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SELF-GUIDED TOUR

TO THE

INTEGRAL URBAN HOUSE

FARALLONES INSTITUTE

BERKELEY, CALIFORNIA

by Helga Olkowski

Introduction by Tom Javits

$2.50 Donation

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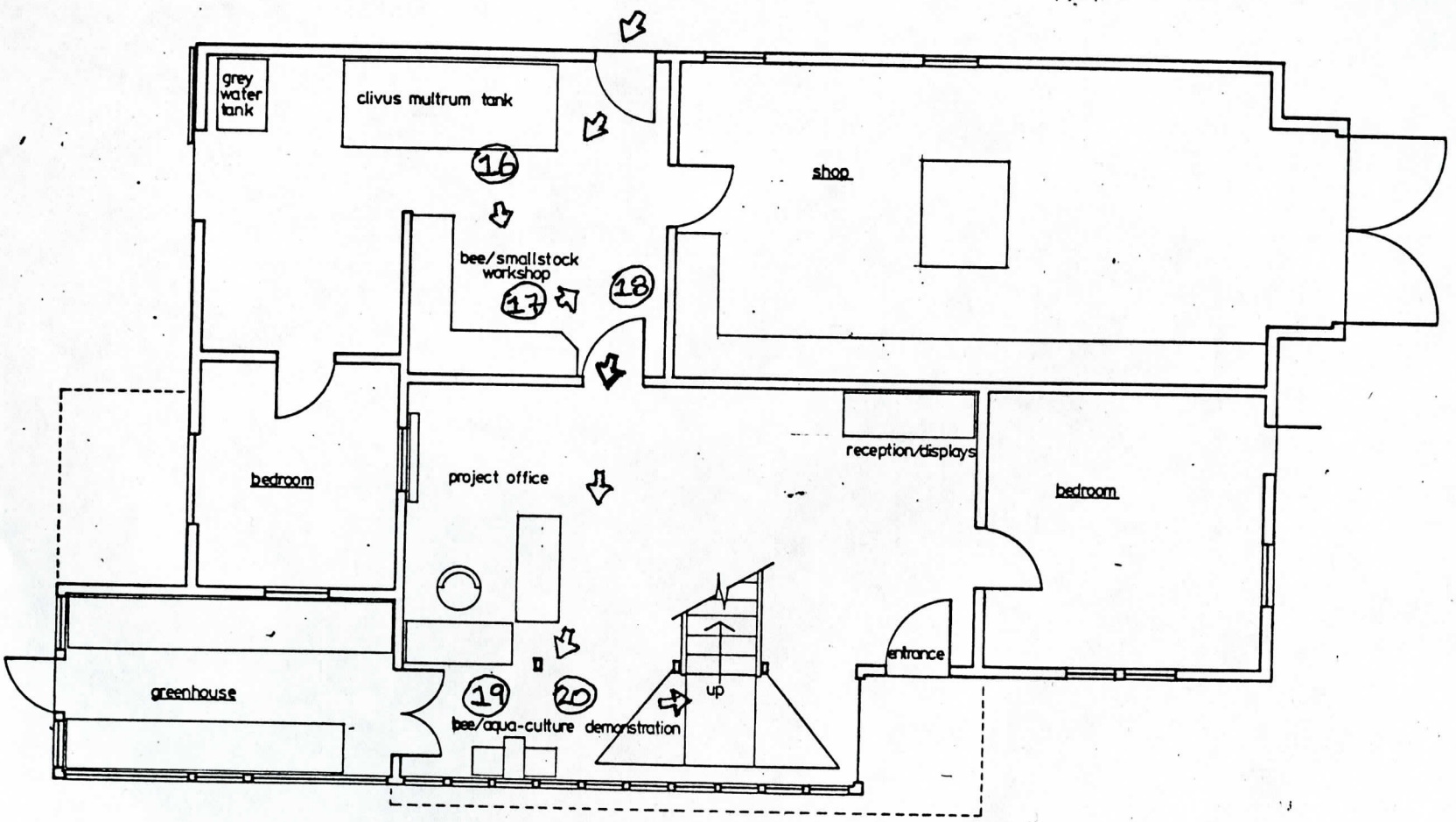
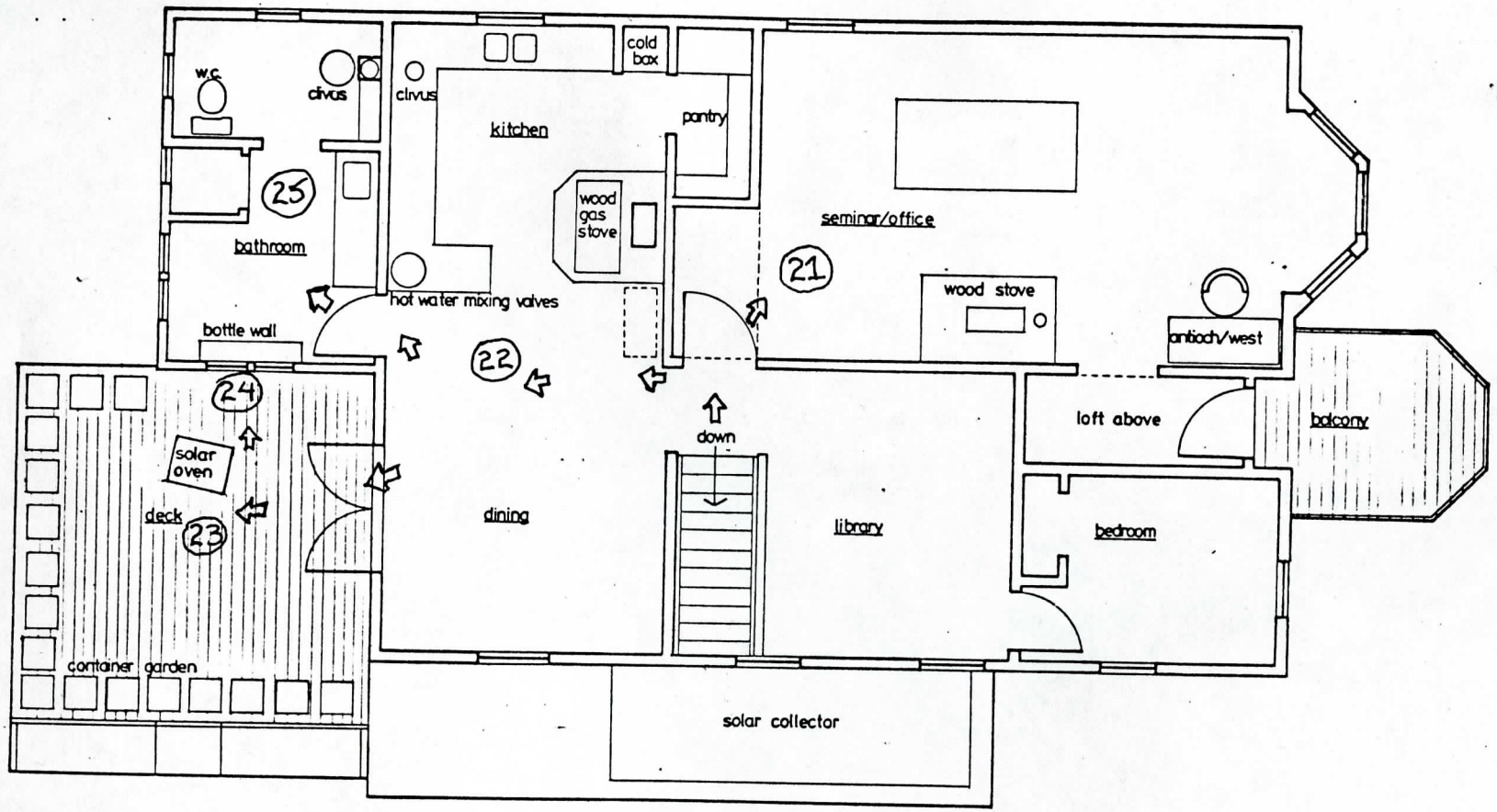


FARALLONES INSTITUTE
INTEGRAL URBAN HOUSE

1516 FIFTH STREET
BERKELEY, CALIFORNIA
94710 tel. 415-525-1150

GROUND FLOOR PLAN

NORTH 0 1' 2' 5' 10' 15'



FARALLONES INSTITUTE
INTEGRAL URBAN HOUSE

1516 FIFTH STREET
BERKELEY, CALIFORNIA
94710 tel. 415-525-1150

MAIN FLOOR PLAN

NORTH 0 1 2' 5' 10' 15'

INTRODUCTION

by Tom Javits

The Integral Urban House, established in October 1974, is a project of the Farallones Institute, a California based, non-profit research and educational organization. The House is devoted to the study and demonstration of environmentally sound strategies and techniques of food production, energy conservation and generation, waste recycling, and pest management suitable for application in urban areas.

During our first year, a staff of ecologists and builders began the work of transforming what was then a dilapidated old dwelling into a self-reliant urban habitat that could serve both as a demonstration project and a research and educational facility. The House was opened to the public for classes and tours in June 1975 as renovation continued. Now, with our education and research programs expanding, we continue to refine and improve both our physical and biological life support systems.

The Integral Urban House is an active demonstration of what people can do to improve both the quality of the urban environment and their own lives. Public classes are held on a regular basis in the fields of solar energy systems, habitat design, urban food raising, and waste recycling. "Hands-on" workshops are conducted in small stock raising, aquaculture, and beekeeping. Teacher training programs and environmental education seminars are conducted to develop instructional skills for classroom teachers. Professional consultation is offered for people seeking guidance in modifying their own homes. A fully accredited Master of Science program in Ecosystem Management and a Bachelor of Arts in Environmental Science are available to qualified individuals in collaboration with Antioch College/West, Berkeley, under the direction of Helga and William Olkowski.

Each week some two hundred people visit the Integral Urban House. Public tours of the house and yard are conducted each Saturday afternoon between the hours of 1:00 and 5:00 p.m. During the week, previously arranged tours are conducted for school, college and community groups.

In order to continue these activities which require the productive skills and dedicated labor of many people, we need the active support of people like yourself. Your involvement is crucial.

The most fruitful way you can participate in the activities of the Integral Urban House is by becoming an associate member of the Farallones Institute. Your financial support benefits you directly. As an associate member you are entitled to three free publications prepared by the Farallones Institute staff on subjects central to the development of self-reliance. You will also be entitled to reduced rates on our public classes and workshops as well as reduced prices on all Institute publications. A membership carries a two year subscription to the Farallones Newsletter which contains information on our current research activities and educational offerings.

A separate sheet is available containing an associate membership form, a list of publications we presently have available, and a checklist of the educational programs and research activities for which you would like more information. If you wish, please drop the completed form in the box on the reception table marked "Information Request". On that table you will also find a display of books we sell and enrollment lists for courses we offer. The receptionist or a tour guide will assist you.

Thank you for your interest in the Integral Urban House. We look forward to your participation in our educational programs and to your support of our research activities.

Welcome to the Integral Urban House of the Farallones Institute

Please Start Your Tour Outside the Front Gate

1. THE FRONT YARD

If any effort is put into the front yard of most urban and suburban homes, it usually comes from a desire to beautify the neighborhood (or perhaps impress the neighbors with one's status or wealth). Here our effort has been to make the area both pleasing and functional.

Raised Beds of Alfalfa

We believe that curbside areas offer a potential for making use of the sun's free energy to produce food. Instead of expending human effort and fossil fuels (in the form of fertilizers, pesticides and lawn mowers, etc.) in the production of a lawn, which is cropped and then frequently thrown away, we have chosen to grow alfalfa. This is a quick growing perennial plant that requires little maintenance and needs no fertilizer as it, like all legumes, has bacteria living in nodules along its roots which can take nitrogen from the air and convert it to a form available to the plant. The alfalfa provides a high protein feed for our rabbits and can be harvested every four to six weeks during the growing season.

Note: If you live along a busy street, vegetables grown at curbside will accumulate residues of lead on their outer leaves and surfaces. This is from air pollution caused by automobile exhaust. (In any larger city, plants will experience fallout from industrial emissions). Such outer leaves should be discarded and the vegetables rinsed in a weak vinegar and water solution. This should make them at least as safe to eat as the vegetables in the store which frequently are coated with residues of pesticides as well as lead. (Reference: Federal market basket surveys of pesticide residues.) Remember, if the vegetables grown in the front of your house are not safe to eat, it's not safe to breathe there either! The vegetables are only around for a few weeks, but you live there. Heavy metals are central nervous system poisons. Let's get the lead out of gasoline.

Hedge

Along the fence we have planted mulberry trees which will be pruned into a hedge. With the prunings we will feed silkworms which we plan to raise in trays along the back wall of the greenhouse. The empty silkworm cocoons can be used as insulation in quilted clothing, blankets and draperies. The insects themselves, frequently eaten by humans in the Orient, can be fed to our chickens or fish. A preliminary experiment just completed has shown us the ease of raising the moths and we plan to do this regularly during the seasons when the mulberries are leafed out.

Ground Surface

In every urban area where trees are planted, the prunings from these park and street-side shade trees forms a large part of the solid waste stream that ultimately ends up in the municipal dump. Instead of being wasted, woodchips provide a very satisfactory path or driveway material for certain situations.

Urbanization everywhere has meant the increasing spread over the earth of impermeable cement, asphalt and brick. Not only do the biological components of the soil die

beneath these layers that exclude water and oxygen, but the water that cannot be absorbed into the soil naturally must be dealt with through storm drains and other artificial channels. Water collected in this fashion creates new problems through the concentration of pollutants that it picks up in its travels over urban surfaces, providing breeding places for mosquitoes and occasionally other nuisance pests.

On the other hand, if the rain can sink into the earth where it falls, the ground water is recharged without problems of erosion and it has a chance to be somewhat decontaminated by the biological action of microbes in the soil and physical effects of percolation through the layers of earth. Furthermore, the soil surface is kept alive under the woodchips and available for growing plants, should a decision be made to change the placement of the pathway at a later date. The microbial activity associated with woodchip decomposition may also have some cleansing effect upon the air.

Obviously there are many situations for which woodchips are not suited, but a conscious demand for alternative road surfaces that offer some permeability, may encourage their development and availability, as well as reduce the amount of waste material flowing to dump sites. The sand and brick pathway just inside the gate leading to the front door is an example of just such an alternative to chips as a permeable walkway.

For further information:

Villiard, Paul. Moths and How to Rear Them. Dover Publications, New York, 1975.

Berry, J., D. Osgood & Philip St. John. Chemical Villains. C. V. Mosby Co., 1974.

Compost Science, a monthly magazine published by Rodale Press, Emmaus, Pennsylvania.

2. THE SIDE YARD

Location: Inside the gate along the southside of the house.

Our interest in plants that produce food, that are aesthetically pleasing, and whose cultivation consumes as little fossil fuel energy as possible has led us both to edible ornamentals and to native California plants. Edible examples are the strawberries, asparagus, artichokes, culinary herbs and rhubarb which can be eaten directly by humans. The chrysanthemums and comfrey can be fed to the chickens and rabbits.

Many native California plants have much to offer landscapers because they are adapted to survive the long dry summer with a minimum of irrigation water. Using water means consuming energy because electricity is used to pump the water to use points. Planting natives not only has an effect on energy consumption; it is important in directly reducing unnecessary water use.

Marigolds (seasonal)

During much of the year the entrance way is bordered by colorful marigolds (Tagetes sp.). A great deal of mythology has grown up around this flower. They are frequently recommended as "companion" plants because of a supposed ability to "keep away bugs." Actually, they do have a root exudate which discourages a plant-infesting meadow nematode, Pratylenchus penetrans. These are not insects but rather microscopic round worms that infest the

roots of certain plants causing poor growth and often visible stunting. (The long thin white roundworms you might see in the soil occasionally are beneficial organisms which decompose organic material.)

If an area is infested with plant-infesting nematodes, planting it solidly with marigolds and turning the crop in at the end of the season is a very effective way of reducing damage from this pest for the following two or three years. But planting a few marigolds here and there has not been shown to be very helpful in reducing nematode infestations, and there is no evidence that it will keep away bugs. In fact, around Berkeley, these flowers seem very attractive to cutworm moths. Whether this increases cutworm damage in the garden or not is not known.

Unfortunately most recommendations on companion planting are based on well-meant, often repeated, but purely fanciful theories derived from observation of coincidence, wishful thinking or inadequately controlled amateur experiments.

(More about pest control in the section on the backyard vegetable garden.)

For further information:

Lenz, Lee W. Native Plants for California Gardens. Rancho Santa Ana Botanical Gardens, Claremont, CA 91711

3. SOLAR HOT WATER SYSTEM

Location: Look up above the entrance to the front door. The solar collection panels are on the slanted roof along the south side of the house.

Ultimately, most of the energy on this planet is solar energy. Sunlight furnishes the energy that green plants use to make the simple sugars on which their growth depends. Almost all life on the planet depends on these green plants. Petroleum, coal and natural gas are all formed from the bodies of plants and animals that used sunlight to live millions of years ago. The sun also creates the changes in temperatures which create the winds that blow and the rains that fall, thus, ultimately providing wind and water power wherever that can be utilized successfully.

We use the sun directly to grow plants and to bring light and warmth into the house through the windows, and also indirectly to heat the water used in the house.

When water is heated it rises; when it cools it falls. So we located the panels for heating the water at the level of the ceiling of the first floor, and a tank for holding the water in the attic above. The water circulates through the system round and round, pumped by the sun by a process called a thermo siphon. There are no moving parts to wear out. The tank and all the pipes must be insulated so that the water is heated and the heat isn't lost to the air. On exceptionally cold nights the outdoor solar panels must also be covered to prevent heat from the system being lost to the cold night time sky.

The solar panels cover 86 square feet and are made of 3/8 inch copper pipes soldered five inches apart to copper sheets. We chose copper because of its ability to conduct

heat from the collecting surface into the water flowing within, its resistance to corrosion, and its general durability. A black airplane paint has been applied to the copper to enhance its ability to absorb heat. The panels are protected by tempered glass. This helps to create the "greenhouse effect". This refers to the fact that when sunlight passes through the glass, it is in the form of short waves seen as light. When these rays strike the ground or other surfaces, they are converted to infrared (the same as the heat waves given off by animals and plants themselves), and in this form, they do not pass back easily through the glass and the heat is trapped inside.

The cold water from the city enters the house at the base of the holding tank and flows down to the collector through a pipe 1½ inches in diameter. It then enters the 1-inch header pipe at the base of the collector and, as it is heated, it rises through the smaller vertical pipes into another horizontal header at the top of the collector. From there the water rises to the 120-gallon glass-lined steel holding tank in the attic. When the hot water faucet is turned on at the sink or shower, the heated water is drawn off from the top of the tank, where the water is hottest, allowing cold water from the city lines to enter the system.

When the sun is shining, the water may rise to 160° F. Since 120° F is ideal for washing dishes or showering, when the water gets too hot for use, it is automatically mixed with cold water to bring it to a lower temperature.

Of course, a certain amount of energy is used, and industrial pollution is caused, through the mining and refining of copper metal. But once contructed, a water heater such as this will not wear out and could last at least several decades. Unlike petroleum, gas and coal, sunlight is free for the taking, abundantly available in most urban areas, and without the deadly radioactive wastes or other hazards involved with obtaining nuclear energy.

During cloudy or foggy periods, the flat plate collector continues to absorb energy from the sun through indirect and reflected radiation, but at a lesser degree than on sunny days. Rather than heating water to 160° F as it does on sunny days, the collector can only raise it to 90° F or so. The reduced collector capacity coupled with sustained hot water usage in the house brings the water temperature down below 120° F after a period of about a day and a half. When this occurs and we want hotter water, we do have a 30-gallon electric water heater which serves as an auxiliary back up system, raising the 90° F solar-heated water up to 120° F. Data collected at the Integral Urban House last year indicated that the back up system accounted for only 5% of the energy usage for water heating; thus the solar collector provides 95% of our entire hot water heating needs.

For further information:

Daniels, Farrington. Direct Use of the Sun's Energy. Ballantine Books, New York, 1964.

Eccli, Eugene, Ed. Low Cost Energy-Efficient Shelter. Rodale Press, Emmaus, Pennsylvania, 1976.

4. GREENHOUSE

Location: Attached to the southwest corner of the house.

Our greenhouse provides us with a sheltered place to start seedlings for the garden all year round and to raise tomatoes and cucumbers during Berkeley's cool winter. It is a source of warm air for the reception room on chilly days, as well. On cold nights the windows should be closed with insulated shutters or curtains.

The advantage of starting seedlings indoors is not just the protection from plant pests, as mentioned before, but also the saving on space in the garden. During the four to eight weeks that the seedling is small, we are harvesting from mature plants outside. When the latter are consumed or reach the end of their usefulness, we can replace them with plants already well on their way to being full grown themselves. This makes maximum use of the garden area.

The greenhouse is also used for studying plant nutrition, through pot testing, uses of waste water and other experiments. The silkworm cultures will be located along the back wall during the time when the mulberry hedge is in leaf.

The three most common pests of greenhouse plants are whiteflies, mites and aphids. We have parasites that control the first and predators that control the other two. Biological control of greenhouse pests has been well developed for commercial use in Britain and Scandinavia, but the American industry has been very slow to adopt these non-toxic, non-polluting techniques.

For further information:

Dekorne. The Survival Greenhouse. Walden Foundation, El Rito, New Mexico, 1975.

5. COLDFRAME

Location: Outside, along the greenhouse wall.

Coldframes are easy to make and provide the extra heat needed to start seedlings outdoors in the winter (in the Bay Area) or early spring (in those parts of the country having a cold winter). They can be simply constructed of a box with a slanted top facing the south to which a glass window is mounted with hinges so it can be raised or lowered. It is important to allow for some method of venting a coldframe because it may become too hot inside,and it is necessary to let some of the moisture out so the seedlings do not die from water molds (called damping off) or from other fungal diseases. The easiest way to vent the coldframe is to prop the top open with a stick on sunny afternoons. On cold nights the glass top can be covered with cardboard or other protection so that the heat is not re-radiated out to the sky.

For small gardens a sunny window sill may provide adequate space for starting seedlings. One can use milk cartons or other waste materials as temporary flower pots for this purpose.

6. THE VEGETABLE GARDEN

Location: The 2,500 sq. ft. to the west of the house.

Is it worthwhile raising some of your own vegetables in the city? We think so. The vegetables you are most likely to raise - lettuce, tomatoes, squash, carrots, beets, peas and beans - are the very ones that consume the most energy when they are grown on the farm. Not only are fossil fuels involved in the pesticides, synthetic fertilizers and the petroleum needed to run the farm machinery, but there are high energy costs in storing, shipping and distributing the produce.

The vegetables you grow just outside your doorway take very little fossil fuel energy since you need use neither pesticides nor commercial fertilizers. Further, we have developed methods which take very little human energy. Approximately three to four hours of work a week (less than ½ hour each day) is all that is required to produce enough vegetables for the entire resident family of four.

There are other advantages to raising your own vegetables. They will be absolutely fresh and ripe when they come to the table; you can grow many varieties that are hard to get in the market, either because they are not much in demand or are too tender to withstand the rough commercial harvesting and shipping; and you know they will be free from poisonous residues. You will also save money. Last year we produced $600 worth of vegetables, without any expense except some seeds and water. We do harvest some of our own seeds, as well.

Raised Beds

You will notice that we grow the vegetables as close together as possible in raised beds. There is no point in growing things in rows, since we do not need to leave room for a tractor to go between the plants. We would not even leave as much pathway space as we have if this were a private garden and we did not have to allow for large groups of people walking through regularly.

The beds are raised to permit good drainage. Berkeley has heavy clay soils and it often rains for many weeks at a time during the winter months, so it is important to make sure the plants do not become water logged. The raised beds also help the public see where they should and should not walk. Of course, if you lived in the southwest of the U. S. and were gardening in light sandy soils, planting in depressions might make more sense. You need to adapt your gardening techniques to the climate, soils, time constraints and aesthetic preferences of your own household.

Most of the vegetables are watered with an oscillating overhead sprinkler, but the squashes, corn and tomatoes are watered with a soaker hose. In Berkeley we usually have enough winter rains so that little watering is necessary during that period of the year. During the hotter, dry months, because the soil is a clay and we keep it mulched, the most we need to water is once a week.

As much as possible we try to keep the ground surface covered with some organic materials. Compost is the best mulch, but the droppings from the rabbits, leaves or straw can also be used. A mulch serves many purposes: it keeps the ground a nice even temperature and protects it from water loss, erosion by wind or rain, and compaction from traffic or falling drops of water (which can compact the soil surface severely, creating an undesireable crust). Placing compost at the soil surface, where there is plenty of oxygen, provides food for billions of micro-organisms that decompose the material, thus supplying nutrients for plant growth that can leach down to the roots with each watering. The organic material also provides food for many small animals that create a

a good soil structure, or tilth, by their burrowing activities.

A good soil is half pore space, and this is best created not by the mechanical action of plows or digging forks but by the activities of the biological components of the soil. Earthworms are well-known for the activities of pulling organic matter down into the soil where it is further decomposed. But there are myriads of other less often seen or recognized animals such as springtails, mites, nematodes, sow bugs, etc., which turn over the soil and improve it through incorporating the organic material and their own dead bodies into the upper soil layers. They also secrete complex slimes that hold their tunnels open and clump the soil particles together in desirable aggregations. The more organic matter you give them, as long as it is not buried so deeply in the soil that there is no oxygen available, the more soil life you will have and the better and deeper they will improve your soil. By encouraging these soil organisms, rototilling and soil turning can be avoided, thus saving energy and time for other activities.

There is still another benefit from creating a complex habitat at the soil surface: many predatory animals, such as ground beetles (carabidae) that eat pest caterpillars and rove beetles (staphalynidae) that eat snails and slugs, require a moist shady medium in which to live. Thus a compost mulch on the soil surface may actually provide some measure of pest control.

The methods used in our garden are specifically designed to deal with the constraints of time, light and space experienced by the average urban gardener. For example, we raise squashes, beans, cucumbers, etc. on fences and upright structures since the climbing varieties are frequently more productive than bush types and we save valuable ground space. For the same reason we plant many cut-and-come-again vegetables such as loose-leaf lettuce and sprouting broccoli. These provide repeated harvest from each plant instead of requiring re-planting, as do head lettuce and standard broccoli. We teach these and other time and space saving methods through public classes held regularly at the house.

For further information:

Olkowski, Helga and William Olkowski. The City People's Book of Raising Food. Rodale Press, Emmaus, Pennsylvania, 1975.

Burgess and Raw. Soil Biology. Academic Press, New York, 1967.

7. PEST MANAGEMENT

We employ cultural, physical and biological methods to control plant pests here and do not use synthetic pesticides. This requires a certain amount of attention and effort because Berkeley has a number of invaded pests such as the garden snail, Helix aspersa, and the cabbage maggot, Hylemyia brassica, which have invaded from other areas and left their natural enemies behind.

In regard to cultural controls, we select the varieties of plants most suited to our climate and to the season of the year in which we plant them, growing them as rapidly as possible so that they can outgrow any plant damage. We start most of our seedlings indoors so that when the plants are set out they already have a number of leaves and thus are less vulnerable than newly emerged seedlings.

We use a great variety of physical controls - barriers, traps and handpicking being among the most valuable. Dry sawdust barriers between the beds discourage snail migration, for instance. Overturned flower pots act as traps from which snails can be periodically removed and fed to the chickens. Periodic handpicking of the snails at night when they are feeding is the best temporary solution. In addition, students in the Farallones-Antioch College/West graduate program are doing research on possible biological controls that might be imported from the European area from which the snail originated.

The cabbage maggot mentioned above is actually the young larvae of a fly, so cones of fly screen, or permanent screened enclosures large enough to cover an entire section of a bed, provide an effective barrier against infestations in turnips, Chinese cabbage and other highly susceptible members of the cabbage family during their seedling stages when they are most likely to be attacked.

In any garden that has not been seriously disrupted through pesticide usage, biological controls are in constant operation. That people can raise any plants at all is due to the fact that most of the potential plant pests present are under natural biological control: their population remains low because of the action of predators and parasites. Many of the latter are "mini-wasps", tiny Hymenopterans, which few people are aware of and which have no common names. To encourage their presence in the garden we try to have some shallow-throated flowering plants growing at all times of the year since these mini-wasps, as well as a number of other important natural enemies of plant pests, require pollen and nectar to survive.

When caterpillar populations (cabbage worm, cutworms, etc.) become so large that handpicking is impractical, we sometimes use Bacillus thuringiensis, a commercially available product that is actually a naturally occurring disease of certain caterpillars. It is harmless to other forms of life and thus does not disrupt the balance of the garden ecosystem.

We are anxious to avoid the use of pesticides, not only because they are dangerous to humans, but because they often create more bug problems than they cure. Insect populations eventually become resistant to all poisons to which they are regularly exposed. The pesticides often kill off the beneficial insects which makes the initial problem worse and releases other insects from their controls to cause new problems. One should have lots of different kinds of insects in the garden, learn to recognize the beneficial ones, and only begin measures to control a pest insect when its population is growing towards the point where damage is intolerable.

For further information:

Olkowski, Helga and William. "How to Control Garden Pests Without Killing Almost Everything Else", Horticulture Magazine, June, 1976. (Available from the Integral Urban House.)

Tallian, Laura. Politics and Pesticides. People's Lobby Press, Los Angeles, 1975.

De Bach, Paul. Biological Control by Natural Enemies. Cambridge University Press, New York, 1974.

8. BEEHIVES

Location: Above the fishpond in the southwest corner of the garden.

Bees are fascinating social insects that provide crucial services to humans through crop pollination and production of honey. Each tier of boxes is one colony or hive, with a queen laying eggs and workers tending the young larvae - going out to forage for pollen and nectar to feed them and to store for their own future use as honey. Each of our colonies produces fifty pounds of honey each year that we remove for our own use in the house.

The hives have been raised off the ground so that as the bees enter and leave they do so well above the heads of any people in the garden. About a thousand new bees are born each day in a thriving hive, and about a thousand die. With our hives located above the fish ponds, many of these dead bees fall into the water and become fish food. The easily constructed ant-proof stand, developed by Bill Olkowski, using materials that are simple to obtain, will keep ants away from the honey without resorting to ant poisons.

Bee hives take regular management to keep them healthy and to avoid having them swarm from over crowding or other conditions. A bee keeping class is taught regularly at the Integral Urban House.

See section 19. OBSERVATION BEEHIVE.

For further information:

Starting Right With Bees, A. I. Root Company, Medina, Ohio 44256.

A larger bibliography can be obtained at the end of the section on Bees in Chapter 9 of The City People's Book of Raising Food, pages151-155.

9. FISH POND

One of the areas of research at the house is aquaculture. We are studying the possibility of supplementing our diet with some protein produced in this fish pond. Most of the systems we have studied start with some sort of nitrogen input, such as human urine. . This is used to raise algae, which feeds small crustaceans such as Daphnia species, which in turn may feed crayfish and/or various combinations of fish such as Sacramento perch, blackfish and rainbow trout. Insects, earthworms, weeds from the garden and water plants are among the many other sources of food for such a polycultural system.

Of course as you move up a food chain, energy is lost at each level, so one could capture more of the sun's energy by eating the algae directly than by eating organisms that feed on organisms that feed on the algae. However, fish and crustaceans such as crayfish provide a more balanced protein for human consumption and add variety to the diet. So if one has enough space, such an aquaculture pond may be worth the expense and trouble.

Presently, we are developing methods to aerate the pond, filter the water and raise the water temperatue.

For further information:

Bardach, Ryther and McLarney. Aquaculture. Wiley Interscience, 1972.

10. METHANE DIGESTER

Location: Northwest corner of the garden.

This was a student project to study the feasibility of constructing a small-scale digester out of easily obtained materials. Previous experience by members of the Farallones Institute (Katz, Olkowski) has shown that cooking with methane made in a simple batch digester is entirely possible wherever adequate supplies of nitrogen and carbon-rich waste materials are available. Chicken, hog and dairy cattle farmers or those who have access to both plentiful fish wastes and sawdust, can make good use of methane as a source of fuel. After the methane is burned the nitrogen remains in the sludge and it can be used for plant fertilization.

A pound of fresh, wet chicken manure will yield approximately a cubic foot of gas which will give 700 BTUs. One BTU will raise one poind of water one degree Fahrenheit - so it may take a pound of fresh chicken manure to boil a cup of water! Obviously research must be devoted to finding and breeding more efficient methane-producing bacteria before methane production will be useful to small homesteads without surplus manure.

For further information:

Methane Digesters for Fuel, Gas and Fertilizers. New Alchemy Institute West, Box 376, Pescadero, California, 94060.

Leckie, Jim, Gil Masters, Harry Whitehouse and Lily Young. Other Homes and Garbage. Sierra Club Books, San Francisco, 1975.

11. FRUIT TREES

Location: Along the northern fence.

We have planted several types of dwarf fruit trees. Those along the fence will be espaliered (pruned flat) against it so as to shade as little of the garden as possible. By planting dwarf trees we hope to avoid too much competition for root space with the other vegetables nearby.

These trees are grafted. The root stocks are suitable to our heavy clay soil but are not particularly good fruiting varieties. To these roots are grafted several types of desirable fruits. On to Russian apple has been grafted the closely related Gravenstein, Yellow and Red Delicious. These varieties fruit at different times during the year and will hopefully provide us with fruit during a long growing season. We are also raising a dwarf apricot, plum and several types of citrus.

Not all fruit trees are equally well suited to every area. Diseases or insect pests vary greatly according to climate, soils and drainage. Frequently a fruit tree may require so many chemical crutches to maintain it that you may decide it is not worth the effort. Therefore it is very important to select varieties that do well in your particular area.

One advantage of dwarf fruit trees is that they remain small enough to keep all the fruit accessible. In some cases various labor-intensive protective devices (bags, nets) may be used to protect the fruit from pests. Of course dwarf trees will not provide as large a harvest as a full size variety, but they may make it possible to have some fruit in small gardens where it would otherwise not be feasible.

For further information:

Tukey, H. B. Dwarfed Fruit Trees. MacMillan Publication Co., Inc., 866 3rd Avenue, New York, N. Y.,1972.

Atkinson, Robert E. Dwarf Fruit, Indoors and Outdoors, Van Nostrand Reinhold Co., New York, N. Y., 1972.

12. COMPOST BINS

Location: On the north side of the house near the animal pens.

Compost is the heart of our system of food production. It is our method for converting kitchen wastes, weeds, plant debris and animal manure into a nutrient-rich soil amendment for the garden.

We use a fast (hot) batch method of composting because it allows us to compost all waste organic materials while producing a minimum of flies and attraction for rats - both of which may become a problem in urban areas if slower (cold) methods are used.

The wooded bins, each approximately 1 cubic yard in volume, allow us to compost in a sanitary and efficient manner. They are air tight to prevent loss of biological heat and intrusion of pests, and they have a tight cover to keep out rain and keep heat in. Once we have made a batch of compost in one bin, it is aerated twice a week by pitch-forking the material from one bin to another.

The first step in making compost by our method is to accumulate the materials. We store kitchen wastes in sawdust to eliminate smells and prevent breeding of flies. The manure accumulates in the trays beneath the animals. Weeds and clippings from the garden are stored in an empty bin.

When enough wastes have been accumulated to fill a bin, they are mixed together in a manner which creates the best possible nutrient mixture for the decomposing organisms. Within forty-eight hours from the time of initial preparation, the internal temperatures of the compost will have reached 160° F. With regular turning and moistening, the compost will maintain high temperatures for sixteen days, long enough to kill weed seeds, plant diseases and insect larvae. The compost is ready for garden use when it has cooled to 85° F or so. This will be in two to four weeks depending on how often it was turned and how small the pieces of material were at the time of preparation. Vegetables can be grown in it directly without the addition of soil, or it can be placed on top of the soil as a mulch.

Composting is both a science and an art. For a detailed description of this method, see The City People's Book of Raising Food.

Apartment dwellers and those without the space for building bins often ask if one can compost in garbage cans or other, smaller containers. Yes, it can be done. However it takes longer and, since the material will not reach such high temperatures, you must be more careful regarding the ingredients. You can use five gallon cans, such as are discarded by bakeries or restaurants, and fill them with alternate layers of sawdust or dry leaves and kitchen garbage. Do not add any diseased plant material, meat or fat, and cover the can so that the smell doesn't attract flies. Pour the content from one can to another every second or third day, and keep the decomposing material moist. The material should be ready in about forty-five days for garden application.

For further information:

Gotoas, Harold B. Composting. World Health Organization, Geneva, 1956.

Compost Science. A monthly magazine published by Rodale Press.

13. CHICKENS

Location: North side of the house.

Like compost making, the raising of animals can be done in shady areas such as the north side of the house where there is not enough sunlight to raise vegetables.

We raise chickens for eggs and for meat. We are using two styles, on the ground and on wire. The chickens on the ground require very little time to maintain. They pick through their own manure, eating any fly larvae or other insects there and this provides them with a varied diet. We also supplement their feed with miscellaneous weeds and other plant wastes and this is easily done by tossing the material on to the floor of the large pen. However, keeping the chickens this way also has some disadvantages. It is harder to recover the manure for use in the compost. Furthermore, chickens can get canabilistic and not infrequently will peck one of their members to death - especially if one is accidentally injured.

We keep some laying chickens in wire cages for the purpose of studying how much insects and weeds can be added to their diet, replacing costly grains, without adversely affecting egg laying ability. Previous studies have shown that at least a quarter of a chicken's diet can be flies, and another half greens, and laying will continue to equal that of chickens raised entirely on commercial feed. In that experiment, the flies were captured in traps. Many other aspects of this system remain to be investigated, however, before we can recommend it to others.

Raising chickens separately in cages offers some advantages in that the manure can easily be captured for use elsewhere, the chickens are not able to harm each other, and much less space is required. However, there are definite disadvantages to this method also. If flies breed in the manure the chickens cannot get to them to eat up the larvae, so flies may become a nuisance unless fly parasites are imported to control the problem. (Such parasites are available commercially). Furthermore, the chickens must be tended more regularly as it is difficult to provide enough feed and greens to last for more than a day or so at a time. In addition, many people are offended by seeing the chickens in wire cages, believing the birds to be happier if they can run around.

The resident staff slaughters one chicken per week, yielding 16 ounces of meat at an estimated production cost of 35 cents per pound. The eight layers produce approximately 30 eggs per week at an estimated cost of 40 cents per dozen. The manure contributes valuable nitrogen to the compost and the egg shells and parts of the chickens not eaten are composted as well.

For further information:

Javits, Tom. How to Raise Rabbits and Chickens in an Urban Area. (Available from the Integral Urban House).

Klein, G. T. Starting Right with Poultry. Garden Way Publishing, Charlott, Vermont 05445.

14. FLYTRAPS

Location: Above or near the chickens, or outside the animal area near the front sidewalk.

In "nice" middle class neighborhoods in urban areas, the average garbage can produces a thousand flies a week in warm weather. (This was shown by a study done by the California State Health Department). Dog and cat manure do their bit to contribute to this also. For example, it has been estimated that in a city of 100,00 people, about 14% of the population has dogs. Since an average sized dog produces about ½ pound of manure a day, a city the size of Berkeley produces somehwere between 7,000 and 10,000 pounds of manure a day - most of it left out on the streets where it is available for breeding flies. This is particularly noticeable around the neighborhood of the Integral Urban House where many dogs and cats run freely. No matter how carefully we manage the manure from our chickens and rabbits, ammonia vapors escaping from these areas, as well as the composting bins, draws in the flies from the entire neighborhood.

Flies are high in protein (as is the manure and garbage they feed upon), so one of the best solutions to the fly problem is to trap the insects and feed them to the chickens, who are naturally adapted to digest them.

There are many styles of fly traps, but they all work on the same principle. The flies are attracted in to a bait (dog manure; corn meal, molasses and yeast; chicken manure; etc.) and upon leaving the bait instinctively fly upward, landing on the inside of a cone of fly screen with a hole at the top. The fly walks up toward and through the hole, which is the lightest spot, and is then trapped in a larger surrounding screened cage from which there is no exit. In this larger cage, the fly buzzes around until it dies. It does not have the intelligence to crawl back down through the hole; that direction is darker and the fly is attracted to the light.

The dead flies pile up in the larger cage and can be fed to the chickens or our fish or added to the compost.

15. RABBITS

Location: In the northeast corner of the yard, next to the chickens.

Rabbits are an ideal meat animal for urban areas. They are quiet; easy to raise; produce highly digestible meat; provide pelts easy to tan, and manure that doesn't even need to be composted before being used in the garden; and require very little space. (Rabbits in the wild have very small territories and have been observed to spend most of their time sitting quietly in their holes, much as they sit quietly in their cages.)

Rabbits reproduce themselves quickly, as everyone knows. In fact a ten-pound female is capable of producing 120 pounds of progeny each year. They are easy to slaughter humanely such that they do not suffer. Their meat is very low in fat, high in protein, though lacking in two amino acids (which can be balanced by serving rabbit dishes together with brown rice). There are many excellent French recipes for rabbit, as rabbit is a highly appreciated contribution to their cuisine.

A one buck - four does system is quite adequate for a family of four, unless you plan to have rabbit very frequently (as many local families did during the depression period.) This will provide four pounds of meat plus two pelts every week at about 35 cents a pound for the meat. We raise as much of our own alfalfa as possible, in both the front and backyards, for the rabbits and we also feed them garden produce and vegetable scraps from the kitchen.

We place sawdust in the trays beneath the rabbits to absorb the urine and catch the fecal droppings. These are periodically emptied into a new compost at the time it is made, and replaced with dry sawdust.

For further information:

Javits, Tom. How to Raise Rabbits and Chickens in an Urban Area. (Available from the Integral Urban House.)

16. CLIVUS MULTRUM
(Waterless Toilet)

Location: Inside the house, on your right as you walk through the door from the animal area.

In one year, a family of four uses 40,000 to 50,000 gallons of pure drinking water to flush their toilet. This is forty to fifty percent of the water used in the average home. Not only is this a waste of a precious resource, already in short supply in some areas of this country, but it is a waste of energy since the water had to be pumped and purified on its way to the house. After leaving your toilet, the water, now carrying your wastes, is usually mixed with industrial wastes, heavy metals and other chemical contaminants, treated to some degree, and finally dumped where it most likely pollutes the ground water or the nearby lake, river or ocean.

Numerous "waterless" toilets have been devised to deal with this problem. The large blue tank in this room is the composting container of a Swedish toilet, the Clivus Multrum (meaning "inclined tank "). No water is used at all with the Clivus. Two entries are provided to the tank on the floor above. One, with a traditional toilet seat, is in the bathroom; the other is a chute leading from the kitchen counter. Since both human fecal material and kitchen garbage are high in nitrogen, it is desirable to add additional materials high in carbon occasionally to balance the mix. This might be in the form of sawdust, dried weeds or leaves.

The various materials combine in the first of the three sections of the tank and begin to decompose through microbial action. A faint down draft at the openings in both kitchen and bathroom, created by a ventilating chimney, with the aid of a small fan, prevent odors from leaking back into the house. Fresh air enters the composting chamber through air ducts inside its trap door, thus promoting biological activity. As the material decomposes it loses approximately 95% of its bulk as carbon dioxide and water vapor, which also vent to the outside. Consequently a tank this size can

accommodate the wastes of six persons for two years before material must be removed.

As the material decomposes it slowly moves down the tank, taking at least two years to reach the third and last compartment from which it can be removed as odor-free, sanitary compost and used in the garden. Since the Clivus at the Integral Urban House has only been in use for a short time, we are not removing compost from it yet. However, first-hand observation of a Clivus in long use has shown us the end product is a pleasing, odorless material.

The cost of this waterless toilet was $1,600, including all the materials for installation. Presumably, as such units become more popular, they will be available more cheaply. A number of other composting toilets are also commercially available. Some, like the Ecolet, take a small amount of energy (electricity) to speed the decomposition process, and are much smaller - the entire unit fitting into a standard size bathroom.

Our own human wastes are a powerful taboo subject for many of us. It is clear, however, that in an increasingly crowded, energy-short planet, "out of sight, out of mind" will have to be replaced by a confrontation of the problem and a commitment to more intelligent waste management systems.

For further information:

Clivus Multrum U S A. 14 A Eliot Street, Cambridge, Massachusetts.

Smith, Gerry. Economics of Water Collection and Waste Recycling (working paper #6). Technical Research Division, University of Cambridge, Department of Architecture, Scroope Terrace, Cambridge, England.

17. HIDE TANNING AREA

Location: Opposite the Clivus Multrum tank.

Rabbit pelts provide a fine lightweight leather which can be used to cover pillows, as bedspreads, or made into vests and similar clothing that does not have to withstand rough treatment.

If the pelts are not to be tanned at once, they are hung from the ceiling on wires to dry out. It is very important that they be kept out of the sun during this period. When dry they can be stored for a short time until enough are accumulated to make it worthwhile to tan a batch.

The tanning process involves wetting the skins again, removing all traces of the thin membrane which often clings to the skins when it is stripped from the carcass (a process called "fleshing"), and soaking the skins for several days in a solution of alum, salt and borax. Then they are rinsed and dried. During the drying period they may be massaged by hand and ivory soap rubbed into the leather to keep them pliable.

See tanning recipe and directions for this process in The City People's Book of Raising Food, where there is also a bibliography on this subject.

18. VEGETABLE STORAGE AREA

Location: In the same room as the Clivus Multrum tank.

Winter squashes - grown in the summer but stored through the winter, potatoes, and onions can be stored in cool dry areas with air circulating around them. Eggs can be stored in sodium silicate (waterglass), and carrots, cabbages and beets can be kept in sawdust or dry leaves. We can the surplus tomatoes and fruits, and pickle other vegetables. Solar drying of fruits and vegetables is another good storage technique.

Of course, in the Bay Area where we can grow food all year round, it is not as crucial to stock up for the winter as it is in colder areas. Still, certain vegetables can be ripened successfully only during the hotter summer weather, so we can extend the season by saving some to eat later. One small bush squash that keeps well and that we can grow very successfully in Berkeley is Golden Nugget. Another larger squash that climbs on fences is banana squash.

For further information:

Storing Vegetables and Fruits (in basements, cellars, out-buildings, pits). Home and Garden Bulletin #119 (15¢).

19. OBSERVATION BEE HIVE

Location: Inside the reception room on the south wall.

What goes on inside of a bee hive? We have placed four frames between glass so that you may observe some of the activities. The observation frames represent a cross-section of the producing hives in our garden.

The queen bee is larger than the others; her abdomen is longer. Her role in the hive is to lay eggs. During the spring and summer she may lay up to 3,000 eggs a day. Nearly all the other bees are female workers. Their first job as adults is to feed the larvae and the queen. They also keep the hive clean of debris and sick bees and fan it with their wings when ventilation or cooling is needed. The ideal temperature of the colony is around 70° F.

The older workers forage for nectar and pollen. The pollen is carried on a group of special hairs on the hind legs called a pollen basket. Watch the incoming bees to see if you can spot the yellow clinging to them. The nectar is carried in a special honey stomach and is regurgitated for the young larvae or for storage in the hive.

When the workers return to the hive they tell the other bees where they have found a nectar and/or pollen source by means of a circling dance. This dance tells the bees following it roughly how far it is from the hive and the direction in relation to the angle of the sun.

In general, honey bees are reluctant to sting as they will lose their life upon doing so. People who are allergic to bee and wasp stings might wish to get themselves

desensitized through injections available for this purpose. If you are nervous around bees, avoid wearing bright colors and perfumed cosmetics when outside where there are many flowers. Also, it is always wise to avoid making any kind of violent motion directly in front of and close to the front of the hive. Guard bees posted at the entrance as well as other workers may become excited, sensing a threat to their home.

Once a year male bees (called "drones") are born. They usually live just long enough to mate with the new queen. Queens may live several years and remain productive, while workers have a short life span, only six to eight weeks.

If you are interested in learning more about bees, how to build and maintain a hive and collect honey, consider enrolling in our bee keeping class. We also have a Bee Club through which members have access to a honey extractor and other equipment that would be expensive to own individually.

20. FISH TANK

Location: Below the observation hive.

Since the pond outside is usually too dark to see into, and the inhabitants secretive in any case, a display tank has been set up in which specimens of the pond culture are available for closer inspection. Above it, to the left, is a poster which gives a description of the perch, blackfish and one type of crayfish with which we have experimented.

For further information about the aquaculture systems:

Dr. Sterling Bunnell
Box 11
New Castle, CA 95658

New Alchemy Institute - East
Woods Hole, Massachusetts 02543

21. SEMINAR ROOM

Location: Through the door at the top of the stairway.

One of the main functions of the Integral Urban House is realized through the public classes that are held here regularly. Sign up sheets for these are in the reception room (downstairs). The Antioch West/Farallones undergraduate and graduate degree programs also use this room for meetings and seminars.

On the north wall is a photographic essay showing the metamorphosis of the house from a shabby, condemned building to its present state. Also displayed are various media articles about Integral Urban House activities; diagrams analysing the nutrient cycling calorie flow and other aspects of the house system; and a detailed explanation of the solar collector. Copies of some of these diagrams are available for sale.

Notice our Norwegian wood stove, one of the most efficient available. A relatively small amount of light kindling will heat this room for many hours. This box stove is capable of converting up to 60% of the energy in fuel wood into effective heat for the room; this compares favorably to an efficiency of 10% for a conventional fireplace.

For information about the public classes, see the sign-up sheets in the reception room or write Tom Javits at the Integral Urban House.

For information about the Farallones/Antioch West undergraduate and graduate degree programs, phone or write Helga Olkowski at the Integral Urban House.

22. KITCHEN

Location: To the left at the top of the stairway.

The basic orientation of this kitchen has been towards the activities of preparing and storing our own home grown food. Thus, a large pantry has been provided to hold jars of home canned fruits and vegetables, as well as grains, beans and nuts bought in bulk. All containers have tight lids to discourage pest-insect infestations.

Next to the pantry we have revitalized an old Berkeley tradition - the "cooler". This is a cupboard, vented through screened openings to the north side of the house at both top and bottom. It is insulated from the inside of the house and thus remains a steady cool temperature throughout the year. Many fruits, cheeses and vegetables do not need the cold of a refrigerator to keep fresh. By storing them in a cooler, the size of the refrigerator itself may be reduced.

There is considerable competition for our organic kitchen wastes. We can either add them to the fecal material in the Clivus (down the chute leading from the kitchen counter), feed it to the chickens and rabbits, or save it in sawdust and use it to make compost.

Miscellaneous paper is used in our efficient wood stove; metal and glass is taken to the recycling centers. Newspapers are recycled through the city-wide recycling system coordinated by the Ecology Center.

Berkeley has a large environmentally-conscious citizenry. There is a great deal of concern about filling up San Francisco Bay with dumps, especially since such wastes are composed largely of materials that could be composted or recycled. At last the city government has been convinced to compost the tree prunings, leaves and grass from city property and is now accepting garden debris from citizens for this purpose as well. You may take out the composted material for use as mulch equivalent in amount to what you contribute in raw materials.

For further information:

Lappe, F. M. Diet for a Small Planet. Ballantine, New York, 1971.

U S D A Pamphlets on Canning, Freezing, Pickling and Composition of Foods. Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20420.

23. ROOF-TOP GARDEN

Location: On the porch through the double glass doors.

Where once the sunlight fell on agricultural land, it now falls on roof tops and porches, wood, concrete and asphalt. These areas can be made to bloom again, even without access to soil, by using containers filled with compost. So far we have not found any vegetables that will not grow in compost alone, but we have found it particularly convenient to grow tea mints and salad greens in these containers on the porch because it is so close to the kitchen.

Compost holds water well, does not shrink from the sides of the containers, makes good use of waste materials, and is only 40% of the weight of soil. Since weight is always a factor to consider in roof-top and container gardening, compost has much to recommend it as a growing medium. Light soil mixtures can be made by adding perlite and similar sponge rock additives, but they contribute nothing in the way of nutrition while compost is by itself a complete growing medium.

At various times we have also had a complete egg-laying chicken system on the porch roof. In a small 5' by 5' by 5' barn-shaped chicken house, six chickens live happily in a deep litter system. A thick layer of sawdust or compost or leaves is laid down on the floor of the house and the manure collects there. As it builds up, the chickens have access to the many insects that are attracted to it. There are perches for the chickens to sit on so that they can look out of the chicken-wire-covered windows. An automatic waterer, a bin that holds enough feed for a week, and a nest box that can be reached from the outside to remove eggs, completes the unit. Developed by Dan Clancy, these chicken houses provide a viable way to bring chickens back to small spaces in the city where busy people do not wish to have to give daily care to their animals. If you wish, plans for construction of a "compost henhouse" may be obtained from us.

Student apprentices at the house have built a number of experimental solar appliances such as the solar oven on this same porch roof. The oven will heat to 350° on a sunny day and stay that way between 11:30 a.m. and 3:30 p.m. with outdoor temperatures around 70°. Obviously this is only useful for certain types of baking and cooking during certain times of the year.

In the window of the bathroom that looks out on to the porch, a series of black glass gallon jugs can be seen - a type of passive solar heater.

24. PASSIVE SOLAR HEATER

Location: In the bathroom window, looking out on the porch.

The principle of a passive solar heating system is to use the sun's energy directly to heat something that stores heat well, such as water. Then, when the sun is not shining, the heated surface or material slowly releases its stored up heat into the space around it.

The south-facing window with gallon jugs in it is just such an experiemnt. Some of

the jugs are painted black and others are filled with black liquid. The sun shines on the jars during the day, heating them slowly. At night, the shutters on the porch side are closed against the window and the jars slowly lose their heat, taking the chill off the bathroom in the process. We hope to study such systems in detail at the Integral Urban House.

25. GREYWATER SYSTEM

Location: Pipes leading from sink and shower to tank next to Clivus on the first floor.

Nitrogen and phosphorus are two of the most important nutrients needed by plants in large amounts. A farmer may use from 200 to 300 pounds of each per acre, depending on the crop being grown. These same plant nutrients are abundantly available in most households as wastes: the nitrogen is found in urine and the phosphorus, in the mixture of detergent and water used for washing. In fact, wash water grows some plants so well that when high-phosphorus detergents replaced soaps for laundry, the growth of algae and other plants in the rivers and lakes into which this waste water was emptied became a real problem in this country.

A series of experiments have shown us that a mixture of urine and wash water may be suitable for watering the plants in the garden and we are designing a system which will store, mix, filter and distribute this automatically into the back yard. However, additional research needs to be done on this system to determine to what extent additives in commercial detergents might be toxic to plants and what effect salts might have on the soil.

In place of an automatic system you may wish to do what many of us have done for years: collect your urine in a jar, mix it with five times its volume of water and use it to fertilize your plants. Once a year you will need to add a light dusting of lime to the entire area and water it thoroughly to remove the sodium that may accumulate with this method.

Is there a public health problem when using your own urine in your garden? Not if you are healthy. In fact, there is probably less likely to be a problem using urine in this way, where it can be filtered through the active biological processes of an organically rich mulch and soil, than in mixing it together with the wastes of an entire city, adding a little chlorine and dumping it into the nearest body of water.