they eeked out a living. It's true, they may have done stupid things on those places, and many were probably poor at their work, which made them lose their farms. But most of them were driven from the land by the industrialization of agriculture.

Their experience exemplifies a law at work in the world, a law of human ecology: high energy destroys information. High energy contributes to the arrogance of university professors who, though righteously appalled when one or more species go down the tubes, pay little attention to farmers going down the tubes and the loss of cultural information that represents. This cultural information, which was hard won through sweat, tears, injuries and death will have to be won back in the same manner, and not just for the land, but for the urban culture too. Though cultural information can evolve faster than biological information through mutation and selection, it will be slow by ordinary, human standards. It will be gut-wrenching during the re-establishment phase, and the land will experience further abuse. The eyes-to-acres ratio will have been even more distorted by then, and I fear that the industrial model for agriculture may be regarded as even more necessary right before it collapses.

My point might be best summarized by the following controversial consideration. 'Lung cancer, the nation now believes, is primarily due to cigarette smoking and could be greatly reduced if no one smoked. I don't smoke, never have, and believe myself that it causes anguish for the millions who die, and for their relatives and loved ones who watch them die. It is a cruel disease and I wish it were gone from the earth. I believe that reducing the tobacco subsidy could help. But the people who grow tobacco are small farmers, by and large, people who carry cultural tradition in their heads and bodies. If they were to stop growing tobacco, thousands of these farmers would be forced into the cities away from the small places that have sustained them and their families for generations. A great deal of cultural information would be lost, even as the number of cases of lung cancer would decline. Which would be worse? To have the high incidence of lung cancer or to lose the agri-cultural information? Of course, our priority should be to find substitute crops for these farmers to grow, substitutes that are as financially rewarding as what is now grown. But if we can't or don't, then the maintenance of cultural information may mean fewer deaths for the future than the prevention of cancer due to reduced use of tobacco.



Steven Hind

Fall Day

Wind brings its old news blowing
through this house in a crack in the hills
where two fields lie still under their loose
bare skins. In their rooms the table and bed
have been alone a long time, hunched in the
dark
like old men trying to get up. Once, twice,
again
at night winds raps a door against its jamb.
Nobody's
home to stop the question. Wind keeps asking
hinges
about letting go. Mouse and black widow return.
Wind reaches out and pulls a brick loose. The
rest
of the chimney stays clenched in its old mortar
against the sky. Take your time, says wind.

Prairie

Foundations in grass
a tracing of bricks squared up
Such empty houses

Lone stumbling uphill
posts ajar on brittle wire
Fences giving out

Owl slips from his limb
skims the brown windy grass
So full of absence

Having no choices
old cellars hold a darkness
Keeping what's given

Choosing Sides

Look at the nail
stained houses
floating
like arks
in the wheat.
You decide
if the harvest
justifies
their grim doors.

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----- Alternatives in Energy

Wind Machines Crippled

On June 21st, according to weather and emergency preparedness authorities, South Salina and environs experienced a "downburst storm." Many residents swore it was a tornado, though no funnels were sighted. Certainly the extent of damage in the vicinity was commensurate with the extent of damage usually associated with tornadoes. A "downburst storm" is a phenomenon associated with tornadoes and occasionally with systems of violent thunderstorms. In a "downburst storm," a large mass of cold air (cold air being heavier than warm air) plunges downward from a high altitude, gathering momentum as it falls, and strikes the surface at a tremendous velocity, spreading at high velocity in all directions from the area of impact.

The Land experienced negligible damage to trees and buildings at ground level, but extensive damage to the 1933 Jacobs and 1984 Windcraft wind-powered electrical generators, high on their respective towers. The Jacobs is designed to mechanically protect itself electro-mechanically. However, both machines were struck so suddenly by winds of such high velocity that neither could protect itself. The Jacobs, due to the great centrifugal force generated by the sudden violent motion of the blades, threw a blade shaft completely through the cast governor housing. When the Windcraft was struck by the same violent onslaught of wind, two out of three of its tough Sitka spruce blades were destroyed, apparently by striking the tower while bent backward by the wind. The aluminum cowl, covering the generator itself and some of the electronics and associated gear, was popped open, and such items as large electrical capacitors were spread over a wide area. The cast housing of the electrical generator itself, normally secure inside the cowl behind the blades, was wrenched loose from its normally secure attachment.

Repairs to the Windcraft will be expensive, and the greatest difficulty will be presented by the location or fabrication of blades comparable to the old ones. The Land Institute has retained faithful former Land student, former staff person, and wind person John Craft to coordinate repairs and get us back into the wind-electrical business as soon as possible.

For those who may be discouraged (we do have our moments,) a recent release by the American Wind Energy Association states that wind production of electrical energy in May 1985 was nearly four times that of May 1984, 14 times that of May 1983, and 200 times that of May 1982. So somebody is putting money and resources behind a perception that wind generation is economically feasible now. We are still committed to renewable energy sources, even if we have received a blow to the economic feasibility.

Weeden Nichols

Conservation Tillage: How Sustainable?

Introduction

Danielle Carre'

Soil erosion was dramatically brought to the attention of the nation in the 1930's with huge duststorms that darkened the skies. It was as one of these duststorms passed over the nation's capital that Congress passed legislation establishing the Soil Conservation Service (SCS) with Hugh Hammond Bennett as the director. Initially the SCS received ample monetary support and federal personnel. The enthusiasm for this new program resulted in part from the recent drama and discomfort caused by the duststorms which deposited blankets of brown dust everywhere.¹

Although wind erosion was a major problem during the Dust Bowl, water runoff eroded a far greater amount of land.² The SCS, through the conservation districts that it developed, advocated the use of terracing, contour plowing, tree shelter belts, strip cropping and grassed waterways. The adoption of these techniques was rapid. Farmers were convinced by the SCS that these techniques would not only reduce soil erosion, but would also provide them with increased yields and greater profits. The public deemed the SCS program successful and considered soil erosion a problem under control.³

Duststorms are no longer a common sight on our farmlands, but soil erosion still removes topsoil at an alarming rate. Our present soil erosion problem is, in part, the result of the expanding world grain market in the early 70's, which encouraged farmers to put more land into row crops.⁴ In addition, farmers also brought land not suitable for row cropping into production.⁵ The agricultural community explicitly followed the advice given by former Secretary of Agriculture Earl Butz to plant "fencerow to fencerow." Profits increased, but so did soil erosion. With short term production gains in

sight, many farmers considered techniques used to prevent soil erosion as either inconvenient or economically unfeasible.⁶

Approximately five billion tons of soil per year are washed away from our land, more than what was lost during the Dust Bowl. Government estimates indicate that soil erosion exceeds topsoil formation on more than one-third of the U.S. farmland.⁷ In other words, we are mining our soils with our present agricultural methods.

The crisis we are facing has not been readily evident. The application of fertilizers and pesticides has produced high yields, giving the false impression that our agricultural technology is sound. But chemical applications can compensate for soil losses for only a short while. The agricultural community must come to terms with the fact that our farming methods are not adequate to protect our soils. We should work to develop a new system of agriculture that will reverse this destructive trend.

Conservation tillage is a recent technology that is being hailed by many in the U.S. Department of Agriculture (USDA) and agribusiness as a solution to our soil erosion problems. Promoters of conservation tillage declare that these practices will not only reduce soil erosion, but will also cut production costs. Many farmers are starting to adopt conservation tillage practices. In 1982, an estimated 11.6 million acres of farmland were in no-till. The USDA predicts that by the year 2000, 85% of all cultivated crop land will be in some form of conservation tillage.⁸

Conservation tillage, as defined by the Resource Conservation Glossary, is "any tillage

EDITOR'S NOTE: From time to time we are asked why The Land Institute researches the potential of seed-producing, perennial polycultures to replace conventional crops on erodible land when no-till systems are already being used to prevent soil erosion. A reviewer of Meeting the Expectations of the Land faulted the editors for not recognizing the role of no-till methods in a sustainable agriculture. In this section, researched and written by Danielle Carre', Vern Stiefel and Michel Cavigelli, we take a closer look at conservation tillage, to see if it fits the goals of sustainable agriculture.



Soil Conservation Service photo shows continuous row crop field in rural residential area, Saline Co. Gullying & sedimentation has occurred two to three times a year for many years.

system that reduces loss of soil or water relative to conventional tillage; often a form of noninversion tillage that retains protective amounts of residue mulch on the surface." Within this definition there is a wide range of tillage practices, all of which include leaving some percentage of residues on the soil surface to reduce wind and water erosion, and reliance on herbicides to control weeds.

Several practices included in conservation tillage are no-till, strip-till or till planting, ridge planting, ecofallow and stubble mulch tillage. In a no-till system, a small slit is made in the soil for the seed; almost all previous crop residues remain on the soil surface. In strip tillage or till planting, the seedbed consists of a rototilled strip 2-8 inches wide and 2-4 inches deep; the residue remains between the strips. Ridge planting is similar to strip-tillage, only the crops are planted on ridges. Ecofallow is a system of controlling soil erosion and conserving soil moisture through crop rotation and maintenance of surface residue. Stubble mulch tillage is a set of tillage practices using two different types of tillage machines: one stirs and mixes and soil; the other cuts beneath the soil without inverting the tilled layer. The amount of residue left on the soil surface depends on the machine employed. The form of conservation tillage that a farmer practices in any area is dictated by the type of soil and climatic conditions present on his farm.⁹

The current status of conservation tillage is the result of the development of plant growth regulators during World War II. These chemicals had the potential to replace the plow as a method of weed control. In 1945, B. A. Brown at the Connecticut Agricultural Experiment Station and M. A. Sprague in New Jersey were the first to use chemicals to control weeds in a no-till system of pasture renovation. In 1954, John H. Davidson demonstrated that herbicides could be substituted for cultivation as a method of weed control in row crop production. In 1959, Ciba-Geigy Corporation introduced atrazine an herbicide used for corn, and in 1966 Chevron Chemical Company released paraquat.¹⁰ As more pesticides became available on the market, conservation tillage, with the active promotion from chemical companies, gained wider acceptance.

Advocates of conservation tillage have documented its advantages. Maintenance of plant residues on the soil surface reduces wind and water erosion of soil and increases soil water retention. Reduced tillage systems improve the soil structure and increase the organic matter content. With some crops on some soils, no-till systems can out-produce conventional tillage systems. Farmers may also lower their fuel costs. With conservation tillage there are fewer trips made across the field. In our present agricultural system, farmers also consider the reduced labor requirements a benefit.¹¹

As with any technology, there are disadvantages we should consider. Conservation tillage

works best on well-drained soils,¹² so the success of this method is limited by soil type. In some areas, residues remaining on the surface cause soils to remain cooler late into spring, delaying planting dates.¹³ Insect and plant pathogen populations have increased on some crops. With the increased application of herbicides, problems of weed resistance to herbicides, shifts in weed species and herbicide carryover can occur. The interaction of chemicals applied and their long-term effects both on site and off site are not known.¹⁴

Conservation tillage in an industrial agricultural setting will create more problems than it solves. Our current agricultural system, with its narrow focus on short-term profits, encourages the rapid adoption of quick-fix technologies without fully considering their social and environmental impacts; conservation tillage is the latest example. Reduced tillage systems do not have to be detrimental to the agroecosystem; in fact, they are important facets of a sustainable agriculture. We need to integrate conservation tillage practices with farming methods that emphasize a land stewardship ethic.

Conservation Tillage and Plant Pathogens

Danielle Carre'

The development of a new technology to solve one problem in agriculture invariably affects other elements within the agroecosystem; conservation tillage is no exception. As more farmers employ conservation tillage as a method of reducing fuel costs and saving soil, there has been a noted increase in the incidence of plant diseases and insect damage on some crops.¹⁵ Conservation tillage practices, such as leaving crop residues on the soil surface, and relying on herbicides for weed control, profoundly influences microbial, insect, and weed populations in ways that are not well understood. Before conservation tillage gains wider use in agriculture, we should examine these limitations.

Retaining crop residues on the soil surface to reduce soil erosion opens niches for disease causing organisms such as bacteria or fungi (pathogens) that were previously unavailable. Many plant pathogens depend on residues of the host plant for survival between crops. The residues serve as a food base for the pathogen's growth and reproduction.¹⁶ When the succeeding crop is directly drilled into the stubble of the previous crop, the organism which caused the initial infection is ideally situated to attack the emerging seedlings.¹⁷ In conventional tillage systems, burial of the infected residue between crops shortens the life expectancy of many pathogens by allowing competing micro-organisms to colonize the residue, or by placing

the pathogen in an environment that is unfavorable for growth, reproduction, and dissemination.¹⁸ The use of conservation tillage practices, especially in continuous cropping systems, may eventually allow pathogen populations to reach epidemic proportions by providing a continual food supply.¹⁹

The disease problems associated with conservation tillage differ in various geographical regions. In Kansas, Cephalosporium stripe, a fungal disease of wheat caused by Cephalosporium gramineum, has become a major disease where farmers continuously crop wheat. The pathogen survives between crops on wheat straw, using the straw as a food base to grow and produce spores. When wheat is seeded into the stubble of the previous crop, the fungus grows from the stubble and penetrates the roots of the seedlings. In studies comparing various wheat residue management systems, such as burning and disking, plowing, disking, chop and disk, and direct drill (no-till), the incidence of Cephalosporium stripe was the highest when direct drilling was practiced.²⁰ Researchers noted a similar situation in the Pacific Northwest. Take-all, a disease of wheat caused by the fungus Gaeumannomyces graminis v. tritici, increased when direct drilling was practiced. The fungus is able to colonize the wheat residue, grow, multiply, and attack the wheat seedlings subsequently seeded in the wheat stubble.²¹

Conservation tillage practice can also influence plant diseases by altering the microclimate at the soil surface and within the soil. The residue that remains on the soil surface causes the soil to retain more moisture, and soil temperatures to remain cool.²² These conditions may alter a plant's susceptibility to disease, and create a favorable environment for damping-off and root diseases caused by soil-borne fungi.²³

In eastern Washington and Idaho, no-till practices reduce wheat yields where wheat is continuously cropped. When wheat is directly drilled into wheat stubble, seedling emergence is poor, and those that survive usually remain stunted. Researchers reported that the poor stands were associated with Pythium ultimum, a fungus that causes damping-off of seedlings.²⁴ Leaving wheat residue on the soil surface promotes Pythium attack of wheat roots by providing cool, moist conditions, and a substrate for the fungus to multiply on.

In some areas the increased moisture and lower soil temperatures have reduced the incidence of stress-related diseases. In Nebraska, studies done by B. Doupnik and M. G. Boosalis on an ecofallow system of winter wheat, grain sorghum and fallow, indicated that this system reduced the incidence of sorghum stalk rot. The disease is caused by the fungus Fusarium moniliforme, a weak parasite. Sorghum is usually susceptible to F. moniliforme when it is water stressed. The increased soil moisture associated with the ecofallow system may account for the lower incidence of sorghum stalk rot.²⁵ An

added benefit of ecofallow is the crop rotation. Farmers drill the seed of one crop into the stubble of another, eliminating some of the pest problems associated with continuous cropping.²⁶

The reliance on pesticides in conservation tillage can also affect plant disease incidence. The effects of these chemicals are rarely limited to the organisms they are intended for; there is a range of direct and indirect effects on soil properties, microorganisms, and plants.²⁷ Changes in microbial populations and in soil properties by the application of pesticides may create an environment unfavorable for plant diseases or promote plant diseases. The indirect effects of these chemicals on pathogens involve interactions between microorganisms and pathogens, the host and pathogens and the host and other microorganisms. Direct effects include either a promotion or reduction in the growth and reproduction of plant pathogens.²⁸

Pesticides can alter the physiology of plants, leading to changes in host plant susceptibility.²⁹ Foliar application of chemicals may reduce wax formation on leaf surfaces,³⁰ allowing the pathogen greater access to leaf tissue. Applied chemicals may also modify the leaf canopy, changing the microclimate within the canopy or on the soil surface.³¹ In addition, pesticides can injure plants, leaving them more susceptible to attack from weak pathogens.³² Changes in the physiology of the host plant extend to the roots. Pesticides can cause an increase in the amount of nutrients reduced from host plant roots, resulting in shifts in microbial populations in the surrounding area.³³ Many soilborne pathogens depend on nutrients released from plant roots for spore germination and growth.³⁴

Beneficial organisms are also affected by pesticides. For example, the growth of certain mycorrhizal fungi is depressed when soil fumigants are applied.³⁵ Mycorrhizal fungi are associated with the feeder roots of most plants, and improve their health by increasing the availability of certain nutrients, especially phosphorus.³⁶ Mycorrhizae may also increase host plant resistance to soilborne pathogens such as Fusarium and Pythium. The loss of this symbiotic association through the application of certain chemicals may cause a decline in plant health.

The ability of a pathogen to attack a host plant is often limited by the presence of other microorganisms. These microorganisms, (antagonists) have the potential to interfere with the life processes of plant pathogens. The mechanisms of interference include competition for nutrients, parasitism, and predation.³⁸ The destruction of this antagonistic population with chemical sprays often leads to increased disease incidence. The use of benomyl to control Botrytis cinerea provides an interesting example. B. cinerea is a fungal plant pathogen that is quite destructive on a wide variety of crops. Benomyl provided adequate control for a while, but researchers soon reported that the

use of benomyl caused an increase in disease incidence. The problem was investigated by G. J. Bollen who found that the application of benomyl eliminated antagonists usually present on the leaf surface, allowing a benomyl-resistant strain of *B. cinerea* to flourish in the absence of its competitors.³⁹

Conservation tillage, as currently practiced, has several drawbacks, but that does not mean that reduced tillage methods should be avoided. Certain conservation tillage practices must be modified. For example, farmers can control plant pathogens, insects, and weeds with a combination of techniques, reducing the reliance on pesticides. In an integrated pest management program, resistant cultivars, crop rotations, biological controls, and polycultures are methods of keeping pest populations in balance. A modified conservation tillage program could become a significant part of a sustainable agriculture.

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Fertilizer and Pesticide Runoff in Conservation Tillage

Vern Stiefel

Farmers have long sought effective methods of limiting soil erosion and associated pesticide and fertilizer runoff. Conservation tillage has been lauded for its success in curtailing soil erosion and surface runoff without sacrificing crop yields. Therefore it seems reasonable to assume that losses of agricultural chemicals would also decrease with minimum tillage practices. Some studies, however, have shown that this may not always be the case.¹

Important factors influencing the transport of agricultural chemicals out of a conservation tillage field include the amount of stubble remaining from the previous year's crop, relative soil compaction, soil type and slope of land. Other important factors are the characteristics of the chemicals applied (e.g. water solubility), their concentration and method of application, and the severity and timing of rainstorms.²

The fertilizers which are most likely to have a negative impact on water quality and are susceptible to runoff are nitrate nitrogen, ammonium nitrogen and phosphate phosphorous. When concentrations of nitrates exceed ten milligrams per liter in domestic water supplies, a health hazard is imposed upon humans.³

Fertilizer runoff is also hazardous to fish, with ammonia being toxic at concentrations of 0.02 milligrams per liter. Ammonia is produced from ammonium nitrogen in water with a neutral pH and temperatures between 60 and 80°F. Relatively small amounts of phosphate in streams and lakes (0.05 milligrams/liter and 0.025 milligrams/liter, respectively) can result in algal growth and eutrophication, which also adversely affect fish.⁴

Pesticides are also dangerous to the health of humans and other animals. It is well known that many of these chemicals are potentially carcinogenic.⁵ With conservation tillage practices, up to thirty percent more pesticides may be needed to control weeds, fungi, rodents, insects and nematodes.⁶ This increase in usage may intensify water pollution. Additionally, it is unfortunate that most pesticides used today are water-soluble and do not readily adhere to soil particles. These two qualities alone promote pesticide runoff regardless of tillage practices.⁷

In two separate studies, J. L. Baker et al., investigated runoff losses of nutrients and pesticides in different tillage systems. Both studies were done on three different soil types: a silt loam, silty clay loam and a sandy loam. The researchers applied the fertilizers or pesticides and then simulated a severe rainstorm. After a simulated rainstorm was over, they collected and analyzed samples from the runoff that occurred.⁸

The results obtained for fertilizer runoff

showed that total nutrient loss was reduced with conservation tillage methods. This finding can be attributed to less soil erosion and runoff when compared to conventional tillage methods. However, concentrations of nitrate, ammonium and phosphate were higher in the runoff that occurred from minimum tillage fields. In fact, where more stubble was left on the surface, the concentration of the water-soluble nutrients was higher. One of the study's conclusions was, "Although the water-soluble nutrient losses are economically insignificant to the farmer, they are important in terms of water quality."

Researchers have suggested several reasons why increased nutrient concentration occurs in runoff with minimum tillage practices. First, when fertilizers are broadcast and not incorporated into the soil, they tend to accumulate near the surface.⁹ In general, soil is more compact near the surface on farms using reduced tillage methods.¹⁰ Water and soluble nutrients are more likely to run off on compacted soils with limited percolation. Second, stubble is an additional source of soluble nutrients which can be leached and transported out of a field.¹¹ Third, stubble may indirectly interfere with the availability of nutrients to plants, because it keeps the soil moister and cooler. Cool and moist soil promotes populations of "denitrifying" bacteria which tie up nitrogen, making it unavailable to crops. To complicate matters, soil acidity increases when denitrification occurs. This also puts limits on total nutrients which plants can absorb.¹²

In one experiment on the effect of conservation tillage on soil fertility, concentrations of nitrate nitrogen were twenty to twenty-two percent lower in no-till soil than they were in plowed soil.¹³ This means the farmer might have to apply more nitrogen during the growing season to ensure good yields.

Cool soil temperatures have another negative aspect: they limit phosphorous absorption by plants. This problem is especially noticeable in young crops in temperate regions. Once again a farmer may need to apply more phosphorous or place it where the plant will be able to use it (e.g. by injecting it near the developing seedling.) Therefore, using more fertilizer to ensure adequate soil nutrition in conservation tillage fields will probably result in more runoff of nitrate-nitrogen, ammonium-nitrogen and phosphate-phosphorous into rivers and lakes.

In the study on runoff losses of pesticides, J. L. Baker et al., found that conservation tillage is largely ineffective for reducing the amount of water-soluble pesticides in runoff. In their experiment, two herbicides (alachlor and cyanazine) and one insecticide (fonofos) were used. Alachlor and cyanazine are fairly soluble in water (at 242 ppm and 171 ppm,

respectively), whereas fonofos is relatively insoluble (at 13 ppm).

As is typically the case, erosion and runoff were less in the reduced tillage plots than in the conventionally tilled plots. This resulted in decreased concentrations of fonofos in the samples from the reduced tillage plots. However, these same samples yielded higher concentrations of the herbicides. The researchers concluded that the most important factors determining pesticide concentrations in the runoff were the duration and intensity of the simulated rainfall. Furthermore, they stated that rainstorms in nature are usually not as severe and so less runoff would occur under natural conditions.¹⁵

Other reasons have been suggested for higher pesticide concentrations in the runoff from reduced tillage fields. When herbicides and other chemicals are sprayed on the soil surface in a water carrier, a substantial portion will be intercepted by the remaining stubble. They are then subject to being washed off the plant residues and carried away. Soil compaction can aggravate this problem by inhibiting percolation.¹⁶

Denitrification processes can indirectly cause more potential herbicide runoff. As stated before, the soil becomes more acid when this occurs. Atrazine, an extensively used herbicide, degrades rapidly in an acid environment.¹⁷ This corresponds to less weed control and possible losses in crop yield, unless other applications are made or different herbicides are used.

To summarize, reductions in soil erosion and water runoff have occurred using conservation tillage. Unfortunately, this has not meant a decrease in fertilizer and pesticide runoff. This is especially true for the water-soluble compounds which have a negative impact on water quality.

If conservation tillage is to succeed as an effective means of controlling chemical contamination of water resources, better management techniques will have to be devised and implemented.

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A Closer Look at Conservation Tillage

Michel Cavigelli

Despite the many uncertainties associated with conservation tillage, the Environmental Protection Agency (EPA), the United States Department of Agriculture (USDA), the Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service (ASCS) under the Reagan administration are all strong supporters of conservation tillage.¹ Advocates of conservation tillage promise increased retention of soil moisture, decreased use of tractor fuel (and therefore decreased input costs and better cash flow), reduced runoff and sedimentation of waterways (a top-of-the-agenda issue for the EPA in 1985-1986²), and, of course, control of soil erosion to almost zero in some cases when conservation tillage is used.³ Certainly, these are all aspects of a sustainable agriculture. If the negative aspects of pesticides and herbicides could be overcome, might not conservation tillage be an integral part of the sustainable agriculture paradigm that we are working to develop here at The Land? Or might not herbicide-based conservation tillage be a transition state to a more sustainable agriculture? After all, a perennial agriculture is essentially no-till agriculture.

Dick and Sharon Thompson's articles in Rodale's New Farm (Volume 7, number 4, pages 24 and 48) about their ridge-till farming practices indicate that conservation tillage is the best way to integrate conservation practices and economically viable farming on a small scale. They have developed a system of rotation, cover crops, manure application and carefully timed mechanical weed removal that allows them to use no herbicides and only minimal synthetic fertilizer inputs on their 300 acre Iowa farm. While their yields remain competitive, they have reduced their input costs, environmental degradation and soil erosion substantially. Their system works because they give their land the time and attention it requires to grow food on a sustainable basis. Cooperative farmers in the Small Farm Resources Project, associated with the Center for Rural Affairs (CFRA), near Hartington, Nebraska, are developing similar practices on their land. When I read that the CFRA and Rodale are supporting the same agricultural practice as the Reagan administration, I knew that the story behind conservation tillage cannot be simple.

Trends in Conservation Tillage

Much of the literature on conservation tillage paints a rather rosy picture of its potential to conserve soils in the United States. Though estimates vary, there is a definite trend towards greater acceptance of conservation tillage amongst farmers. Estimates of the use of conservation tillage in 1973 vary from John Block's 3.2 million acres to No-Till Farmer magazine's estimate of 44 million acres.

This compares with 1983 estimates by the Conservation Tillage Information Center (CTIC) of 94 million acres and No-Till Farmer's estimate of 126 million acres.⁴ James Risser, former Washington, D.C., correspondent for the Des Moines Register, noted in an October 7, 1984, Register article that sales of equipment and the specific pesticides used in conservation tillage have increased also during this period. Pierre Crosson, of Resources for the Future, estimates that by the year 2000, 60% of all U.S. cropland will be under conservation tillage. The Office of Technology Assessment puts this figure at 70% and the USDA at 80%.⁵

Agribusiness predictions and promotions are just as optimistic and enthusiastic. Chevron, a leader in conservation tillage promotion, has predicted, in one of their advertising publications, that by the year 2000, 82% of U.S. cropland will be under conservation tillage--65% being under no-till, the conservation tillage technique which requires the largest chemical inputs. Risser, in his Register article, mentioned that, in anticipation of the coming revolution, Chevron has even reorganized its corporate structure. Risser also noted that both the chemical and implement industries--and even the seed industry--see conservation tillage as a means of hoisting themselves out of a sales slump in which they have found themselves due to a stagnant farm economy. Ken Cook, commentator on agricultural and conservation issues, writes in the Journal of Soil and Water Conservation (Volume 39, number 6, page 368), that for corn alone, annual company sales would increase by \$120 million with a mere 12% increase in the amount of herbicides sold.⁶ Not surprisingly, agribusiness is promoting conservation tillage as a soil conservation method that reduces costs to the farmer. Both Cook and Risser mentioned in their articles that Richard Foell of Chevron summarized the industry's propaganda in saying, "What is good for agriculture is good for agribusiness, and conservation tillage is good for agriculture."

Promotion by Agribusiness

The profit potential of conservation tillage has induced agribusiness to supplement their more traditional advertising with a full-fledged, government co-sponsored conservation tillage promotion campaign. Patricia Paul, public affairs specialist with the Soil Conservation Service, wrote, in the Journal of Soil and Water Conservation (Volume 38, number 3, page 169), that many meetings, such as a regional conference in New York in 1981 would not have been possible without "(1) the participation and financial backing of agribusiness and (2) broad-based support by agricultural/conservation agencies and organizations." The culmination of these smaller fairs and four years' planning was

a national conference on conservation tillage in October 1984, organized by USDA, and financially sponsored by the agricultural industries. Both Cook and Risser noted that the agricultural industries were happy to treat conference participants to the best steaks, whiskey and gourmet cheese, indicating their high hopes for conservation tillage. Government-industry cooperation is epitomized in the development of the Conservation Tillage Information Center. This net-working organization is based in the national office of the National Association of Conservation Districts (NACD) and was planned by the USDA, agricultural industry, the EPA, private foundations, Soil Conservation Society of America, and the NACD. Its stated purpose is to promote "better information flow between private and public sectors," concerning conservation tillage. In essence, it is a government subsidy of agribusiness. It is obviously not only industry that views a healthy agribusiness as being indicative of a healthy agriculture.

USDA Support under Reagan

Such a cooperative relationship between agribusiness and government is not unique to conservation tillage. What is unique is the Reagan administration's concomitant stance towards soil conservation. Maureen Hinkle of the National Audubon Society writes in the Journal of Soil and Water Conservation (Volume 38, number 3, page 201) that the apparent surge in conservation tillage use was a major factor in justifying the proposed 53% cuts in 1984 SCS funding. Estimates of soil saving potential of conservation tillage range from 30% to greater than 90% when compared with conventional tillage. In personal communications, both Hinkle and Ron Krupicka, of the CFRA, stated that this attitude is still prevalent in Washington D.C. The Kansas Rural Center notes in their May 1985 newsletter that both the Office of Management and Budget and USDA "believe that changes and advances in technology make old conservation measures obsolete." Finally, James Risser, in his Des Moines Register column stated: "Partly because it's cheap to do so, Secretary Block has devoted much of his department's conservation energies to proselytizing farmers to adopt 'conservation tillage'." In essence, by promoting the free-market approach to soil conservation, the federal government can still promote soil conservation without spending large amounts of money in cost-sharing programs or other types of subsidies which have been used traditionally for soil conservation measures such as terraces, grassed waterways and windbreaks. Fortunately, Congress has stood firmly behind SCS funding despite Reagan administration pressures.⁸ Such solid support, Krupicka told me, is based on the fact that the SCS is highly visible across the country and therefore it represents a real constituency to which Congress must respond.

Despite the fact that agribusiness is supporting, via conservation tillage, much of the current soil conservation work, the reported

dramatic increases in conservation tillage use, now and in the near future, seem to indicate that the fifty-year old call for soil conservation is finally being heard by farmers across the nation. It turns out, though, that the uncertainties associated with conservation tillage, as it is promoted by the government and industry, go beyond chemical contamination and other detrimental biological effects.

Adoption and Soil Erosion Rates

Peter Nowak, a rural sociologist at the University of Wisconsin, Madison, and Peter Korsching of Iowa State University have raised important questions about the adoption rates of conservation tillage and the conservation-effectiveness of practices commonly referred to as conservation tillage. In a study reported in the Journal of Soil and Water Conservation (Volume 40, number 2, page 199), Nowak and Korsching found that, although 78% of respondents in an Iowa-Cedar River Basin study claimed to be using conservation tillage on their fields, only 19% were actually practicing potentially soil-conserving practices. On soybean fields, the disparity was not as great: 78% claimed and 47% actual. Nowak and Korsching used contemporary (1980-1) Iowa State SCS criteria (1500 pounds residue/acre on cornfields; 750 pounds residue/acre on soybean fields) as their definitions of conservation tillage. When they used Iowa's more conservative criteria (2000 pounds residue/acre on cornfields; 1000 pounds residue/acre on soybean fields), they found that only 7% of cornfields and 26% of soybean fields were actually under conservation tillage. And this is in the cornbelt, the area where conservation tillage is most popular, according to the CTIC's 1984 National Survey of Conservation Tillage Practices.

The results of Nowak and Korsching's meticulously collected data indicate that other estimates of conservation tillage usage may be erroneous due to the use of less meaningful collection methods. James Lake, field office coordinator for the CTIC, claims, in a Journal of Soil and Water Conservation article (Volume 38, number 3, page 158), that they have "the most reliable data collected to date." They gather this information by sending questionnaires to farmers, soil conservation experts, industry representatives and other local people involved in soil conservation, Lake continues. While these sampling methods are not as simple as asking only farmers about their practices, they still do not incorporate measurements of ground cover nor of soil erosion rates on a field-by-field basis as Nowak and Korsching did. On a national level, the CTIC probably does have the most accurate data, but Nowak and Korsching's detailed study indicates that the CTIC's sampling methods may not be good enough to indicate the true status of soil erosion control on fields under conservation tillage.

Nowak and Korsching summarize their findings:

All too frequently, conservation tillage is defined on the basis of which primary tillage tool is being used, rather than how and when it is employed. Thus, for many operators conservation tillage has only meant giving up the moldboard plow and shifting to a chisel- or disk-based system. The land can still be plowed twice in the spring, but the operator remains unconcerned about soil erosion because of this "conservation tillage" system.⁹

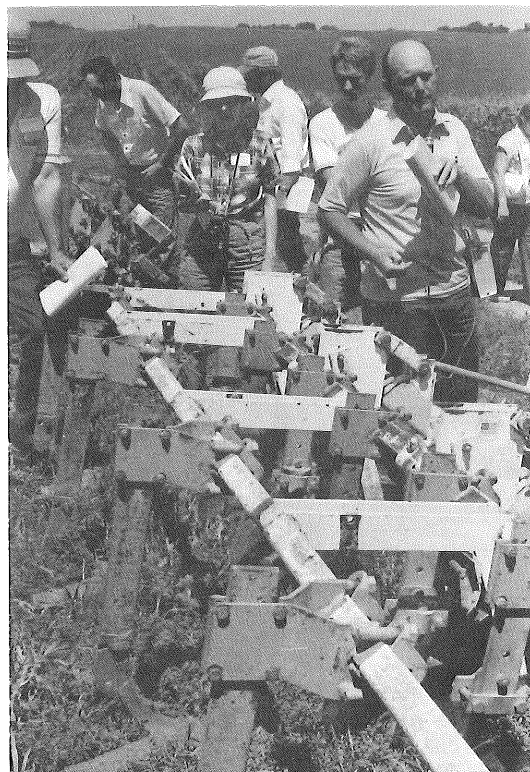
A Technological Fix

In true technological fix style, conservation tillage, a new technology, is being enthusiastically distributed without much understanding of its effects on biological nor on cultural systems. Krupicka emphasized, in talking to me, that soil loss is not a technological problem, but an attitudinal problem. It must be dealt with as such. Referring specifically to conservation tillage, Nowak emphatically reminded me that "the trickle down hypothesis just does not work with complex technologies." For these reasons, data on the amount of pesticides and conservation tillage equipment sold does not indicate the amount of soil that is being saved, and conservation tillage promoted via a Reagan-style free market approach cannot substitute for the SCS.

One problem with relying solely on conservation tillage to control soil erosion is that it cannot be used everywhere as an effective soil-saving practice. The SCS accepts a soil loss tolerance of up to five tons/acre/year.¹⁰ Estimates of soil saved under conservation tillage range from 30% to greater than 90% when compared with conventional tillage.¹¹ In areas where erosion is greater than ten tons/acre/year, it stands to reason that conservation tillage may not be enough to reduce erosion to five tons/acre/year. In other areas, such as the Palouse region of eastern Washington State, some of the most fertile but also most erosion-prone land in the nation (erosion rates often exceed 100 tons/acre/year), conservation tillage may never be used extensively. This is because research has shown that, despite heavy fertilizer application, conservation tillage leads to reduced yields.¹² In general, it is being used mostly on lands that are not highly erodible.¹³ A report which compared conservation tillage with organic farming concluded that "on the millions of acres of soils unsuited to conservation tillage, organic farming may be the only feasible conservation farming system."¹⁴

Conservation Tillage and Farm Size

People who are sensitive to the role of small farms in a healthy U.S. agriculture and rural culture are particularly skeptical about conservation tillage. Ron Krupicka told me that he finds that soil saved due to conservation tillage is saved "at the expense of saving



Gary Young shows conservation tillage equipment on the Small Farm Resource Project tour.

farmers." This is because a farmer, in order to become a no-till farmer, must invest heavily in new equipment and herbicides. These new costs push already financially strained farmers further into debt and indirectly contribute to the demise of the smaller farm. Maureen Hinkle points out that increased chemical costs may offset any savings in tractor fuel.¹⁵ Krupicka thinks that the time/labor-saving aspect of conservation tillage is its primary attraction for farmers, since the "verdict is still out" on the economic benefits of herbicide-based conservation tillage. Marty Strange, co-director of the Center for Rural Affairs, elaborated on this point at the 1985 Small Farm Resources Project Annual Tour. He noted that energy-intensive crop drying methods eliminated harvest season as the limiting factor controlling farm size. Planting time is the current limiting factor, and conservation tillage allows this barrier to increased farm size to be broken by allowing more acres to be planted in a shorter time. It is not clear that the federal government is consciously promoting conservation tillage partially because of this role it can play in facilitating a shift to larger and fewer farms, but if that were the case, it would not be out of character with the Reagan administration's approach to farm policy.

Conservation tillage has also been criticized as being used, in these days of overproduction, to increase production. The USDA is currently doing research to develop a conserva-

tion tillage method by which soybeans can be grown on an 18% slope.¹⁶ This, again, is not out of character for a government that repeatedly funds conflicting production control and production incentive programs.

Such contradictory policies are partially due to different agricultural agencies' specialization. This, in turn, is a fundamental block in the adoption of any effective soil conservation program. While extension agents are armed with financial planning advice for the farmer, the SCS agent comes forth with conservation plans. The two are often proposing different plans, and it is therefore difficult for the farmer to devise an economic plan which encompasses conservation and vice-versa, he told me. What is needed is a large initial investment in a workforce of more dedicated and knowledgeable conservationists, each one of which will "begin by being a good listener" and continue by giving each farmer the moral and technical support he needs in order to develop an effective soil conservation program.¹⁷ This is essentially what the Center for Rural Affairs is: a progressive extension service which is sensitive to farmers' and the community's needs. The CFRA helps develop integrated conservation, production and financial programs on a farm-by-farm basis. Conservation tillage practiced by farmers in this program is largely self-initiated in the form of on-farm research.

Conclusion

These conservation tillage practices and those practiced by the Thompsons are fundamentally different from the conservation tillage that is being promoted by government and industry. The former are effective because they are an integral part of a program which is sensitive to biological and cultural considerations. These alternative paths form the foundation of a sustainable agriculture. On the other hand, herbicide-based conservation tillage is not meeting the needs that its proponents claim on as significant a land area as is often suggested. According to some informed observers, promotion of herbicide-based conservation tillage is merely a continuation of past poor, yield-based agricultural policy which may be hurting the farming family and community more than helping them. It is on ambiguous, sometimes wildly overstated claims of the benefits of herbicide-based conservation tillage that soil conservation policy, or lack thereof, is being developed by the USDA under the Reagan administration. Although examples of effective conservation tillage practices on small farms and the support systems which make them feasible exist, current policies largely ignore the crucial societal aspects of soil erosion control in favor of a technological fix. Though herbicide-based conservation tillage may help save some soil, it is by no means a potential candidate for inclusion in a sustainable agriculture.

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