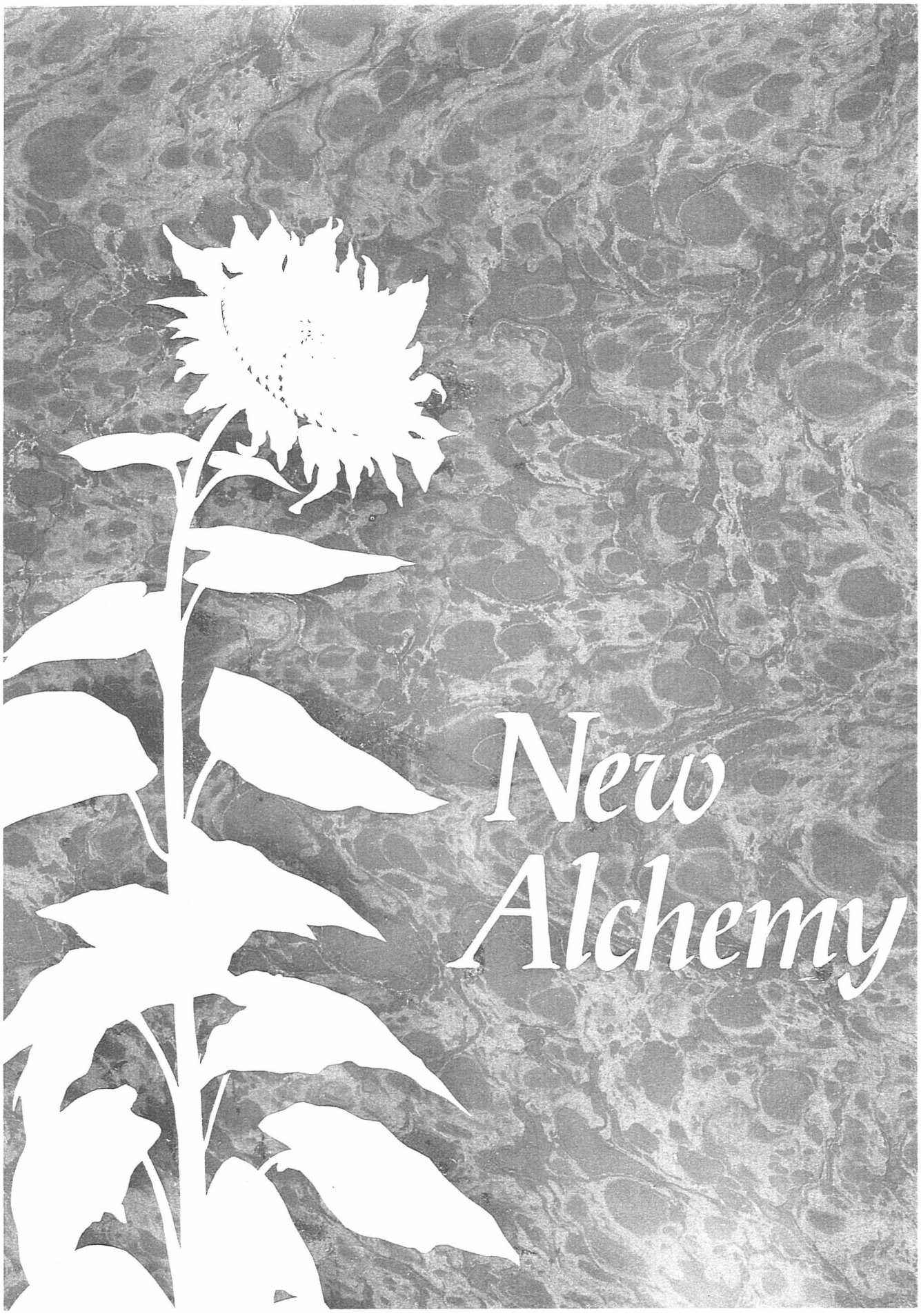

New
Alchemy

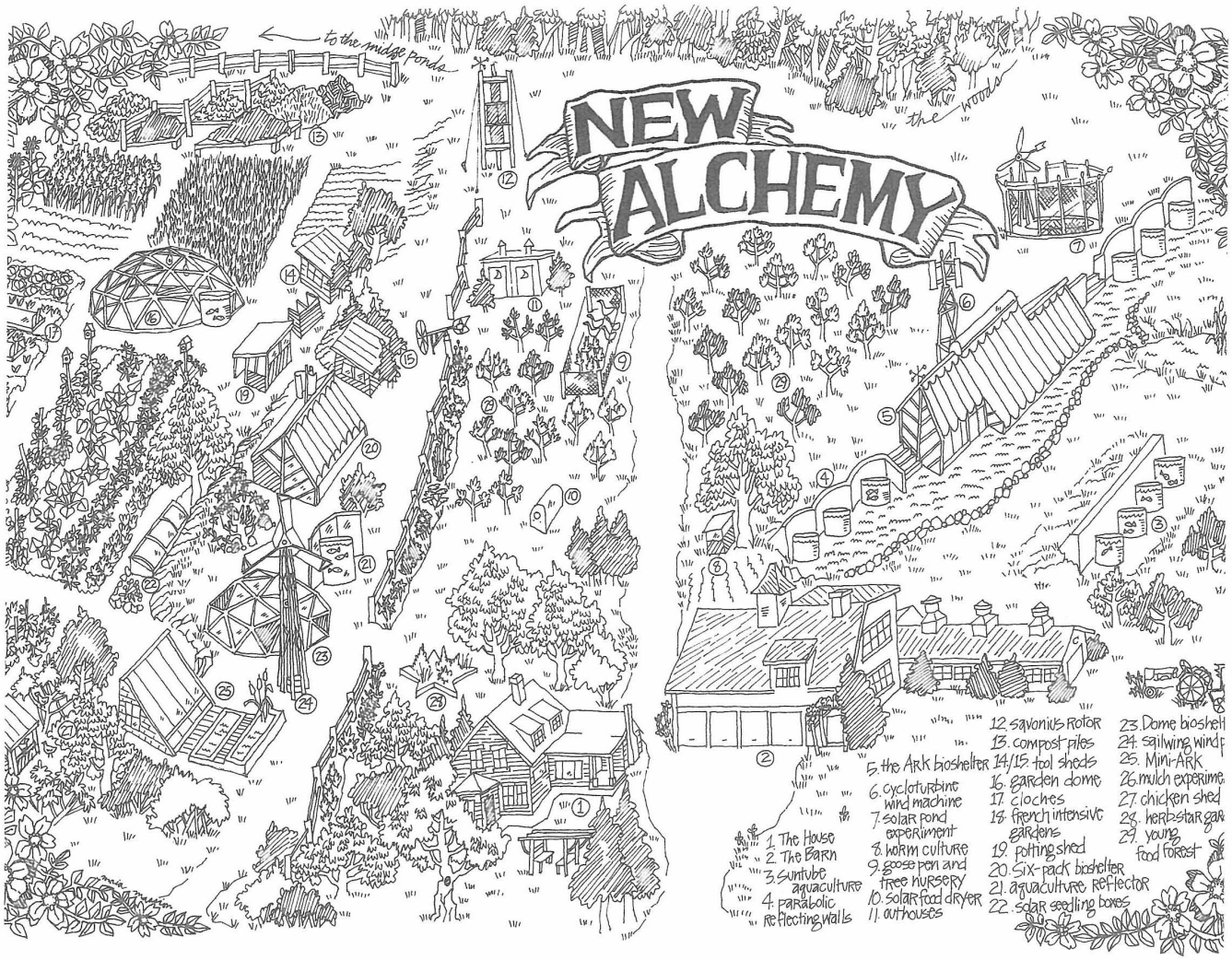
Not long ago we spent an evening looking at some films made during New Alchemy's early years. For old hands they were wonderful — nostalgic, funny! The children were so little. Everything looked so makeshift and tentative. Some of us were thinner — and, well — younger. The reactions of some of the newer people were interesting. One of them said, "Everything seems so established. I didn't realize that it hasn't always been that way."

For those of us who have been around for a long time, the evolution has been sufficiently incremental and gradual that, although we were aware of ongoing transitions, we had never really been confronted so concretely with the degree to which New Alchemy — and we — have changed. And yet, in another way, we are still the same undersized maverick organization pursuing a vision wildly at odds with the image still officially espoused by industrial society — building windmills, rather than tilting at them, and rarely sure beyond a few months of salaries or funding.

And, if it's not always quite as heady as it once was as much of the time, there are still the lovely days and periods that carry us through the more mundane ones.

The original idea of including a section in the Journal just on New Alchemy was to try to convey a sense of the place beyond the vision and the work. We have written of our births and deaths, our struggles with sex roles and heirarchy, our stumbling blocks, our triumphs and our feasts. We had to expand it to include reports from Costa Rica and Prince Edward Island. As we grow larger and more complex, all of this becomes increasingly difficult to capture. Yet this year again, while confronting our readers with PAVE PAWS and the rationale for computers, there remains, among all the seriousness and loftiness of purpose, the somewhat ponderous comfort conveyed in the essense of the "Terrible Joke."

— NJT



Overview – *Nancy Jack Todd*

JOURNAL PUBLICATION: GESTATION AND BIRTH

This is our fifth *Journal.* The first was published in September, 1973. It was preceded by a series of newsletters and bulletins which included John Todd's *Modest Proposal* and *Newsletter Three on Methane Digestors for Fuel Gas and Fertilizer* by Richard Merrill and John Fry. Looked at in one way, our publication schedule may seem a bit unpredictable, although only *Journal Three* has not made its appearance in the early fall. The erratic timing reflects our financial vicissitudes. There are times when we simply don't have the money to go ahead with printing. As I write this in late May of 1978, it looks ominously as though this could be the fate of the fifth *Journal,* which, like the third, could be delayed by what we hope is only temporary destitution. This also accounts for the delays in reprinting. At the present, the first, second and third *Journals* are out of print and, in spite of considerable demand, we can't afford to reprint them, although we have every intention of reprinting the second and third when it becomes possible. It seems less likely that we shall do so with *Journal One* although, nostalgically, we should like to.

Barring financial uncertainty, however, a fairly workable publication schedule, one that is in rhythm with our yearly patterns of work, seems to be emerging. It is, I think, obvious to readers that the *Journal* is not the product of a staff of writers, but is written by the people in the group who actually do the work reported in various articles. This means that, for the growing season, which can extend from late April into October and is also our season for Farm Saturdays and workshops and a minimal six-day work-week, it is out of the question for anyone to do any writing. Reports and articles must, perforce, wait until fish and gardens

Art by Maia Massion

are harvested and made ready for the winter and data are collected. With people already overextended, it would seem not only unrealistic but inhumane to set a deadline before January or even February first. To see one's friends hollow-eyed by Christmas feels a little unsettling. But this means that material is not ready for editing until mid-winter and, with the increasing number of articles, this takes several months. As articles are completed, they are relayed, a few at a time, to Claire Viall at the printer's for transferring to the Composer, after which the galleys come back to us for a final proofing. Meanwhile, the visual material which, again, is done largely by group members and is their second order of business, after writing, is collected and organized. With this, everything is delivered to Jack Viall, our printer and friend, and he and I do the layout. This usually takes place in late May or June and the *Journal* remains with Jack. He and Claire, who also is a good friend, have a small three-person print shop in West Harwich, and they run it with dedication and care, reminiscent of traditional New England crafts. By the time Jack has processed the *Journal* and it has been bound, the summer is gone, and we plan for delivery back to us by early fall. It remains to us to mail it, which is no inconsequential feat and usually an obligation met by the group en masse.

Because this schedule seems to have evolved almost of itself and is by far the most compatible with the rest of New Alchemy's work, we have come to think of the *Journal* as a harvest publication, coming, we hope, reliably at that time of year and garnering the work that we feel is ready to be passed on to our readers and friends.

LIMITS TO GROWTH - SORT OF

One of the most frequently asked questions of the informal, friendly kind that we receive at New Alchemy is regarding the size of the group. Incurably vague about these things (it would have been a grave mistake in personal mathematics for me to have had more than three children – I should have lost count), for years I have replied that we had a shifting population of about a dozen. This was a fair ballpark estimate, with all the comings and goings, and visits from fellow travellers, families, friends and volunteers who have come to work for us for a while. The dozen or so of my answer did not include the extended family or network of people who have participated as consultants, designers, engineers and advisors which, of course, comprises a much larger number and is even less susceptible to census-taking.

Lately it has become obvious, even to the most obtuse, however, that we have grown. Rather like one's children who often achieve a change in state rapidly and unexpectedly catching one somewhat off-guard, the gestalt of the group has changed. One way of telling is by weekly meetings during the winter when many people are often away on other projects, at which times we sometimes used to muster not many more than six or eight. This year, even with several permanent members absent, we counted eighteen, which must put us at about twenty-seven all told, counting volunteers, and we expect Kathl Whittaker and Jay Baldwin to join us in late 1978.

We hope with this to have achieved at least a temporary homeostasis. Our expansion so far has

Photo by Hilde Maingay

been necessitated by the size or the workload which could no longer be shouldered by the original numbers. We trust that we haven't initiated an unfortunate variation on the Peter Principle and that the work to be done will not, in turn, swell accordingly. Right now, it seems, and this I think is reflected in the articles in the *Journal,* that most of the niches, for the present, are filled. Tanis Lane, Denise Backus and Conn Nugent share the huge burden of administration and funding that formerly fell on Bob Angevine, John Todd, Christina Rawley and myself. Extending the scope of both the bioshelter and aquaculture research and thus helping Ron Zweig, Al Doolittle and John Wolfe have brought their computers and their skills. Joe Seale will work with Earle Barnhart in wind research, as will Jay Baldwin, who is a soft technologist of many parts. Kathl Whittaker is a soil scientist and will be collaborating with Hilde Maingay, Susan Ervin and Kathi Ryan. Our artist in residence, Jeff Parkin (cover) joined us last year to help Bill McLarney in his work.

Again, as a rough estimate, about twenty permanent members might be an adequate answer to the "how many" question for the next little while. If a loss of intimacy has resulted in reaching this size, it has been compensated for by the inputs of fresh thinking, different points of view, and new creativity that the recent arrivals bring with them. The only major inconvenience of the increased numbers is the wearying, corresponding growth in the number and length of meetings. The weekly meeting can now run to over four hours, as each of us goes on feeling obliged to get a word in. Survival skills for endurance have included the taking up of handwork by more and more people of both sexes. Bill McLarney often manages to get through them by sleeping for the duration — or most of it. But then, in retrospect, he always has.

NEW ALCHEMY, PRINCE EDWARD ISLAND

In September, 1976, the Ark, a bioshelter designed and built by New Alchemy and Solsearch on Prince Edward Island with funding from the Canadian government, was completed and officially opened, as described in last year's *Journal.* It has had, in such a short time, an eventful history and has attracted an undreamed-of number of visitors.

In spite of Prince Edward Island being a popular tourist spot, the majority of those who come to the Ark are neither sightseers nor dilettantes in search of novelty, but people who are troubled by inflation in the costs of essentials and open to the idea of alternative methods of providing them. Coping with the interest of the public at large quickly became more than a full-time job and this did not take into account the demand from various

Photo by John Todd

official bodies ranging from the United Nations to representatives of governments and other organizations from many countries, distinguished visitors and officials from departments within the Canadian government. It is difficult to pursue the paths of research and education simultaneously, especially with so many people wanting access to a structure of limited size that is also committed to housing plants and fish. Yet, from the outset, the Ark was a research project — not an answer, but a compendium of questions in such areas as the practicality of solar and wind energy and the possibility of intensive, ecological food production. It represents a shift in paradigm from standard modern housing, which is an ongoing energy sink and a source of pollution to the adjacent ecosystem, to a bioshelter concept which is independent in terms of energy, processes its own wastes and is a potential source of products useful locally.

Evaluating the possibilities of the Ark and realizing its potentialities is a research project involving years. We were, after the initial building grant, understaffed and underfunded to fulfill the obligations in research, education and public service posed by the Ark. Fortunately for us, there is, on the Island, an indigenous organization, comparable to and highly compatible with New Alchemy. It is directed by Andrew Wells, an Islander with an independent but remarkably similar vision to ours. His organization is called the "Institute for Man and Resources." After con-

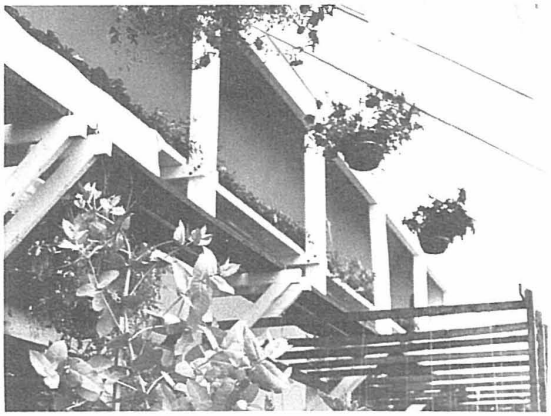


Photo by John Todd

siderable agonizing, we decided, because I. M. R. was in a much better position, both geographically and financially, to carry on the work on P. E. I., that we would turn the management of the Ark over to Andy's group, retaining some guidance over the direction of the research. The new director of the Ark is Ken McKaye. Nancy Willis continues to be in charge of agricultural experimentation.

We find ourselves happy with this arrangement. We are a small group, and, although we have grown larger of late, we are still stoutly trying to maintain limits to our growth. We also see ourselves as initiators and testers of ideas, not as administrators on a large or farflung scale, which inevitably involves, as Conn Nugent observed, the type of problems encountered by the Romans when they crossed the Rhine.

As things stand now, we have planted a seed. Whether it has found a benign environment remains to be seen. We have always hoped that our ideas, free for the taking, would be adopted, but also adapted by people to their own social and environmental milieu. The Ark belongs to Prince Edward Island and its people. It is for them to see which of the many possibilities it holds are relevant for them. But, because Andy Wells for a long time has been closely affiliated with the Island's Premier, Alex Campbell, and because Mr. Campbell, who has been extremely supportive of the ideas of New Alchemy and other future-oriented projects, has recently been re-elected to an unprecedented fourth term, we have hope that our seed has fallen on fertile ground.

PAVE PAWS

In the fall of 1977, some of us at New Alchemy, in greater and lesser degrees, embarked on a new adventure. We found ourselves in a position where we felt obligated, if peremptorily, to tackle yet another dragon – this time in the guise of a giant radar station under rapid and remarkably unpublicized construction at Otis Air Force Base, just five miles from the farm on Cape Cod. The radar is a Precision Acquisition of Vehicle Entry Phased Array Warning System and goes by the suitably sinister anagram of PAVE PAWS. It is one of the largest in the world and will be able to scan the Atlantic for three thousand miles to the north and south and to pick up an object the size of a car over Europe.

The challenge or threat that it posed to us is not unlike one that many people have encountered with nuclear power stations, in that the residents of an area, with very little forewarning, are presented with a project allegedly for their benefit, with little or no debate on the inherent health or environmental implications, or even whether they agree to having it in their midst. Nuclear power stations in general and the Seabrook and Pilgrim plants in particular find us in a comparable position, but we consider New Alchemy to be, in part, an anti-nuclear statement by dint of its existence and, to that extent, we are supporting the anti-nuclear movement. Then, too, our thinking is not that of a unanimous entity. Individual participation in grass roots and protest politics varies widely. Christina Rawley in particular has been active in the Clamshell Alliance and was one of those arrested at the first Seabrook occupation. Many of us went to the support rally for the second and will go again to the third. Opposing nuclear power will continue to be of major concern to us.

The situation with PAVE PAWS is slightly different in that, as of the fall of 1977, the dangers of exposure to microwaves or other frequencies of the electromagnetic spectrum causing non-ionizing radiation were not a part of public consciousness. It was only with the publication of a series of two articles by Paul Brodeur in the *New Yorker* for December 13 and 20, 1976, that much information began to reach beyond a few troubled scientists, researchers, technicians and medical people. With the subsequent publication of Mr. Brodeur's book, *The Zapping of America* in the fall of 1977, the public at last had access, in lay language, to a documentation of microwave technology and its military and non-military applications. Because PAVE PAWS is a local, even disconcertingly intimate issue, because it overtook us with so little advance warning, and because so little was known of the potential effects that it was considered a little uncouth to be too questioning, coming as it did cloaked in the mystique of a sacred cow – defense – it seemed unrealistic just to hope that it would go away. Christina and two of our volunteer staff, initially Carl Goldfischer and subsequently Gary Hirshberg, undertook to give a great deal of their time and energy to organizing a series of public meetings and a campaign to inform Cape Cod residents on the issue.

In this case, as in so many others, a question of appropriateness seems to arise. I have been at too

many occasions at which one or another speaker will ask, with what I find lamentable jest, "Well, just what is 'appropriate technology' anyway?" And go on to stretch the credibility, or at best the common sense, of listeners with descriptions of any kind of industrialism as appropriate under some circumstances, usually in the name of relieving unemployment. The term "appropriate technology", it seems to me, is less useful as a definition than as a yardstick against which a range of technologies can be measured. At one end of the yardstick one would place all the unforgiving technologies that are inherently destructive of life – human life and that of the biosphere – now and in time to come, technologies that in Dennis Meadow's phrase, "foreclose all other possibilities." By this measure, nuclear power, nuclear weapons and large-scale attempts to tamper with global ecology, as with weather modification or giant solar power stations in space that would transmit microwaves to earth to harness for electrical energy, and the spectres of biological and space-age electronic warfare all align themselves as inappropriate to the point of being unacceptable. At the opposite end of the scale could be placed the gentle technologies that use renewable energies, cause little environmental disruption, have a reasonable net energetics ratio in manufacture and are applicable in meeting the needs of an area. Examples of this kind of technology in developing countries are some of the biogas converters and methane plants already in use and in the ideas of the Intermediate Technology Development Group, which has been under the leadership of George McRoby since the death of Fritz Schumacher. From our own work, the water-pumping sailwings described in this *Journal* or the formation of gley qualify as useful and non-destructive and therefore appropriate technology.

Then there is a whole sliding middle range where appropriateness must be judged by further criteria. In some cases like fossil-fuel based technologies, as exemplified particularly by extensive use of the private automobile, they may be seen to be transitional and fated to be phased out. While not directly lethal, their consumption of resources and long-range environmental destructiveness indicates they will need to be replaced or transformed. Genuine utility as opposed to superfluousness is another qualifier of appropriateness, with a large percentage of the products currently on the market subject to scrutiny. The stringent weighing of environmental and social costs relieves much of the fogginess from the concept. A comparison between a recreational motorboat, a private car and one of our bioshelters could be ranged along this scale. All use fossil fuels, as the structure of the bioshelter incorporates a fibreglass substance known as Kalwall which is a plastic product. The motorboat, as both fuel-consuming and excessive, would obviously be the least appropriate. The car, although a villain on many counts, is closer to a necessity, pending the revival of public transportation systems, and would come next. The bioshelter, although it has energy demands during manufacture, stops its fuel-consuming at that point and functions on renewable energies. In doing so, it represents a softer, more appropriate, even more intelligent technology. The idea of appropriate technology remains for the present a useful frame of reference in judging priorities and making decisions.

We deemed PAVE PAWS to be inappropriate, not the least for the unknown cumulative effects on the health of the residents of the area. To risk the disorders which plagued many of the staff of the American Embassy in Moscow and ranged from mild nervous symptoms to abnormally high, often pre-leukemia, level white blood cell counts, and an extremely high rate of cancer for continual electronic vigilance against hypothetical and, in any case, almost surely fatal attack, seemed a large sacrifice to demand of an area. It is hard not to see oneself as expendable.

Beyond the health question, opposition to such a huge incarnation of the war machine, even when labelled defensive, seemed obligatory. Paraphrasing Dr. Helen Caldecott, who spoke in protest at one of our public meetings, it is essential for people to become active in trying to deter the escalation of the arms race. With arsenals scaled to massive overkill for the entire planet, there are few points at which this collective insanity can be broached by ordinary people. We can, of course, accept our helplessness and let our destiny, perhaps as a species or a planet, be played out by great, amorphous forces; or we can act to try to change it. Occasionally, individuals like Anwar Sadat of Egypt have made gestures that exemplify the kind of imaginative leap of faith that could be mirrored on a small scale in one's own actions. At some point, opposition to planetary destruction has to cease to be theoretical, as is beginning to happen in the demands of anti-nuclear movement and in a much smaller way, in the struggle over PAVE PAWS.

As we go to press, Massachusetts Congressman Gerry Studds and Senators Kennedy and Brooke have called on the Air Force to make an environmental impact statement. This was not done initially, when the project was in the planning stage, and never would have been, had not hundreds of Cape residents insisted that the Air Force hear them. In the long run, this will likely only buy time, although comparable radar projects have been cancelled elsewhere after encountering local opposition. The fact that the Air Force was forced to acquiesce can be seen as a victory, however modest, for individuals against bureaucracy, as a statement of opposition to war and as a sign that, if sluggishly at times, democracy still works.

A TERRIBLE JOKE ABOUT THE NEW ALCHEMY INSTITUTE

There is a generally unacknowledged, but undeniably extant, aspect to life at New Alchemy that has rarely been written about. It is the terrible joke. Its status tends to ebb and flow, depending on how many of its practitioners are around at a time. The principal exponent and devotee is Bryce Butler, whose tales are unrivalled in their labyrinthian and excruciating qualities. But there is no question that the tendency, however deplorable, is infectious and, as everyone is more or less susceptible to colds, we fall victim to the urge to tell terrible jokes with a great range of responses. Bill McLarney has succumbed more than once. Conn Nugent is prone to do so and, from all advance indications, Jay Baldwin may be as bad as any of us. There are those who never do, of course, but our best, or at least most appropriate, terrible joke to date must be credited to Sandy Polanski, Susan Ervin's sister, whom we do not see often. Whether she is as subject to this sort of thing in more or less benign climates, I don't know, but she was inspired with the following while visiting Susan last summer.

It seems there was an old musician, long retired. In his day, no one could equal him on the horn (I'm not sure whether it was a saxophone or a clarinet). But the years on the road, the late hours and drinking had taken their toll and left him washed up and pretty obese as well. He hadn't lost everything, though. When he chose to, he could still summon up a sound from his horn with as much or more power or resonance as anyone — beautiful and rich.

The old fellow had a son who, in his way, was somewhat representative of his generation — a frail, weedy young man who subsisted largely on bean sprouts and wafted wheat germ. Yet, true to his heritage, he was not without musical talent. Although he could barely raise a note from the saxophone (or clarinet) his fingering was incomparably sensitive and delicate.

The two were sitting side by side on the front porch one torrid afternoon, attempting to practice and bemoaning their respective and collective fates. "Oh, Dad," sighed the son, "it's all over. We'll never be able to make music again." The old man looked unhappy for a moment, then rallied. "Never you mind, Son," he rumbled, touching him gently on the knee and, grasping his son's horn while the surprised younger man was still fingering, he blew a terrific blast, pausing only to gasp (to be read aloud!):

"Thin you. Alchie me. Instant toot!"

Well, it is indeed a terrible joke, but it's a wonderful terrible joke and, as has been said of humorists, it isn't easy — to go on paying the rent and make terrible jokes at the same time.

Art by Maia Massion

FARM SATURDAYS

We ask people planning to come to arrive by noon. At this time, there is a general introduction on the background, paradigm and ideas underlying New Alchemy's work. After this, everyone revives with lunch. We ask our visitors to bring food with them – a bit more than they are likely to eat themselves and, preferably, something like bread or fruit or cheese that is easily shared. This way there is almost always enough and people get a chance to meet each other as they serve the food.

The workshops proper begin at one-fifteen to one-thirty, after a clean-up. There are usually two, sometimes three, taking place at once. The topics cover our basic areas of research and, accordingly, are on various aspects of agriculture, aquaculture, energy and bioshelters. The specific subject for each of these varies from week to week. Pest resistance or agricultural forests may be discussed under "agriculture", cage culture or semi-enclosed systems under "aquaculture." There is usually an additional workshop on the social and political implications of alternatives which can range from feminism to the opposition of nuclear power. It is our intent that these sessions be genuine discussions and not lectures on our part. An exchange seems to us a more genuine and rewarding form of communication.

Photo by Hilde Maingay

Coming to New Alchemy

– Conn Nugent

Photo by Adolf Baker

A lot of people who want to improve the social arrangement of things talk about "human needs." They suppose that the best way to meet human needs is to provide subsidized "human services." Education, health care, legal aid, counseling, public recreation, daycare. These are good things, mainly.

But it has occurred to other people that reformers should concern themselves with production as well as services. Producing useful objects in a benign setting can be rewarding work and the best of therapies. I like William Morris's old notion that the greatest general good would be enjoyed by a citizenry which lives simply and tries to satisfy itself through an egalitarian arrangement of fruitful work, shared values, and fidelity to nature.

I came to New Alchemy because I believe it is designing tools for a world in which that notion might be realized.

The irony, maybe double dealing, of all this is that I am a human services man myself. My job record is a collection of standard liberal impulses: youth work, Peace Corps, criminal defense, family planning, private philanthropy. I have a law degree and a self-image as a pragmatist. My move here strikes some old friends as odd, quixotic, anti-historical.

Maybe that's because many of those friends, left wing and right, share a common image of socio-economic structure: complicated division of labor, centralized control, capital-intensiveness. I'm drawn to John Todd's words:

> "It is becoming clear from the recently growing knowledge of living systems and from general systems theory that it is the structure, or morphology, of a system that determines its behavior and subsequently its fate. The coefficients or parameters within a system determine only rates or relative dominance."

Somewhere down the line – in a way, I don't care whether it's thirty years or a hundred and thirty – we are going to run short of fossil fuels. We will either maintain the current structure through the intravenous of new power sources (probably nuclear) or we'll need a new structure. Unless we plan well, either eventuality will cause enormous dislocation. The poor would get it in the neck. I'm for a non-nuclear alternative and for a gentle, equitable transition.

That a no-nuke future will demand fewer consumer services and a more widespread productivity looks likely. The challenge seems to be to make things fair and comfortable. We can return to the pre-industrial era easily enough, and probably gain some peace of mind in the process. But we don't need the early mortality, squalor and social hierarchies of those days. Far better would be to use our own luxurious oil-times to devise technologies and designs that will permit a new socio-economic structure that could marry the shared values and sense of place of, say, medieval Europe, with the material decency, democracy and intellectual freedom that we demand today. I tend to think the best society will be one that requires its citizens to do a lot for themselves. For that to work, those citizens will have to be capable and informed and free from the fear of social dominance. It could be that what we need is a national order that, like Marx, prohibits privilege, but, like Jefferson, leaves much to an educated yeomanry.

I don't know. As I said, New Alchemy is in the tool business. In a sense, our work here is to create options for grandchildren.

A final consideration, less mega-think. I always seek enjoyable work. "Work which is pleasure, pleasure which is work," as Morris said. Work at New Alchemy isn't utopian, but it's got law firms beat to hell. I like being here. I like bringing my six-month-old boy to the office, working some Saturdays, skipping some Tuesdays, digging in the garden and lugging junk and writing papers. I like the religion of this place: there is an explicit devotion to the integration of ourselves and the earth. It is very moving.

Calculating Engines

– Albert M. Doolittle, Jr.

It may come as something of a shock or, at the least, as a surprise to some of our readers to learn that New Alchemy has acquired two computers. While not trying to redefine the term "appropriate technology" (the definition of which is the subject of some debate anyway), we felt that the area of computers, microcomputers in particular, through decreasing cost and increasing usefulness, was redefining itself and might not be out of place under the rubric of appropriate technology. To understand this, the image of a computer in a room filled with large machines tended by equally large numbers of people must be put aside. High technology electronics has miniaturized and simplified sophisticated machines such as computers to a point where they are no longer the dominate entity in a human/machine interaction. Because New Alchemy has become a research institute that generates large amounts of data yearly, the data must be collected, reduced, verified and collated into publishable and usable form.

Over the last ten years, there has been a revolution in electronics. Catalyzed by space-race war technology, transistorized circuits have been so reduced in size that well over 50,000 transistors can be placed on a single silicon wafer ½-inch square (1.61 cm.sq.) or smaller. This process, called Large Scale Integration (LSI), makes it possible to produce for one hundred dollars hardware that formerly cost hundreds or thousands of dollars. Commercial applications like pocket calculators and digital watches have both accelerated the technology of mass production and driven the costs down to less than ten dollars at the retail level. Designers have been shrinking the size of computers so that the computing capability of large computers can be packaged in a box the size of a typewriter at very low costs. We are seeing a descending cost-size factor and, correspondingly, increasing performance factor which portends LSI electronic systems as a major force in shaping the future. LSI production is not confined to major technology producers. Many devices are made in Malaysia, Korea, the Philippines, Taiwan and Hong Kong. Although cheap labor is obviously being exploited, this does indicate a broad base for the production of such a high technology. A further example of this is in the quote of Koji Kobayashi, President of Nippon Electric Company, following a 1975 tour of the Peoples Republic of China, that the Chinese were fast approaching "the world's highest level in production of high capacity LSI's".[1]

There is an interesting anomaly in LSI production. A term called "Creative Quotient" (CQ) must be defined. In a manufacturing process, CQ is the amount of creativity or flexibility of use in the product passed on to the end user. Examples might be modelling clay and a manual can opener. Modelling clay is simple to manufacture technologically, yet retains a high degree of creativity (high CQ). The can opener requires more manufacturing in terms of technology and decreases in creativity (low CQ). Although it is possible

to open bottles with a manual can opener, as one goes higher on the manufacturing scale to an electric can opener, that capability is removed. Although not a hard and fast rule, in general, as a product becomes more complex, creativity is increasingly relegated to the creator rather than the user of the product. Because of its inherent design, we are, a priori, forced to press button A before button B to get the thing to work. More analytically stated, Creativity Quotient is inversely proportional to the manufacturing complexity as shown in Figure 1.

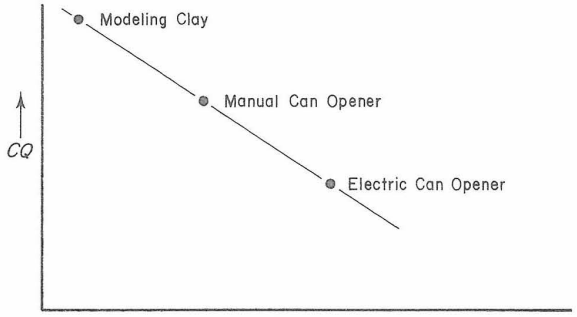


Fig. 1

With LSI technology, the case is reversed. Digital watches, as LSI devices, would be on the low end of the spectrum. They are the simple products. For the user, they are easy to operate, but they have a low CQ. There is little owners can do with them beyond telling the time or date. Calculators are higher on the scale, leading to a higher CQ. Although limited in the functions they can perform, some potential creativity remains after they have been manufactured. The user can create new problems or games which, with the programmable calculators, can be quite complex. The calculator is essentially a microcomputer with a fixed program residing in its memory. When turned on, the program begins to execute on the calculator's computer. If the users have access to the stored programs and can change them to suit their needs, they are in possession of a high technology product with immense creativity or flexibility (i. e., high CQ). This aptly defines the microcomputer. The user communicates to the computer in a mutually understandable language, such as Basic or Fortran or any other interactive language, and the computer performs the task or calculations.

Looking back at Figure 1, LSI technology could be added as in Figure 2.

As the technology becomes more complex, there is an inflection in the curve as the CQ rises with increased technology. This means that, as higher technology devices are produced, their control is reverted back to the user. Rather than viewing the complexity inherent in such technology as enslaving, it should be seen as a serviceable tool.

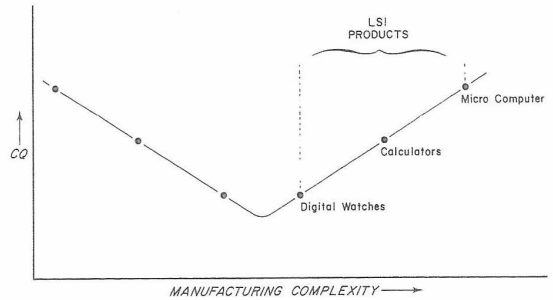


Fig. 2

Access to this type of complexity lies through programming. This should be considered a learned skill. There are at present approximately 60,000 home computers in use. Many children have learned to be computer programmers. Once the knack has been acquired, the power of the processor belongs to the users to do what they may.

At New Alchemy we have used our microcomputers to design data acquisition and control programs that collect and store data for later analysis. We also have programs to analyze and plot the data. We are not trying to replace ourselves as observers and participants in our experiments, but we do use them to read instruments and turn on pumps, open valves and control vents. They cannot smell, taste or see, but they can measure temperature, pH, sunlight, humidity, dissolved oxygen and many other physical parameters twenty-four hours a day.

In determining our computer system, we had two requirements that were somewhat mutually exclusive. In the first place, we wanted a low-cost data collector which was compact and able to withstand hot humid environments like that of a greenhouse. Secondly, we needed a system that could store large amounts of data and had programs available to reduce and analyze this data. Our solution was to separate our prerequisites into two separate computers.

We approached MICROLOG, Inc., of Guilford, Connecticut, with the idea of a small inexpensive data collector with the flexibility to collect the type of data we wanted without having to precondition our signals. This meant that we would design a module to read soil moistures, for example, directly from the sensor rather than from a box into which the sensor is plugged. All the sensors will plug directly into the computer. The economics of this type of set-up lie in the fact that a computer can read several sensors for the price of one signal conditioning box.

Our second requirement was met by a small PDP11/03 computer manufactured by Digital Equipment Corporation. With it we can communicate, using a high level language like FORTRAN-IV or BASIC and store the data on floppy disks which are essentially magnetic tape in the shape of a 45 RPM record. Our

data can be plotted on a video screen and copies made of the plots for future reference. The two computers are linked as though they were computer terminals. The PDP11/03 requests data from the microcomputer which, in turn, selects the channel, reads the value and transmits the information back to the PDP11/03. The PDP11/03 then further processes the data, stores it and subsequently displays the processed data on the video screen. (See Figure 3).

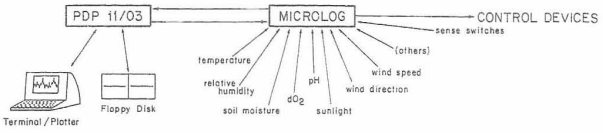


Fig. 3

Using a terminal type of link gives us added flexibility in that a regular terminal can be substituted for one of the machines. The PDP11/03 could be replaced by a terminal or recording device. The micro would then act as a small stand-alone data collector. The data could be stored on cassettes or on similar media and later be transferred to a computer for analysis. In fact, the microcomputer itself could be used for simple analysis.

The real power of computers in collecting data is derived not from the collecting and processing aspects, but from the ability of the computer to make logic decisions at the same time as it collects the information (called real time interaction). Not only can the computer read the temperature, amount of sunlight or other parameters, it can do something about them. The response might vary from typing a message to collecting a problematic situation. For example, if the temperature is too high, it will open a vent. That is a simple task and certainly does not require a computer. But more complex tasks, if a computer is not used, require extremely complex logic systems and can be very inflexible. For example: if the sun is bright in the morning, the air is warm and the time is 10:00 A. M., the vents should be opened so the building can get a jump on anticipated heat from the afternoon sun. If the sun is bright and the air is warm but the time is after 3:00 P. M., the vents should be closed or kept closed to conserve the heat. However, if the temperature goes above a certain value, no matter what the time of day, the vents should be opened. Conversely, if the temperature is cool, the vents should not be opened even if the sun is bright. The task can be performed by a wired-up logic, but it is interesting to look at the simplicity of the program. (See Figure 4.)

Figure 4

```
WARM    = 20     ; degrees C
SETTEMP = 30     ; degrees C
BRTVAL  = 50     ; mw/cm2
TOP READ TEMP, SUN, TIME
    OPEN = FALSE
    IF (TIME < 1600 AND TEMP ≥ WARM AND SUN ≥ BRTVAL)
        OPEN = TRUE
    IF (TIME ≥ 1600) OPEN = FALSE
    IF (TEMP ≤ WARM) OPEN = FALSE
    IF (TEMP ≥ SETTEMP) OPEN = TRUE
    IF (OPEN = TRUE) CALL OPENTOP; routine to open vent
    IF (OPEN = FALSE) CALL CLOSETOP; routine to close vent
    GO TO TOP
```

Other examples pertaining to non-mechanical systems such as the aquaculture systems could be cited. The computer could calculate a day's requirement of supplemental feed given the amount of sun and the estimated photosynthetic activity in the solar-algae ponds. It could advise and inform of important occurrences and act as an assistant.

With very little hardware, the computer can perform multitasks and collect data. We hope to make the understanding gained from these tools available in non-computerized forms such as operational manuals for bioshelters. We are not designing environments which require a computer for maintenance, but we do see it as a useful tool for studying complex systems.

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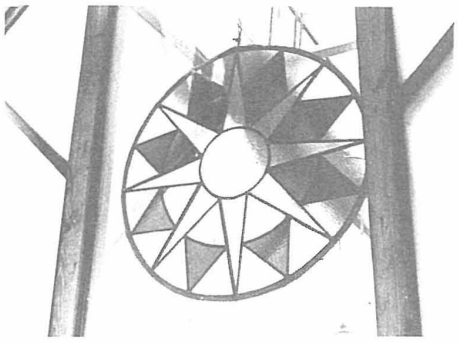
Photo by Hilde Maingay



On the Cryptic Phrase "Mathematical Modelling"

– John Wolfe

Several projects at New Alchemy now involve mathematical modelling. Joe Seale has developed a model of the thermal processes in the PEI Ark which will be tested against reality and refined over the next year; Colleen Armstrong is collecting data in the Cape Cod Ark on aphid outbreaks and the subsequent infestation of the aphids with a fungal parasite in order to model that phenomenon; and the author is part of a three-year project to model and optimize the solar aquaculture systems.

What are these things, mathematical models? There is such a wide variety it is hard to pin down a definition, but let me try: a mathematical model is a set of mathematical statements that describe the relationships between elements in a system.

Robust mathematical models can serve four purposes:

1) organize and tie together knowledge,
2) reveal the logical implications of that knowledge,
3) direct research by pointing out which important relationships are not yet well-defined, and
4) guide action by showing how changes in particular relationships or elements affect the rest of the system.

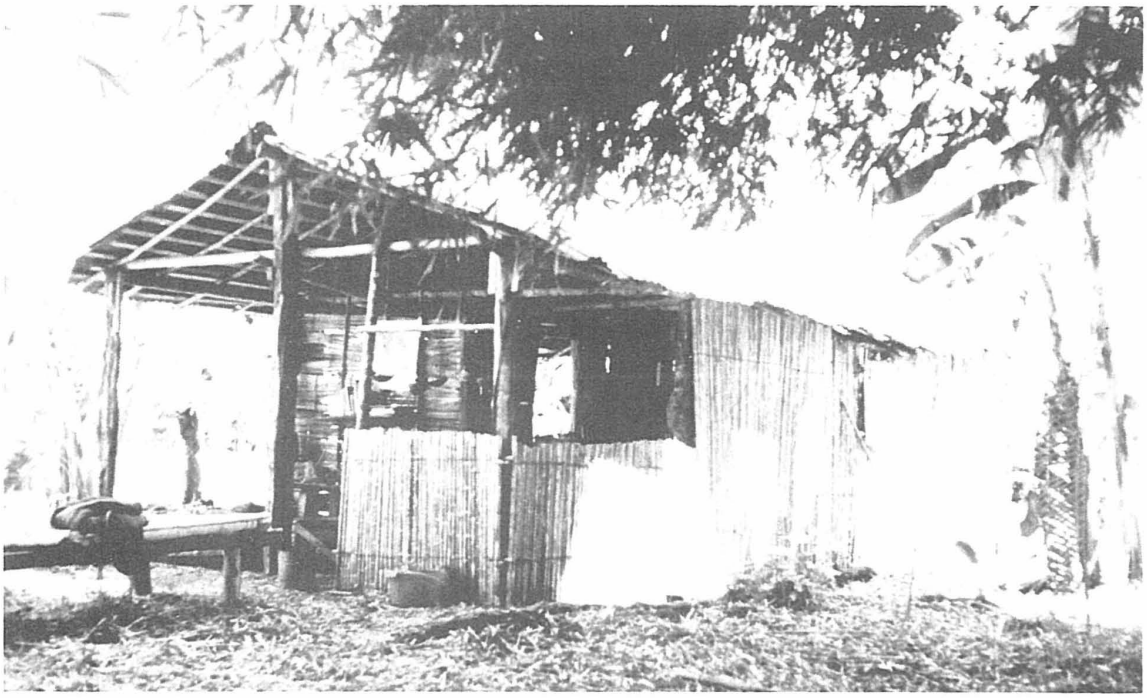
In other words, a good model enhances one's understanding of a complex system.

To avoid being an academic exercise, a model should be action-oriented; it must be directed toward solving a problem. In the aquaculture modelling project the problem is to maximize the growth of edible fish protein while minimizing the capital costs, labor, non-local energy inputs and commercial feed.

The mathematical tool one picks to model a system is crucial. One must avoid being limited to one mathematical method, or as Dennis Meadows puts it, "If all you have is a hammer, everything looks like a nail." At this point it appears that system dynamics offers the most appropriate approach for analyzing the ecosystems in bioshelters. System dynamics was developed to analyze feedback systems, and the essence of most ecological systems is this complexity. For instance, when our fish cut back the algae populations they, in turn, curtail their own growth. This is self-limiting, or negative, feedback. On the other hand, by cutting back the algae densities the fish allow more light to enter, spurring faster algae growth and thus more fish growth. In addition, the fish keep important nutrients in circulation, with the same result. Both are examples of positive feedback. Combined, positive and negative feedback loops exhibit an infinite variety of behavior, including oscillations, overshoot and collapse, and growth to a plateau.

Other mathematical tools, such as analytical solving of differential equations without using a computer, can model feedback systems only as long as the feedback loops are few and linear. Unfortunately, biological systems seldom contain linear relationships. For instance, the rate at which a tilapia in our solar ponds eats algae may increase steadily as algae densities increase, but beyond a certain point the fish becomes satiated. Thus the relationship between ingestion rate and algae densities is nonlinear. In mathematical jargon, system dynamics discretely integrates, or numerically simulates, nonlinear differential equations involving feedback.

As of this writing, John Todd, Al Doolittle, Ron Zweig and I are beginning to model the dynamics of the solar algae ponds. Hopefully, the model will guide us beyond the factors that presently limit fish growth in our ponds, but this isn't our only approach. This summer will witness the grand race between New Alchemists for the creation of the most productive solar ponds. It will be a race in more ways than one, for the computer will be churning out mathematical simulations, trying to find the optimum system too.



Costa Rica-*1977*

– William O. McLarney

This year's tale of Costa Rica cannot match its predecessor *(Journal Four)* for drama; there are no nefarious characters like "Farmer Man" lurking behind bushes, no squatters to evict, not even any major reverses of fortune. But for us it was a more exciting year than 1976, and the happy excitement, based on accomplishments, was shared with our neighbors. I only hope I can make a story without villains (though not altogether lacking in clowns) exciting to our readers.

Things got off to a pleasant start in January, when Susan and I arrived to find that Tony Lavender had taken splendid care of the place. The house had been improved, the soril field (again *Journal Four*) well tended, more fruit trees set out and – a first for NAISA – there was *food* in the vegetable garden when we arrived. A particular and surprising success was mustard, which provided us with abundant greens well into the dry season; tomatoes, cucumbers, peppers, malabar spinach and collards also did well.

With the guard changed and Susan and myself settled in, the first order of business was to call a community meeting. We were introduced at the meeting by Geronimo Matute, president of the Junta Directiva of the Asociacion Integral de Desarollo Comunal de Gandoca y Mata Limón. Those present bore with my Spanish, which is strictly "de la calle" (street Spanish) and certainly no act to follow Matute's poetic, oratorial style, while I explained that we had received a grant from the Arca Foundation for work within the community. For most of the people there it was the first admission that "los gringos" were there for more than the fun of it. I went on to describe the various areas in which we could contribute knowledge and experience in putting the money to work (vegetable gardening, fruit tree cultivation, reforestation, expansion of the soril project and fish culture), asked for comments or other ideas and indicated that visitors to the farm were welcome.

Response at the meeting was polite, but not notably enthusiastic; there were other community issues to discuss – maintenance of the foot trail which serves the community, possible stationing of a Guardia Rural (rural police) office in Gandoca, etc. But, beginning the day after the meeting, people began popping up. It soon became clear that by far the greatest interest was in fish culture.

Fish culture is anything but established in Latin America, and much of the fish culture that has been developed has suffered from entrepreneurialism and thus failed to serve the nutritional needs of the people. In Costa Rica, for example, there has been a well-run

fish culture station at Turrialba for ten years. The station has somehow managed to develop itself into a money-making business for the local municipality. But the extension work visualized by the various agencies which have contributed to the development of the station (FAO, the Peace Corps, The Inter-american Institute of Agricultural Science, The University of Costa Rica and the Costa Rican Ministry of Agriculture) has simply not materialized. Small farmers around Turrialba do not grow fish and, in other regions, campesinos have only the vaguest idea of fish culture.

So we were surprised when seemingly the most "radical" of our ideas was the one which most stimulated the community. What we didn't know then was that, for the first time, Costa Rica has a chief of fish culture within the Ministry of Agriculture. Under the direction of this man, Herbert Nanne, Jr., several new aquaculture stations have been established and advisers from Taiwan have been brought into the country. Sr. Nanne, convinced of the importance of developing fish culture at the economic level of the campesino, has initiated a campaign of familiarizing Costa Ricans with the concept of fish culture by means of the one form of media which reaches all Costa Ricans – radio. So we had unknowingly planted our seeds on fertile ground.

We asked for volunteers, preferably young people, to train in fish culture. Two young men, Oscar Cerda, age 23, and Llunier Vallejo, 19, stepped forward. We chose to take on Oscar first, since Llunier had a year to go in high school.

Our first task was to construct ponds; Oscar announced with some pride that his father's profession had been "palero" (literally, shoveler), and so he had had a certain amount of experience relevant to the job. It was decided that Oscar would act as "foreman", directing the physical work and seeing to the selection of workers from the community, while I would plan the construction and supervise the biological aspects.

The problem of where to locate ponds was solved when Matute donated about 1,000 square meters of his land, fortuitously located just over the fence line from the NAISA farm. The area, which had been converted into pasture, was low and swampy. One ordinarily sites fish ponds on high ground to facilitate drainage. As it happened, this particular low area had still lower ground at one end, so won out over other possibilities by virtue of its convenient location. We also considered important the fact that it drains directly into the Caribbean (only about 200 yards away) so that there is no danger of any escaped tilapia creating ecological problems in adjacent bodies of fresh water.

Our fish culture system is to be similar to the "Campesino Fish Culture Units" of Anibal Patiño in Colombia. (See *Journal Three).* Even before beginning work on the ponds we planted about a hectare of fish food plants, principally melanga and camote, both of which produce tubers edible by humans or hogs, in addition to the leaves to be fed to the fish. Later, Oscar planted a forage plant known as ramio, provided by Raul Bonilla (about whom, more later), and this year we hope to introduce comfrey.

Oscar assembled a work crew, ranging in age from 16 to 72, including Llunier, who was on vacation, for our first assault on the pond site. We agreed that it would be best to pay the workers the standard wage for day laborers in the area. A point might need clarifying here. One might argue that a community development project should not pay workers from the community, but rather proceed on a voluntary basis. Such an attitude, while debatable in the United States, is simply not tenable in Latin America when people are living close to the line economically and full days or weeks of their time may be needed. Sometimes financial support in the form of wages can be the key which permits people to test ideas when otherwise they would be forced to reject the gamble.

The first task was to cut and remove the overgrown pasture grass so that we could see the contours of the land. We found two more or less natural pond sites, but also a disconcerting number of vertical and horizontal tree stumps and trunks. We laid out two ponds and the appropriate drainage ditches, incorporating as many as possible of the trunks and logs in dams, dikes and ditch walls. Then we set to extracting the rest with shovels and pry bars. I concluded there were no faint hearts in the crew when I discovered the appalling frequency with which coral snakes emerged and were dispatched with machetes. Meanwhile, Matute was fencing out his curious cows. Finally, on February 23, six days after the official opening of the project, we got down to the business of making holes in the ground, using the constantly breaking shovels which are depressingly typical of Central American hardware.

From the start, Oscar proved himself an ideal foreman. Faced with a work crew of men mostly older than himself, he managed to direct the work without creating major antagonisms, listened to advice when someone else knew better than he, and never pulled rank when it came to his share of the physical work.

The size and composition of the crew varied. During one week, when the whole community was involved in a major bean harvest, it was just Oscar and myself with shovels. More often we had five to eight workers. The attitude of most of the men was a joy. Some of us here in the States, if we have put in time with grousing, loafing, clock-watching work crews or if we have been ordered as I have by a foreman to slow down so as to make an easy job last, are prone to think that joy in manual labor was invented by the counterculture. A few weeks on a job like ours in

Costa Rica would straighten that out. The kind of men we had in Gandoca is capable of working long, hard hours without complaint and will exhibit a ditch well dug, with a smooth bottom and neat, square walls just as pridefully as a skilled Gringo carpenter might display a handsome desk.

This pride is borne lightly. Our work and its goals were serious, but the pond site was a place of laughter; mud fights were not unheard of. I was the butt of perhaps more than my fair share of the humor. It can be embarrassing when a fellow half your size throws a piece of sod at you and you catch it and find you can't even *lift* it. More than once I found myself plastered against a dike with tufts of grass apparently sprouting from my chest, while everyone else roared.

There was verbal humor as well; one day I suggested that if we could just locate a market for mud, we would all be rich. Matute allowed that they would probably make good use of it in Holland, and the rest of the day was spent hatching schemes for exporting mud.

Once in a while we would slip and take on a worker who wasn't up to standards, and that could be cause for humor, too. One such fellow was nicknamed Chiriquano. He was strong enough and competent enough with shovel, axe or machete, but had a distaste for mud – an attribute which became increasingly inappropriate as our task progressed. At first I was worried; here was one man receiving the same pay as everyone else, but avoiding the "dirty" work. What would happen to our morale? Oscar handled it without a harsh word. Sometimes we would encounter a giant log requiring our collective strength. "We need your muscle here, Chiriquano." And, with amazing frequency, he would draw the deep end or the end that would give way and pitch him headlong with a resounding splash. When I remember Chiriquano my clearest image is of his disconsolately trying to rinse his socks in the muddy water, while the rest of us look on with great solemnity.

But perhaps the best index of the workers' attitude was not in their physical performance, but in their intellectual interest. Recognizing that in all disciplines there are theory and practice, and that our little aquaculture exercise was outrageously imbalanced on the side of practice, we decided to initiate a series of weekly after-work seminars in the theory of fish culture and related facets of biology. We settled on Wednesdays. I had in mind that these sessions would primarily be of interest to Oscar and Llunier, but we opened them up to anyone who wished to come.

The first Wednesday, it rained all day. By the end of the day everyone was drenched and shivering. To my amazement, the entire work crew stayed to listen to me carry on for an hour in bad Spanish about food chains, polyculture and the like. Attendance remained high; today there are more than a few people in Gandoca and Mata Limón who know such things as the interrelationships of soil fertility, light, phytoplankton, and fish production, or fish culture methods used in China.

Even though we had planned the work for the "dry" season, rain was the bane of the project. An especially heavy spate of rain came just after we had finished cutting and raking the grass and removing the stumps. We had begun to remove the sod from the bottom and pile it up to build the pond banks. I was ready reluctantly to take a few days off. All my Gringo experience said that you don't dig sod in a flood. But "No", insisted Oscar, "ya esta mas facil" (It's easier now.) And we waded into the swampy mess with machetes. Thwok! Thwok! The sodden sod was cut into blocks and floated to shore, eliminating a lot of lifting and carrying.

I don't want to come on as though we were a bunch of heroes or to bring on boredom in talking about the hardship of the task, but I think it should be understood just how important it is to some people to build a fish pond and what a "day's work" means to them. From the time the grass was cut until construction was finished, everybody spent eight hours a day knee to waist deep in mud which I described in a letter as approximating a mixture of "hot oatmeal and chicken shit with a little rubber cement on the bottom." Temperatures were usually in the 90's, sometimes over 100; it was always humid and about a third of the time it rained. (Perceptions of the climate differ. I remember one rainy day seeing Miguel Herrera come into our kitchen at lunchtime, shivering, to warm his hands over our kerosene stove. The temperature was 85 degrees.) The mud was so ubiquitous that the first part of my afternoon clean-up ritual was total immersion, clothes and all, in the ocean surf. Even I sometimes got chilly then.

I often laughed to think of what one "expert" on Latin America had told me when, as a student, I had asked why aquaculture was so poorly developed there when the need was so great and the climate so favorable. "Because the people don't like to work in the water", the great man said.

Far fewer snakes were seen after stump removal was completed, but one day a full-grown alligator cruised through, looking grouchy. If you want to feel helpless, try facing up to an alligator in the water, armed with just a shovel. There were mosquitoes, and a rather remarkable diversity of creatures capable of crawling up pant legs and biting. There was also the constant problem of infections resulting from scratches, machete cuts, mud in the eye, etc. Susan was kept busy dispensing aspirins, alcohol pads, bandages and eye drops. Feet, in particular, suffered; a vicious sort of rash affected nearly everybody. The thought that workers were literally limping five miles to work every day on sore feet was bad enough, but

the sight when they removed their boots was appalling. Oddly, after the first couple of weeks, I was not affected. I habitually worked in ragged sneakers, while the others wore the loose-fitting calf height rubber boots which are, for some reason, traditional in the area. Eventually, some of the men began to assume that my immunity was not solely attributable to insanity, and started working barefoot. The result was somewhat more cuts and scratches, but a whole lot less infection.

I was never sure just how seriously to take things. One day Omar "Mato" Briones showed up for work clutching his shovel in one hand and his jaw in the other. He was suffering from a toothache, but it was all I could do to send him home. A few days later he was in the hospital in Limón. From what I am told, Mato was lucky to have survived the infection he had.

Susan wisely offered no objection to playing a traditional role in this case – tending the house and garden, cooking and administering medical aid. Most days the men brought their own lunches, but about one day a week she would lay out a feast for everybody, judiciously balanced between traditional local foods and her own multi-ethnic improvisational cuisine. Every morning we would observe a five minute break when she brought out something to drink. Except on the hottest days, almost everyone preferred hot herb teas to cold lemonade.

Our task would have been difficult in any event, but the total lack of roads, stores or machinery made it that much more so. Negotiations for a chain saw never quite bore fruit, so all log cutting was done with axes. Mud from the middle of the ponds had to be carried to the banks in tubs and buckets. When we had broken every expendable such container in the vicinity we continued with plastic feed sacks.

A particular problem was encountered in building the reproduction pond. Our design called for the ponds to be approximately 1½ meters deep at one end and ½ meter deep at the other, with perhaps ½ meter of "freeboard" on the dikes. This did not necessarily mean that we would have to dig that deep, since dikes could also be built of dry earth from nearby high ground if that proved more feasible. However, it was necessary to get down to hard clay and to make the bottoms smooth and level. This was not too difficult in the larger pond, which was constructed first, but there proved to be an inordinate amount of semi-liquid stuff in the upper pond. It was almost impossible to walk in; sometimes it would take several minutes just to pick up your foot, and then you'd have to go back for your shoe. But it didn't matter too much, since often all that was necessary was to plant yourself and let the goop flow at you. However, neither a shovel nor a leaky bucket is an ideal tool for removing a fifty-fifty mixture of soil and water. We got it done, but it took forever. The distance from the bottom of the reproduction pond to the top of the dike is now about eight feet.

The unanticipated amount of excavation presented us with yet another problem. The deeper we dug, the more fallen trees we discovered. Apparently these were trees which had been cut when the area was first converted to pasture. Being tropical hardwoods, most of them had scarcely begun to rot. In many cases, they were pinned into the mud by downward extending branches. For about three weeks there was always at least one man flailing away with an axe in a constant shower of muddy water. The pieces, up to three feet in diameter, had to be rolled out, a process which left more than one of us on his face in the mud.

A final complication was provided by the peculiarities of the local climate. It seems that, in Gandoca, swampy areas flood during the dry season and drain in the wet season. The reason is that the swamps drain directly into the sea. During relatively dry weather, the Caribbean is often stormy and large sand bars are built up at the mouths of swamps and small streams, so that water from light rains and from year-round streams accumulates. When the rains come with torrential force, the sea is often calm and a sufficient head of fresh water is built up to cut through the sand bars and drain the swamps. With our pond drainage system uncompleted, we were forced periodically, sometimes as often as twice a day, to leave the pond site, troop out to the beach and shovel a channel, perhaps four feet deep and fifty feet in length, through the sand bar.

I had to start back to the States on May 5. By that time it would have been clear to anyone viewing the site that we were making two ponds and an accompanying drainage system. But it was not clear that we would be able to finish before the rainy season. My fears that our work would be undone subsided in late May when Oscar wrote to say that the aquaculture facility was completed. The dikes are reinforced with horizontal pieces of bamboo running the full length of the sides and with vertical stakes of wild cane. They are planted with grass to retard erosion and melanga and camote to feed the fish. I wish I had a picture, but the combination of high humidity and salt spray devoured my camera.

Both ponds are drained by a rigid PVC plastic pipe which passes through the bottom of the dam and is connected, on the pond side, to a flexible hose. These are the only non-indigenous materials used in the system. This device, invented by the Paraguayan fish culturist Juan Pio Rivaldi and known as a Rivaldi Valve, represents perhaps the simplest way to effect partial or total drainage of a pond at will.

As of this writing (mid-October '77), the ponds have survived all rains, as well as a hurricane which passed through Gandoca (a rare occurrence). While they have

yet to be stocked with fish, they are already serving an educational function. Even before I left, we estimated that two-thirds of all the men, women and children in the community had passed by to see the project, ask questions and in some cases suggest a site for their own ponds.

Susan and I seized on this opportunity to do some informal polling. We discovered that we were not in error in thinking that, even though Gandoca fronts on the sea, the community stands in need of fish, particularly since our friend John Holder, who made most of his living fishing with hook and line, has moved. Most people said they had fish for dinner three or four times a year and the same for meat, but that they would eat fish "three meals a day" were it available.

We have also had visitors from neighboring communities, including the regional health and law enforcement officials. I was invited to speak to the school children in Mata Limón. Easter Week, when it is traditional for Costa Ricans to go to the beach and Gandoca's population triples, we received visitors from all over southeastern Costa Rica and northeastern Panama. During our absence, Oscar has been in charge of the station most of the time and has continued our informal extension work.

With construction completed, the next phase of the project was to provide Oscar with some practical experience in aquaculture prior to my return. Costa Rica's oldest fish culture station is run by El Proyecto de Diversificacion Agricola in Turrialba. At the time we began our project, Raul Bonilla was in charge of this station. Unlike most "tecnicos" Raul began from the bottom, cutting grass at the station with a machete, and learned as he went, until today I consider him one of the most capable people in aquaculture in Latin America. I introduced Oscar and Raul, and Raul agreed to take Oscar on for a couple of months, with his salary to be paid by NAISA, so that he could learn the skills necessary to operate a fish farm. All that was needed was for me to write a letter to the Junta Directiva Cantonal Agricola in Turrialba. "A formality", I was assured.

But, between the time I left Costa Rica and the time when Oscar was ready to leave for Turrialba, Raul transferred to another fish culture station at Veintiocho Millas. Oscar, who had been delayed by a few small things like the hurricane, went to Turrialba, found no Raul and got precious little information. Meanwhile, I was involved in an exchange of confusing letters (formalities?) with the bureaucracy in Turrialba.

Finally, I phoned Herbert Nanne in San José. While placing the call I had cause to ponder my own preference for field work over office work. I had never met Sr. Nanne, only because I was too anxious to get into the field and get my feet wet to take time "going through channels." If I had been more willing to spend a few days tramping the streets of San José, would this problem have been averted? Was my taste for the field rather than the office a matter of wanting to get the "real" work done or just a personal environmental preference? Was I suited to administer anything? Would we ever get Oscar straightened out and fish in our ponds?

Sr. Nanne was most cooperative, but my call really wasn't necessary. In the meantime, Oscar had been to Veintiocho Millas and found, not only Raul, but also Herbert Nanne. Sr. Nanne was kind enough and impressed enough to put him to work immediately and to provide him with salary and housing through the Ministry. We have the feeling that it is still pretty unusual for an honest-to-God campesino to walk out of the woods into a government station looking for training in fish culture.

As I write, Oscar has just completed his training and is ready to take tilapia breeders back to Gandoca. The short-range plan is to stock only the reproduction pond. By the time I return in January, there should be enough good-sized young fish to sex them and stock males only in the growing pond. We will feed the fish much as Patiño did, but we will sex our fish rather than use cages to prevent unwanted reproduction, as we know of no locally available cage material comparable to the Colombian "guadua" bamboo. A possible experiment for the coming year involves the cultivation of termite nests, found on dead wood everywhere in the region, as a protein source for tilapia. In years to come we hope to plug various native fishes into the system but we wanted to begin, not with an experiment, but with a fish people know how to cultivate.

The eventual course of fish culture in Gandoca and Mata Limón, and particularly its economic application, will have to be decided by the community. This year we plan to adapt techniques to the local situation, demonstrate tilapia culture, and produce

as many young fish as possible. We will also consult with local farmers on the siting and construction of ponds and provide training in fish culture for others in the community, Llunier particularly.

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My narrative has concerned aquaculture almost exclusively, but that is not our only activity and much less do we envision it as such in the future. In the fourth *Journal,* I described our work with the herb tea plant known as soril. During 1977, Susan was largely responsible for continuation of our soril research. At this point, we can say that we see no particular problems in soril agriculture, though I'm told it doesn't stand up well to hurricanes. So far, we have not found processing methods suitable for use by small farmers on the scale we envision. Our failure to do so can be explained at least partly on the basis of my own lack of diligence in searching out appropriate technology for the task. That can in turn be explained by my preoccupation with aquacultural and administrative questions, and also by the fact that the soril growers of the community and I are questioning the appropriateness of the crop for the area.

We do not question the need for some sort of cash crop. I have explored the need for cash crops in *Journal Four,* but we are beginning to suspect that the advantage in producing export crops like herb teas lies with the giant corporate farm — and that is just what we do not want the region to turn into. Perhaps it would make more sense to use fish or fruits, which can contribute needed food directly to the community as well.

One important finding with regard to soril came from the kitchen. Susan proved that it can be made into delicious pies and jams. The locals, accustomed to using it only for teas and cold drinks, were quite impressed by this. Perhaps some day soril will play a substantial nutritional role.

Whatever happens, soril has already played one important role by serving as the basis for our first community experiment. Soril provided the first opportunity for the farmers of Gandoca and Mata Limón to work together with NAISA people, and for all of us to iron out some of the doubts we might have had about each other. From that point of view, there can be no such thing as a "failed" project.

Crafts are anything but highly developed in the region. Susan's vegetable dyeing and weaving attracted much interest and even some offers to buy. This year she will be taking on one weaving student, Filomena Vargas.

We also discovered another important function for ourselves this year as intermediaries between the community and the world of aid and development. Seeking funding to complete the fish culture project,

we made contact with John and Mary Contier of Catholic Relief Services in San José and invited them to spend a few days at the farm. During this time we arranged a meeting, which deliberately was kept small. Oscar and Llunier were invited to speak for the fish culture project and Matute as representative of the community-at-large.

However, another friend, perhaps misconstruing the purpose of the gathering, also showed up, roaring drunk on rubbing alcohol — with his radio. "Merican music! Plenty swing!" My evening amounted to a wrestling match as I tried to moderate the radio, dissuade our friend from offering his poison to the others and reason (?) with him. To add to the hilarity, Oscar with his machete slew a rat that dashed across the kitchen floor. It was certainly the most irregular meeting in the annals of New Alchemy (not an organization noted for excessive formality), and for all practical purposes I missed it. I didn't much care. I figured our friend had blown whatever chance we had of getting help.

To my amazement, when the smoke of battle cleared, I discovered that the Contiers had offered, not only to try to help fund the fish culture project, but to look for support for a larger community development project for Gandoca and Mata Limón. However that came about, it was not on the strength of what *I* said at that meeting.

I tell this story, not just because it is amusing or for the sake of conveying the news, but because it points up one of our legitimate roles in Costa Rica. There are any number of organizations like Catholic Relief Services in countries like Costa Rica, staffed by good people like the Contiers, who are looking for good projects. There are, in the rural communities, any number of hard-working and concerned people capable of articulating their needs if given a forum. And seldom the twain do meet. If a person from one of the agencies does get out into the country, it is a hit or miss proposition whether he or she will get to

the right community and meet the right person. If the campesino goes to town he is often ill prepared to find the right door to knock on and, if he does get in the door, he is liable to be brushed off by the receptionist. In retrospect, we may eventually decide that the two most vital tasks we performed in Costa Rica in 1977 were to bring the Contiers to Gandoca and to put Oscar in touch with Costa Rican aquaculture officials.

The CRS meeting was followed by one of the community Junta Directiva (plus a few), also held at our house. This meeting, which commenced with a tour of the fish ponds, was attended by Aquiles Rodriguez, Lino Ramon Lopez, Ismail Rojas, Victor Briones, Juan Centeno, Lauriano Duartes, Orlando Sequiera, Matute, Oscar, Susan and myself. It was as orderly as the preceding one had been riotous. We were pleased to see all ages represented on the Junta, though we would have been more pleased to see some women present, as women do participate in community meetings.

A long range plan of development for the community was presented, which included such items as a dispensary, a community hall, improvement of foot roads, an airstrip and purchase of a launch to get goods in and out. One might have expected a community having their first brush with the funding world to excitedly bite off more than they could chew. Instead, they decided to ask for far less money than the maximum which the Contiers indicated might be obtainable and to limit themselves to two projects, since more projects undertaken could lead to projects badly done. They chose our underfunded aquaculture project, since that was already under way, and the launch, since that seemed to have the least chance of ever being realized without outside help.

I was dispatched to San José "in total trust" to draft a proposal describing the community's resources and needs and explaining the two projects. As of this writing, the proposal has cleared the CRS and Church authorities in Costa Rica and is under consideration in the New York office of CRS.

One other important item of business was accomplished in 1977; reorganization of the Board of Directors of NAISA. Our original board, apart from myself, were "paper tigers" who lent their signatures to help legitimize our activities in Costa Rica. As of this spring, I am the "secretario", Matute is "tesorero", Robert Wells is "fiscal", and Margarita Downey Saborio is "presidente." Bob (an attorney) deserves special thanks for giving us a lot of "informal" (= free) legal advice in times of real poverty.

Our plans for the future are largely contingent on funding. Fortunately, we are enough of a campesino organization that we will be able to do something under any economic circumstances. But we do have plans and dreams. They are rooted in the opinion, held in common by ourselves and all the farmers we have talked to in Gandoca and Mata Limón, that far, far too much of the agricultural (and aquacultural) research being done benefits only the large grower. This is partly a reflection of how research funding is directed but, especially in Latin America, it also reflects a lack of awareness by scientists of the realities faced by the small farmer.

Elsewhere in this *Journal* I have mentioned the idea of a research institute directly responsive and responsible to the campesino. The groundwork for such an institution has been laid by NAISA and the people of Gandoca and Mata Limón. Another step was taken when Tom Gardiner, a young man with Peace Corps experience in Costa Rica and an M. S. degree in agriculture from the University of Massachusetts, signed on for six or eight months with us. If all goes well, he will extend that stay and begin to design and carry out agricultural experiments in collaboration with local campesinos.

Before this plan progresses very far we will need to have a real farm and a building or two. (The present NAISA "farm" is really no more than a plot of land to live on and grow a few vegetables.) Nothing elaborate – it is a tenet of NAISA that workers from outside should live in and as the community – but it does take land. In the short run, I am sure we can do research on our neighbors' farms, but in the long run it is neither convenient nor fair to tie up other people's land in lengthy experiments. We will never be a large group; too large an "outside" presence would inevitably be disruptive. But we do hope someday to have facilities for guest and student investigators.

Our present needs are for land, funds – and a skilled translator to help us make our work available in Latin America outside our immediate area. We do not, and probably never will have, an "office staff", but serious inquiries are invited. You may write to this address or to Aptdo. 902, Puerto Limón, Costa Rica.

VISITORS – COSTA RICA

We are beginning to receive a substantial number of letters asking to visit the NAISA center in Costa Rica. More surprising to us – in view of the sixteen mile hike ordinarily necessary to reach us – during the first four months of 1978 we received several drop-in visitors. Nice folks – mostly – but it *is* inconvenient when you're cooking for dinner for three and suddenly there's six.

So – it always comes to this – we are going to have to inaugurate A POLICY. The policy will be different from the one we have on Cape Cod. Most readers are familiar with "Farm Saturday", which permits us to accommodate the public one day a week, while still getting on with our other work. Such a program is not feasible in Costa Rica for the simple reason that, located as we are, any visit is perforce at least an overnight visit. And there are *no* overnight accommodations remotely near us.

It is probably appropriate to say something about the difference between our overall program in the United States and Costa Rica. In the States we function primarily as a research institution, developing ideas and techniques for dissemination outside Hatchville. In Gandoca we do some of the same, but we are more concerned with approaches to community development as they can be implemented in our community. Thus, there are less interesting gizmos to look at and a greater need to deal with *local* drop-in visitors. We feel that it is essential that we be open to residents of Gandoca, Mata Limón and neighboring communities at any time, and a considerable part of our time is consumed in dealing with such visitors. So we must ask that other visitors have *very specific reasons* for coming. There are simply not enough of us to have it otherwise.

If, after careful consideration, you really feel that you have something important to learn from us or offer us, we insist on the following:

1. Secure permission and set a date ahead of time. This can be done by contacting Bill McLarney at the Cape (June-December only) or by writing NAISA, Apartado 902, Puerto Limón, Costa Rica. Allow plenty of time for letters to Costa Rica; as much as a month may pass between visits to our mailbox.

2. Be prepared to work hard at whatever you are asked to do.

3. Be prepared to be completely self-sufficient with respect to shelter and food. We *may* be able to offer a roof or share food, but we can't promise.

4. Be aware – as some travelers are not – that anything you'd think twice before doing in North America bears at least three thoughts in Costa Rica. I am thinking particularly, though not exclusively, of drugs. Any substance that is illegal in North America is more so in Costa Rica. It is a *rule* at NAISA that *no* illegal substance is brought in or through the property, bought, sold, used or planted by anyone. Any infraction of the laws would implicate us all, and we cannot take *your* risks.

5. A good command of Spanish is very helpful, though not absolutely essential.

We trust that you will understand our situation and that this policy will not cause too much inconvenience. We will continue to publish on our experiences in Costa Rica (hopefully, soon in Spanish) and hope that this will fulfill much of our responsibility to communicate.

Book Reviews

– Nancy Jack Todd

There were two books published during 1977 that I should like to review for readers of the *Journal* who might not yet have encountered them. Both are by women and, although they are very different, I think they are both important books. Their writing could be looked on as an act of service. In the case of one of them, *The Underside of History,* it is a comprehensive attempt to revision history and to write in the role of women, so that not only women, but all of us might gain a more complete sense of the patterns and events that have led us to the present. The other, *Creating Alternative Futures,* begins with the present, analyzes how we managed to get into our current economic and resultant ecological debacle, and suggests practical stratagems for making the transition to a sustainable future.

Photo by Hilde Maingay

Boulding, Elise. 1977. *The Underside of History, A View of Women Through Time.* Westview Press, Boulder, Colorado. 829 pp.

During most of the Vietnamese war, I lived in Ann Arbor, Michigan. I worked there with a very impressive group of women who called themselves, collectively, "Ann Arbor Women for Peace." They were affiliated although not actually a part of the national "Women's Strike for Peace." It was working with this group that first led me to believe in the untapped potential in greater participation by women in public life. One of the activities that involved a lot of our time was the collating, folding and stamping of the seemingly endless streams of mail that issued from and through us. In the talk that accompanied our moving hands, a name that recurred often was that of Elise Boulding – Elise speaking here – meeting with influential people there. We knew her as a Quaker and a pacifist. She was, for us, a model, a woman with the courage of her convictions, deeply committed to, and active in the attempt to end that senseless war.

Now she has written a book out of her dedication to another cause important to her: that of righting the imbalanced perception we hold of the roles played by women throughout the past. Initially, when I first decided to review the book for *Journal* readers, my thought was to recommend that every woman should have a copy for herself and for her daughters, if she had them, but that, of course, is wrong, for men suffer as much as we do from the distorted view of history and stand to benefit as much from a broader understanding of the evolution of the human family— and not just of mankind.

Dr. Boulding's book is entitled *The Underside of History, A View of Women Through Time,* and is dedicated to "all women of every time and space who are this book." The book is a retracing of the past onto which she lovingly draws in bolder strokes the shadowy figures of the women whose lives, over vast reaches of time, precede our own. The early chapters are devoted to our evolutionary heritage and cover sexual dimorphism and dominance and the development of sex roles. Turning to the paleolithic and building on a thorough researching of archeological clues, Dr. Boulding reconstructs the ways in which women lived in hunting and gathering bands. With the beginnings of agriculture and the establishment of patterns of settlement came changes which magnified as the scale of settlement grew from village to town to city. Work became specialized and civilization, as such, began. The great ancient civilizations in Sumer, Egypt, India and China are discussed.

One of the most interesting aspects of the book for me, as a former history major, lay in reading about the cultures to which I had had considerable exposure and in discovering how completely the quality of the lives of women had been glossed over. For example, roles of women in Ancient Athens are portrayed as richer and more varied than the cloistered, domestic ones of which I had read. Dr. Boulding points to the painting, sculpture and tragedy of fifth century Athens as indicating the psychic force women must have had in spite of being political nonentities.

Similarly, in the description of European history, which I had studied in some detail, I discovered so much I had never known. Of kings we heard much, but never of the young princesses, trained from early childhood for political marriages on which the fate of nations often depended. While still in their teens, many of these young women kept peace between otherwise fractious countries through embodying family alliances that straddled conflicting political ambitions. It was said that, for a king, every daughter was worth a standing army if deployed in the right way. Dr. Boulding tells of the devotion of many Eastern European queens, princesses and noblewomen in caring for the sick and the poor. And there are wonderful human stories of such well-known figures as Eleanor of Aquitaine whose last signature on a public document read, "Eleanor, by the wrath of God, Queen of England." For the first time, I learned of the Beguines, a lay sisterhood that provided a place for working women, both physically and socially, as an alternative to marriage or the church. The slightly better-known work of religious women, mystics and nuns is also discussed.

For a book that is eight hundred and twenty-nine pages long, scholarly and covers a time-span from the paleolithic to the present, any attempt at description can only be random sampling and, as such, completely inadequate. It is thoroughly documented with references, charts, tables and figures and is illustrated with photographs and reproductions of drawings or illuminations. One such is from an illumination from a medieval manuscript and depicts with delicious irony a nun and monk tilting, the nun with evident and malicious enjoyment going at the disconcerted monk. Others portray some of the moments and range of joy and pain and work that women have experienced.

It is a book one wants within reach for a lifetime, to turn to again and again. It begins to address an enormous gap in the human sense of self. Dr. Boulding says, "The idea that great women are as evanescent in history as the melting snow is a poetic statement of the fact that women are invisible to each other, as well as to men, as the makers of history. They do not know their own foremothers."

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Henderson, Hazel. 1978. *Creating Alternative Futures.* Berkeley Publishing Corp., 200 Madison Ave., N. Y. C. 403 pp.

Creating Alternative Futures is a collection of Hazel Henderson's essays and talks over the last eight years,

although the majority are from the last three. Hazel Henderson is an innovative thinker. With Carter Henderson, she is the founder and co-director of the Princeton Center for Alternative Futures, Inc., an entity which William Irwin Thompson has referred to as "a Mom and Pop think tank." Her book, which is subtitled *The End of Economics,* begins with an overview of the current state of society which she calls "Recycling Our Culture." In it, she describes the cultural climate of confusing apparent anomalies in which experts from various disciplines issue conflicting statements on the state of public affairs and how those of officialdom – government, the military and industry – often belie the experience and observations of the individual. She points out that bureaucracies, by dint of their structure and size, are inherently resistant to change, leaving an inevitable time lag between attitudinal changes in society, even when they are quite widespread, and changes in public policy. That the linear, Cartesian, reductionist paradigm is long bankrupt and no longer has survival value is becoming increasingly accepted, as is the need for a paradigm shift, yet it is not reflected in the activities of government or business. Ms. Henderson suggests the image of the hologram, an information system in which every bit contains the program of the whole in much the same way as New Alchemists use the biological metaphor, to conceptualize a decentralized, communitarian society based on a humane, organic technology.

The first half of the book is comprised of an analysis of the "end of economics." For those who have accepted a world-view that admits to the folly of the continuing espousal of ongoing industrial growth in a world of finite resources, expanding population, mounting social dislocation and environmental degradation, this section of the book will serve to clarify understanding as to how we have reached this pass. For people who have succumbed to an uneasy feeling that all is not well, but are not sure where to turn for guidance, it should come as something of a revelation and as reassurance that they are not mad after all. The emperor is bare, indeed. And for those still clinging to Keynesian economic theory, I can only speculate that they will find a cogent debate that they must respect as containing arguments and evidence they will be hard-pressed to deny or brush under the carpet.

The second half of the book is devoted to the paths we might follow in creating a sustainable future. Many of the ideas will be, in some degree, familiar to people with an acquaintance with the counterculture or any of the wide range of alternatives that sprung up over the last few years, yet they are seen with such clarity and a wholistic and kindly vision that disparate efforts can be seen to be merging into a discernible pattern, reaching both horizontally and vertically into society. At the governmental level, the Office of Technology Assessment provides a channel through which the Congress can hear from less established constituents. She lists the Council for Economic Priorities, the focus of which is vigilance for malpractice in industry and government, consumer organizations like Consumer Action Now and environmental concerns like Friends of the Earth, as well as the less well-known activities of groups like block committees as epicenters for participatory social transformation. It was such a collective melange that was responsible for the first Earth Day and, more recently, Sun Day.

Ms. Henderson advocates the imaginative use of the media as a means of democratizing the creation of policy by giving civic and public service groups access to the public. As she points out, freedom of speech and of the press are hollow privileges in an electronic age, if you can reach no one. The diverse roles played by agents of social change are described, from feminist and ecological groups through professional ones like the Union of Concerned Scientists, as well as Alternative Technology organizations and the functioning of informal networks for the exchange of information and encouragement.

In a lovely image in the epilogue, Ms. Henderson says, "It is said that Minerva's owl only flies at dusk, and we only see the age in which we live at its twilight." She has helped us to do so with this humane and intelligent book.