Chapter Seven Section One

Ecosystem Planning and Management

When this analysis began, who would have thought that the finding and funding of "shortcuts" in achieving the education of women in poor societies would be the most crucial step toward global sustainability?

The foregoing description of the ecosystem, and what pushes it to keep going, is preamble to the process of guidance. The outcome that is to be achieved is a feasible route to a sustainable future. Processes by which that goal is reached must be as acceptable as the goal, and planning effort must be expended continuously. A published plan represents strategic integration of many elements, but it leads only to a desirable intermediate stage. The actions that need to be taken are distributed among several governments and autonomous agencies, and at several levels outside the community. The top threats to these sustainability proposals, consisting of five clusters altogether, will be taken up separately, and specific proposals will be offered. There are things within our means that can be done and, more important, the tools and procedures appear to be powerful enough to make a major difference within the next two human generations.

Before exploring ecological planning processes, it will be helpful to recall the new assets that have been introduced as a foundation:

* Many more actors who cannot vote, but do transact, and can contribute to making the future of the community sustainable.

* Life cycle processes that promote an intergenerational flow of investments in human resources through nurture, social capabilities, transactional bonding, provision of new infrastructure, and building up reserves for resilience against contingencies.

* Indicators of flow-through rates and the accounts for estimating accumulation that depend upon our mutual understanding of environmental limits. These indicators involve food and energy, water supply, materials, time, and attention, while recognizing the virtually inexhaustible and
ubiquitous potential for information, which provides partial substitutes at critical times and places.

* A distributed control system and database called Knowledge, which is a shared stock of factual information that takes the form of statements about images. These can be speedily retrieved with the use of indexed key words, nouns, or patterns, while users recognize the need to filter out metaphor, fiction, ideological or religious dogma, and errors before undertaking commitment of scarce resources.

* The recent emergence of a virtual ecosystem of programs on the Internet connecting localized stocks of images (packages of new Knowledge) which, when properly addressed, promises a huge amplification of intellectual power and productive activity.

A path of action is regarded as feasible if a substantial gain (say 50 percent of eventual need) can be achieved within three to thirty years, depending upon the scale required. Scientific feasibility occurs over a longer term, a fact that suggests that socially useful applications will be available in twenty to one hundred years, if they can attract increasing effort for exploration of alternatives and for development in the interim. Those who have knowledge of the life cycle processes implicated can infer narrower estimates.
Chapter Seven Section Two

Urbanization Unleashed: The Freedom to Move and Search

A radical transformation is under way for the human race, and members of the living generation are caught in the middle of changes being brought about by the flight of people into the cities.

People have always moved to new places of residence, but in the past they left hardscrabble areas to take over places with better grazing or richer soils.

Today, many are refugees from wars and persecution seeking a place merely to be themselves.

Cities in the past built empires for short periods by conquest, but then were sacked or abandoned, leaving only ruins. These early cities were not viable for the long run, because they had not managed peacemaking and health well enough to control epidemics caused by inadequate sanitation and overcrowding or to prevent food scarcity.

Cities were population sinks until about the beginning of the seventeenth century, when some had learned enough about hygiene to reduce their death rates to levels below the birth rate. Since that time, life has increasingly looked better in the cities. Joining the proletariat in the city continues to be preferred to living the life of a peasant in the countryside.

Dimensions of the demand for urban settlement are pressing: Contemporary China alone contains about a hundred million people drifting and searching for a permanent home. Is there an urban home for them somewhere on Earth?

The mature, industrialized societies of Western Europe and North America have not yet reached equilibrium. They are approaching a ratio of twenty to thirty urbanites to each person who prefers rural life. These ratios suggest that the world has another century of urbanization ahead, in the absence of some catastrophic discontinuity.
Then the urban settlements would contain two to three times the present number of three billion. Policies intended to stem the flow to cities, like those employed by the former USSR, China, Indonesia, and the United States, have failed in large measure to halt entry, because immigration pressures create underground channels. Smuggling people across boundaries to cities elsewhere is more profitable than money laundering and the traffic in most contraband goods.

Can these migrating masses be supported in the cities at a tolerable level of living? The quick answer is that known and tested technology is powerful enough to handle a doubling of the number of city dwellers almost everywhere, but a few regions in the world may be swamped and have to depend upon the promise of already available powerful scientific knowledge to accommodate more residents later in the century. Bongaarts (1996) has come to roughly the same conclusion, based upon the supply of inputs available for future food production and continuation of efficiency improvement up to limits now experienced. High points in that logic follow.

**Metropolises Can Cope with New Growth**

Consider the typical transition in terms of the community eco-structure (chapter 2) occurring in today’s rapidly urbanizing societies. The transition is achieved often in the course of only one human generation; the increase in population densities is indicated in Table 7-1. In it, numerical relationships reached in the "low-income metro" state of settlement are obviously conjectural and expressed by order of magnitude.

They represent a compromise from what was observed in field studies when the urban transition approached completion in societies such as:

- Japan
- Taiwan
- Malaysia
- Thailand
- Puerto Rico

Since small machines:

- timekeeping devices
- radios
- rice cookers
- mechanical toys
- cycles

are rapidly becoming more affordable, we must expect major increases in complexity and productivity beyond those cases.

A practical outcome -- one that would eventually yield a high level of comfort and convenience based upon a low level of resource consumption -- would have to evolve from basic needs. Wasteful current practices seen in the real world must be replaced by known efficient techniques to reach an "ultimate urban state" prototype for a neighborhood or small community.

Paths by which new urban communities can reach a "sustainable steady state" depend predominantly upon many sub-cultural and relatively local factors. No general solution exists. These factors, along with possible solutions, have been collaboratively investigated for specific communities at the growing edges of:

- Cairo
- Delhi (All in the 1980s)
- Dhaka
- Jakarta
- Shanghai (1991)

Researchers have undertaken a limited updating of the changes imposed upon their sites.

Squatter settlements filled with refugees from rural catastrophes are the most troublesome. In the view of many residents and close observers, they serve as "schools of hard knocks" and "breeding areas for micro-enterprises" while being simultaneously "infested with crime and disease," and they constitute a "blemish upon the reputation of the city."

Half or more of the initial squatters "graduate" to join more prosperous communities in the city within a couple of decades, selling their homes to "slumlords" who then rent to new immigrants. Meanwhile, one-third or so stay to make small, almost invisible improvements in the original settlement.
The remainder return to their villages, usually to take on inherited roles, or are incarcerated.

Decades after the first settlers arrive, increases in land values in the original settlement stimulate redevelopment to support modern urban activities (apartment houses, offices, transport facilities, schools, clinics, etc.). Most immigrant ethnic groups in North America, which evolved a highly assimilated culture, acquired sufficient education to enable them to reach middle-class status by the third generation. In Eastern Asia the progress of settlers within the metropolis has sometimes been still more rapid.

To cope with new metropolitan growth at the periphery with the resources generally available, planners have to guide city authorities toward undertaking more interventions in the provision of public services.

* Peripheral open space that could serve multiple purposes for adjoining neighborhoods, connecting natural patches to sustain wild species and allowing the city itself to "breathe," while emphasizing density suited to an extension of metro mass transport.

* Nearby wetlands developed for the masses, so they can live with the surviving reeds, birds, amphibians, and fish.

* Green spaces maintained as market gardens, orchards, fishponds, and dairies for local markets. These uses produce commodities that frequently spoil, if their delivery from the hinterland to the consumer is interrupted by congestion.

* Land use and passenger transport networks laid out to preserve space, thereby stabilizing land values.

How can governments preserve space for new settlement?

Normally they should ask planners to select downstream sites for future growth, if at all possible. Where this has not been done, bruising:

- economic
- social
- cultural
• political
• legal

problems distinctive for each locale have rapidly arisen. Proposed planning solutions for local problems are particularly important for the startup phase in suburban communities, because early precedents will determine whether the core of a settlement pattern completed later is sustainable. As has been emphasized here, the full life cycle of a community must be considered, from initial layout to replacement and reconstruction processes, without frustrating immediate progress.
Chapter Seven Section Three

Utilities Management: Water

In most of the world’s cities today water is provided to residents free or consumer use is highly subsidized. It is metered only for large consumers, if then. Therefore it is wasted and often polluted along the route to consumption.

Yet water is the most critical input for life, and expanded water supplies are rarely obtainable without depriving others. Emphasis on recycling--making existing supplies serve many more times--was introduced in chapters 1 and 5. Management policies require improvements along lines laid out in Box 7-1 for semitropical and tropical climates. Promising social and technical innovations are appearing in California (Gleick and Wong 1998) and in Israel.

Box 7-1

Environmental Impacts of New Water Recycling Technology

Important consequences follow from recycling and overall economizing rationales regarding water consumption in poor urban settlements:

1. Most of the water circulated through the urban settlement would be raw, but filtered, because the heaviest consumers (industries and gardens) require nothing better.

2. Upgrading of water quality would be carried out on numerous decentralized sites that serve special industries, food processors, hospitals, and religious groups.

3. Filtered water can henceforth be sterilized at local sites and then packaged, since low-cost plastics from petrochemicals are now produced on all continents, and procedures for antiseptic reuse of container materials are available.
4. The neighborhood water center could sell packaged potable water, ice made from it (a luxury that many poor people in the tropics already pay for to avoid risking dysentery, typhoid, and hepatitis), and hot water. The last of these could be taken away in insulated containers from a reservoir kept heated, preferably with active solar energy collectors or by-product steam.

5. Sewage becomes much more variable in concentration -- thin during the rainy season and thick during dry months.

6. A discipline must evolve that controls the dissemination of heavy metals (lead, mercury, cadmium, etc.), which are often used in small-scale industries, and soluble toxic organic substances, so that they do not accumulate as a result of recycling.

7. Sewage treatment opportunities exist for the production of some bio-gas. Algal production could use the carbon dioxide and sulfur; often metalworking and glassworking have the most valuable initial uses for refined bio-gases.

8. The liquid effluent from a bio-gas digester contains a major share of the nitrogen and phosphorus incorporated in the human and animal diet, so it becomes an ideal medium for the cultivation of green or blue-green unicellular algae in shallow ponds. Algae culture also stimulates greater efficiency in using sunlight and land than can be obtained with higher plants. The sludge and compost are useful soil additives for market gardens.

9. These protein-rich algae may be harvested as fish food, or by mechanical filters (the highest efficiencies observed are obtained in the integrated pig, fish, and duck farms of south Taiwan).

10. The surplus water, after bacteria have been eliminated by the rapid growth of algae, can be used for irrigation in market
gardens, thus ending up as a constituent of vegetables and small fruits delivered to nearby city dwellers.

11. The runoff from the vegetable gardens can be directed into an "organic" rice paddy, which allows a rich culture of zooplankton to develop in the standing water.

12. Water from the rice paddy can then be introduced into nearby estuarine brackish water to provide food for the indigenous infant fish. The prize species is the highly exportable tiger prawn, although it usually makes up only 20 to 25 percent of the total catch.

Because sizable amounts of fuel energy can also be saved in this technological rationalization process, incentives for a program for integrated water and energy conservation are most compelling during times of rapid price rises for imported fuel.

Global Energy Use and Energy Conservation

Managers need an overall frame for economizing. The concept of a minimum adequate standard for community residents as a goal for planning was introduced by Meier (1956). It presumes a level of living and an urban infrastructure that permits each citizen to enjoy highest mental function and full cultural participation (e. g., attention), but eliminates "conspicuous consumption."

More recently this way of life has been termed, from the point of view of the member of an affluent society, "voluntary simplicity." To establish economies within this framework, Western societies would need to reorganize to reduce consumption of energy and scarce materials, while poor societies would have to evolve such institutions in a more direct manner. The concept was elaborated two decades later (Meier 1974) and was reviewed again in the 1990s in the light of scientific and technological knowledge accumulated in the interim; a new energy budget is elaborated in Table 7-2.
The United Nations University has mobilized industrialists of an environmentalist persuasion to join a crusade for re-engineering production processes that go beyond recycling as it is presently organized.

For this group the goal is ‘zero emissions from the factory or the firm’ (ZERI). What is left over after making the primary product goes into secondary and tertiary by-products. Experience in Germany and Scandinavia shows that industries can achieve a 50 percent reduction in use of materials and fuel and increase profit, while more than 90 percent savings due to redesign is sometimes feasible.

The ZERI concept is more demanding than the standard integrated industrial complex built in planned industrial estates and parks, because the most of the integration is internalized within a single organization.

Economists say that the ZERI principle is basically inefficient, if markets for intermediate by-products and salvage have been organized. However, it has been shown that when this extreme intellectual challenge is presented to design engineers and managers concerned with manufactured products and processes, the extra creativity required frequently results in astonishing savings.

Technological advances reported in the late 1990s have radically changed informed thinking about global energy prospects. Improvements in the new solar technologies:

- Passive thermal
- active thermal
- photovoltaic
- ocean thermal
- wind
- biomass

make possible off-the-grid locations with power costs in the competitive range. Fourth-generation nuclear power can fill the needs of existing areas of metropolitan settlement with insufficient sunlight. Highly polluting fossil fuels can be catalytically converted on site to power in batteries, hydrogen, metals, and chemicals, with the pollutants reduced to inert ash, or injected into deep wells (emptied of natural gas), coal mines, or the bottoms of oceans (Parson and Keith 1998).
California’s flawed experiment with a transition to an energy distribution network market for electric power and natural gas promised savings up to 30 percent beyond modern experience with regulated national or regional monopolies will result in even greater savings when the peaks in consumption are balanced properly.

Given the success of these newly understood and applied procedures for demand management in cities, future consumer costs for energy should continue to remain within the spread of presently acceptable costs (five to fifteen cents per kilowatt-hour) indefinitely. The only foreseeable breakdown in the supply of solar power would arise from a "winter" caused by dust from large volcanic eruptions.

This once-in-a-millennium exigency could be overcome if stocks of gas turbine fuels are maintained in vulnerable metropolitan areas. Thus, exhaustion of fossil fuel deposits no longer poses a discontinuity for urban livelihoods in the twenty-first century.

Very light hybrid vehicles constructed from reinforced plastic foam with electric propulsion and clean exhaust should save 70 percent of the energy expended for passenger mobility and also provide an emergency power supply for the building industry (Brilawski and Lovins 1998).

Houses would be super-insulated (possibly earth-sheltered) with smart multiple-pane windows, warmed with waste heat, cooled with surplus summer radiation, lit with special fluorescent lamps, and managed with a computer (Lovins and Gadgil 1998). The plastic cars will induce new and rehab housing in developed cities first, and poorer societies will adapt the same or similar integrated resource-conserving concepts to solve their urban energy problems.

A warning about conservation: existing manufacturing equipment and installations will not soon reach early obsolescence enabling write-off as scrap, so these transitions might need more than one human generation to take effect.

This technically feasible and cost-effective future for low- to moderate-density urbanization is at odds with proposals put forward by most "green"
organizations, but leading engineering design groups in the United States, Japan, and Europe are competing frantically to make this vision a reality.

The slow step appears to be the acceptance of global standards for performance and dimensions. National interest groups and labor unions are often stubborn holdouts, slowing acceptance of steps toward greater economy, but they are quickly undercut in newly emerging societies, such as:

- Brazil
- Mexico
- South Korea
- Taiwan
- Portugal

by a free trade environment. Progress in this direction may not be ideal, but it would assure that all the peoples of the world could share the scarce energy resources and reach minimum adequate levels of living in one to two generations.

Balancing new information about supply at reasonable cost with new potentials for efficient use makes it possible for everyone to have a fair share, unless they insist upon living close to the frigid poles of the planet all year round.

Solar radiation is costly to collect and transport.
Chapter Seven Section Four

Assuring Supply of Food for Cities

A truly nagging worry for the future urban community is the assurance of a continuous food supply.

Missing a year could be catastrophic. How can a threefold increase in demand be guaranteed? Everyone recognizes that the "bread baskets" and "rice bowls" of the rural areas have backward inflexible institutions, eroding soils, and a work force that is likely to remain poorly educated for at least several generations. True, a surge of exportable surplus has been accomplished over the last several decades, making possible the huge recent growth of cities.

That was done with the aid of:

- fertilizers
- "miracle" seeds
- irrigation engineering
- pesticides

which together were prerequisite for the Green Revolution. Actually, the Green Revolution has been so successful that the unconventional, unprecedented technologies suggested in the 1960s and the 1970s (Meier 1974) have been brought to market in a minor volume. The scenario for the next global food crisis needs to be rewritten (Cohen 1995).

Conventional thinkers, including the Worldwatch Institute experts (Brown 1995) and others, cannot find enough soil, water, and effective organizations to supply future needs, so they have joined the "doomsayers." They claim we must expect very serious crop failures in large land masses like China, South Asia, and Africa. The threat of earth warming from the changing composition of the atmosphere adds to the uncertainty.

They forgot to take into account that transport capacity is now sufficient, although available only at premium rates in times of crisis.
It can move:
- grain
- sugar
- cooking oil

stockpiles to afflicted regions in a matter of months. As world stocks threaten to run out, local prices rise dramatically, and some new production capacity is brought into cultivation.

But how much stockpile should be built up and maintained? Too large a reserve will depress prices and reduce production, thus increasing the likelihood of another crisis.

A calculated, manageable new strategy is now available, emboldened by the last world price rise. Recognizing that land formerly in cultivation but lying fallow may not be brought back into production fast enough, so the authorities might ration the livestock feed.

Localized riots over
- bread
- rice
- “mealies” (ground white maize)

may be postponed by introducing partial substitutes, such as maize and soybeans, and reducing the amount of grain fed to animals. That policy also induces hoarding, which must be controlled by careful accounting. There will be scaremongering headlines on the way to creating a sustainable food supply, but the casualties will be attributable mainly to the bad luck of having to endure civil wars and incompetent bureaucracies.

Clearly, prices will sometimes have to rise to an even higher level than those when entering the new millennium. Then it will be possible to attract the necessary urban capital and take more risks with innovative technology. Urban authorities need stocked granaries if they are to stave off trouble in the streets.

A recent review of novel approaches (Meier 1995) has updated the earlier findings. Reduced costs of solar energy, drip irrigation systems, and somewhat higher top yields from seed have confirmed earlier claims.
Prospective supplies of staples that can be shipped anywhere, and even the perishables for the daily cuisines of the growing cities, are regarded as "noncritical," despite repeated warnings in the press. These conclusions are confirmed by the UN’s Food and Agriculture Organization and by independent analysts, who make their cases with data (Alexandratos 1995, 1997; Mitchell, Ingco, and Duncan 1997).

By far the most promising midterm option for expanding capacity of food output is to induce less effective farmers to reach levels of productivity equivalent to the levels of the best in the same region.

Achieving that goal requires that information be transmitted promptly from the centers of expertise to farmers who need it, using telecommunications channels that did not exist before. Microcredit, based upon evidence of competence and trustworthiness rather than family assets, can assure that supplies and equipment arrive just in time, when delivery is coordinated by "expert systems."

Modern educational technology can shortcut many slow steps for more rapid diffusion of agricultural knowledge, and it is an input that can be contributed by cities consuming the edibles. Digital, cordless telephones required for this speedup are coming onto the global market at prices that start below the present cost of telephones and which should decline rapidly. The cost of education on CD-ROMs and DVDs (digital video disks) drops in an equally spectacular fashion. Isolation felt by peasant farmers and household cultivators should greatly diminish (see Box 7-2).

There remains the question of reliability of official reports. Two regions most haunted by the threat of famine were investigated to look for local impediments that might frustrate these applications of new technology. The larger, China, was found to be making much practical progress with its integrated agro-ecosystems, and it has also made a heavy commitment to telecommunications.

However, China still lacks the ability to visualize leasing desert coastal land over sea surfaces to supply its coastal cities with container ships of foodstuffs. Supplementing the erratic rainfall of coastal deserts with
desalinated seawater powered with solar energy has been suggested. Agro-
cosystems that supply the respective regional cuisines could then be
installed (Meier 1997).

Another field investigation worked out an apparently feasible procedure for
combining high-tech packages with existing low-tech production methods in
Africa in a way that addressed other critical social problems as well as food
supply. It promises to overcome what were believed to be insuperable
barriers to development, including the educational deficit, excess human
fertility, the psychological costs of unemployment, and political instability.

In this procedure, a huge boost is supplied by low-flying communications
satellites capable of covering the whole world. Quality of management is
greatly enhanced by the recent rapid expansion of the NGOs organized by
women engaged in food production and processing (Meier 1996).

Mass food processors that appear in every city to operate the flour mills,
grind the corn, press the oilseeds, and refine and package the sweets before
they are distributed to retail shops and supermarkets, are the obvious
organizers.

In China these are government enterprises that can be agile in a free
enterprise economy such as Hong Kong. In Indonesia, Egypt, and elsewhere,
food-production enterprises have to be set up by larger family firms that
understand the vagaries of the local market and can acquire long-term leases
for land and manage the "food utility." The level of investment may easily
grow to $10,000 to $20,000 per hectare. The supplies may be perturbed by
natural disasters or political impasses, so occasional serious local shortages
will require a capacity for administered sharing of food supplies, called
rationing.

The hardest part of planning and management for food sustainability is
organization. In times of extreme bad weather, poor planning will be widely
exposed.

After a sequence of three regional crop failures, refugees from food
scarcity will begin to flow in numbers large enough to become newsworthy.
Networks will rate it the lead human interest story on the evening news seen by billions of relatively secure urban dwellers all over the world. Feelings of guilt will be expressed in many ways, mostly irrational. Heavy blame will be placed upon managers, public and private, who had accepted risk of unprecedented crop failures. Mass protests against price rise decisions by politicians caught on the spot are also photographed.

Data might show that there was enough food to go around, if it had been allocated by humane principles. But the emergency powers allowed managers are insufficient in this worst-case scenario to prevent hoarding and bring about sufficient sharing. The planning that has been done so far is based upon post-World War II precedents of a much smaller scale, which cannot be expected to overcome a problem of this magnitude.

Nevertheless, one can remain an optimist, because the newest knowledge and experience with the best management strategies have not yet been incorporated into planning for food sustainability.

Projects and programs with high immediate payoffs, justifying an early start, can be identified; these have properties powerful enough to deflate major famines in the most deprived parts of the world. In Box 7-2, a new strategy is revealed as a multilevel scenario.

### Box 7-2

**Planning for Sustainable Food Security**

Broad statements about what is possible in food futures are not very persuasive. However, an alternative argument, containing detailed technical statements about how to undertake, step by step, building up a supply capacity, is tedious to follow. Therefore, a simple ploy will be used to bring together the fundamentals, the logic, and the various initiatives planners can use for assuring that the inevitable food emergencies can be met and resolved at acceptable cost.
Imagine that your team has been assembled in order to lay out a strategy for a large, independent foundation whose mission is to guarantee that food will be available for up to nine billion city dwellers. Such a foundation is not unrealistic: As scores of huge fortunes have accumulated in the last several decades, heirs have realized that these funds will be lost to taxes unless they are spent on philanthropy. A precedent was established more than fifty years ago by the Rockefeller Foundation, which stimulated in advance many of the innovations that made the Green Revolution possible.

Since cereals are valuable enough to store and transport economically to any part of the world, the supply of foodstuffs has become global, but the distribution according to need has been handled by community and household institutions. Let us call the organization designed to manage both production and distribution The Food Agency, and equip it with all the functions needed, from diplomatic to R & D to new enterprise launching. The Food Agency recognizes that the United Nations has several experienced world-serving organizations with responsibilities for food, especially the Food and Agriculture Organization, but that each operates under major constraints. Also, more than one hundred food-centered multinational corporations have staked out areas of commitment and territories in which to be active.

The team of strategists for the Food Agency discovers right away that the best agricultural research institutes move much more slowly than those in medicine and that their laboratories are less well equipped than those of the largest companies. DuPont, Dow, ICI, and Monsanto were chemical giants rapidly reinventing themselves to produce specialties that expedite crop-growing and food-product synthesis with biotechnology. They employed technical experts who used the latest computerized instrumentation. Meanwhile, existing elite world-serving institutions, while pressed by budget cuts and suffering from dwindling political support, have recently put their heads together and assembled a review of seeds.
They agreed upon the most promising directions for future research (Science 1997). Staple crops -- maize, wheat, rice, sugar, cooking oil -- have made huge progress since World War II, but quite a bit of biological potential remains to be reduced to practice. Overall, maize seems most likely to become the prime supplier of starch for calories during the next generation because a reformation of agriculture in the Americas has yielded the largest export surplus per unit area and per worker. Major gains in output achieved by diffusing new high-yielding plants and their cultivation to other farmers and by extending the area under cultivation.

However, this band of aggressive firms that hoped to apply the new findings from bio-tech soonest in the interest of the needy suffered many setbacks from delay, law suits, harassment by extreme environmentalists, embargoes and public criticism, together with severe financial losses, so they have retreated badly mauled. Does the world really want to prevent future hunger?

Our Food Agency, however, feels every promising direction needs multiple demonstration units that convert what has been learned into highly imaged lessons and continuous consultation. China set up numerous eco-villages to which other villagers were conveyed by bus, and taped the demonstrations for television so as to make them seem real to many who could not visit.

The teaching tools of the 2000s make it possible for farmers to learn the necessary details with the aid of crop-growing simulations. The demonstration units can teach each other by continuous communication, so innovations can mature more quickly. The Chinese have an Institute for Intelligent Machines that is well started in the use of simulations, but their farming system differs from those evolved elsewhere in the world, so the approach must be re-invented elsewhere.
Higher crop yields require much greater improvements in information transmission, particularly from grower to grower.

**Somewhat Radical Thinking**

Almost all recent agricultural research has concentrated upon monoculture rather than intercropping, because it was easier to learn incrementally from one season to the next. But now we have data collection systems that can deal with complexity, so it is possible to investigate polyculture. It is expected that in risky sites sustainability will come from the co-evolution of plants, microorganisms, insects, animals, gadgets, and farmers' imaginations.

In Africa women are paying attention to crop growing and, to overcome their predominant illiteracy, they would have to learn mostly from visual images and verbal instructions through the voice channel. Experienced growers are extremely curious but skeptical, so they must learn by seeing and doing for themselves.

Beyond the process of making seeds multiply into more seeds, the Food Agency strategists discover from the data that huge losses are incurred when inputs and information do not arrive in time and when storage is mismanaged. A predator can be stopped well before it has consumed the crop, and only if the defense against it arrives within two days or so of discovery. The 1990s have produced speedy parcel delivery systems available to anyone who is connected through telecommunications and knows the name of what she or he wants to order. These improved connections in agriculture could add 20 to 40 percent to the marketable supply of food in the most needy places. Thus expert systems and operations research lead to refined "just-in-time" management of agricultural services. Franchised information systems are just now entering the poorest rural societies, and the services they provide enable prompt contact with the stock of knowledge.
Really Radical Solutions for Cities

People move to urban settlements in order to live better, and sufficient food when scarce, even more than fine clothing, distinguishes the good life.

Residents look forward to the festival days on the calendar, each associated with its own centerpiece dish and delicacies. Such occasions as weddings and funerals are celebrated with gorging and drinking, often on a wasteful scale. Memories of such events are cherished during the hard times in between. Food planning must go beyond crisis management, using indicators of the spread of happiness as measures of performance.

In China cuisine is a form of high art. The future is foreshadowed by the practice of premium restaurants in Chinese cities of making private deals with accessible villages that are willing to integrate their output to fit the demands of the chefs. If this practice, which now accounts for less than 0.1 percent of the meals, were to be expanded to cover 10 percent (a common fraction of meals eaten out of the home in prosperous cities), the collaborating villages must become counties. Obviously China lacks the land.

The Food Agency should take advantage of market processes while defining resource-conserving challenges within the classical cuisines. Soy milk manufactured for infants and children is an instance of widespread acceptance, even preference, for a readily available food. Breakfast cereals are another.

(Aside: The street people of Calcutta survived a long electrical workers' strike that prevented baking the bread ration and any other cooking. They found that the puffed rice and wheat stored in gunny sacks in the godowns [warehouses] awaiting
packaging could be mixed with milk or water without Agency
could get the innovation process rolling by setting liberal prizes
for the design of replacements for resource-intensive
traditional meals. It could go on to finance working production
models and stimulate venture capital to promote promising new
products.)

On a still larger scale, cities and firms could lease marginal land
and water in virtually empty areas overseas (for example, the
northern and western desert coasts of Australia, or the
peripheries of Arabia and Africa). They could equip these sites
with solar energy and desalination, rotate apprenticed growers
to learn various farming skills, and have fast container ships
convey staples, greens, fruits, poultry, pork, and domesticated
fish to the markets and shops of the sponsoring metropolis.

Workers learning the trade can expand the flow of production,
much as has occurred in the ranchitos of Latin America that
were founded by former migrant workers to California, which
now export heavy volumes of off-season produce to the United
States and Canada, and are rewarded by high prices in the
markets for perishables.

Proposed here is a kind of "demand-side management planning"
for food that rationalizes the vagaries of the market beyond
what is already achieved by large supermarket chains.

The payoffs, are enormous. The right food at the right time is
pure joy!

Something really significant to assist in food sustainability can be done with
the bodily wastes flowing out of urban communities. In addition to water
recycling in poor cities, the fixed nitrogen and phosphates in the sewage can
be reintroduced directly into the urban metabolism.
The old idea of an aesthetic "edible landscape" can be converted into a green, productive cityscape. When this idea was posed in Colombo, Sri Lanka, my host pointed out the fence covered with winged beans and the leaves of the ivy grown to cool the walls; both were feeding the milking goats. However, really valuable tree crops, like fruits and nuts that can pay their share of the land rent have been inhibited by theft and vandalism. But now information technology offers very cheap alarms and, at somewhat higher costs, instant recognition of culprits through photography, even in the dark.

Early strawberries growing out of the south-facing walls of a "greentown" in Tokyo, and bright red globular persimmons hanging from street trees in the autumn in Beijing, are enormously attractive. However, orchards and grape arbors, in the baghs of the Middle East, should have transparent walls so that passersby can enjoy their beauty. Facades in the city can change colors with the season.

Domesticated fauna such as peacocks or pheasants can roam the side streets. Fish ponds in low-lying areas can raise beautiful varieties, like silver and golden carp. These fish can go to market through holding tanks in miniparks and can put on dazzling entertainment by leaping for morsels, and racing to snatch them once they have hit the surface at feeding time, before capping a banquet. Again it is a matter of integrated design -- creating new images from applied science with new tools.

Showcases of working models, in the form of museum features, can illustrate the utility of human waste and teach a city how to evolve a sustainable urban ecosystem (Meier 1997).

Various methods of estimation suggest that 10 to 30 percent of the food intake, especially the delicatessen provender, combines intensive "organic" gardening with dairy substitutes (e.g., sorbets from algae) and small animal husbandry. The greatest challenge is to fit the highly economical algae and fungi to the palates and the cultures as they are brought together in the megalopolis. Window gardens can produce three to twelve crops a year of spices, garnishes, and ultra-fresh vegetables.

Sunshades for the windows on a high-rise building can support stay-at-home family gardens to produce a good life!
The true value of the food is in the pleasure of eating, so this prospect is not complete. How could the good life be enjoyed without the extra attention, the tasty sauces, the fresh spices, and the small fruits that celebrate the holidays and mark the family events?

Every grower will add to her/his repertoire, and master new recipes as well as specialized crops. Quality of life will rise notably thereby, and the cities will pay in cash for systems that lead the way.

Good food is one of the quickest routes to social well-being, which the scientists call "happiness." The cooking instructions can go beyond a recipe, since they also can be demonstrated on a simulation, so that near professional results can be obtained, after a bit of practice. (Mike Dolan, "Game On!" May 2001, WIRED, 136-64.)
Chapter Seven  Section Five

Quality of Life, Happiness, and Sustainable Development

This is a realm that needs revisiting in order to plan and manage for the best outcome. People all over the world are searching for a better and more secure life.

Most of them expect to find it in a metropolitan area. City life can certainly be better than what is available to large numbers elsewhere, however, once people have settled in, most are not satisfied with conditions that are only better. They dream about something closer to their image of the best in life, and they often agitate for it.

Normally, popular demand for quality of life is expressed in fulsome phrases. Quality living is supposed to result from a free market, a welfare state, or government policies for human betterment. However, better quality really constitutes an enlarged package of services, as revealed by localized social research.

Listening to what people say in public about the quality of urban life does not help very much in understanding how to create quality, because for centuries the most vocal critics of cities were from the educated, self-serving elites, who often saw only the dreams and the warts. They romanticized green retreats, apparently impervious to the boredom the latter can breed for those whose brains have not been previously filled with images, and not anticipating the desperation for escape that slow-paced environments breed among younger people trapped there.

The most profound philosophers, such as Amartya Sen (1993), recognize that quality of life depends most fundamentally upon the availability of choices. Some of this freedom to choose arises from overcoming the pangs of hunger, but it is additionally based upon an educated tolerance for diversity. Some cities have produced more tolerance and peaceable diversity than others. What are they doing that the others fail to discover?
Every few years journalists assess the quality of life of various urban communities in a competitive manner. It is a subject that allays the fears of many and justifies demands for reform. Thus, these articles sell publications and raise the level of argument from expression of personal feelings to identifiable public issues. Many of the upwellings of community concern and action, similar to those in Seattle (see chapter 5) and other cities in North America, start from aggregated feelings and lead to focused programs and plans (Enlow 1999). The features of quality in residential communities these surveys take into account are:

* Attractiveness of appearance within a given investment range (greenness of the cityscape most influences the judgments)

* Personal security, especially control of crime and hurtful accidents, through the maintenance of public order (trust in police restored)

  - Mobility control that keeps traffic from flowing through the respective neighborhoods at an intolerable rate, while expediting the journey to work

* Educational reputation of the public schools for preparing students for further education and for employment

* Accessibility of market areas supplying daily consumption requirements and public services, especially recreation

  - Openness to new ideas, behaviors, people, and organizations

  - Good opportunities for gaining a livelihood that are non-discriminating with respect to age, gender, ethnicity, or race

  - An environment, both natural and built, that seems healthy, with no threat of serious afflictions (malaria under control, and no serious pollution)

  - Vigilant and even-handed justice.
Reports from the appraisers actually represent the preferences and judgments of "respectable" people. The bottom line is whether these pacemakers would be willing to move into a community rated more highly in these categories than the one in which they are presently residing.

For managers of enterprises with many employees, the data regarding what kinds of people leave, which others are satisfied enough to settle in for the long run, and which ones feel trapped, can be crucial for deciding how to locate factories and offices (Figure 7-2).
Our happiness floats for the longer term on a fulcrum based upon achieving satisfaction with peace.
One disturbing trend in cities considered to have a high quality of life is that large differences in wealth and consumption have become more notable, and political cliques use the law to defend financial interests. Communities with the most desirable features of sustainable quality of life often set the stage for fractious politics.

The most sensitive objective index that covers all the features of the QoL was introduced in Chapter Five as one of the most promising of the ecological accounts. Assessments would be the rate of voluntary win-win transactions of all kinds completed -- an enumeration that is becoming more technically feasible with incoming information technology. Small shifts from time to time in the focus of social transactions are reflected in much larger changes in the demand for land and property, wherever an open market for land exists.

Thus, the scarcity of prime residential land serves as a sensitive indicator of relative quality within a city and between cities.

Therefore, urban planners watch the indexes of property rents and sales, diagnose the causes of gains and losses, and recommend intervention that can inhibit speculation in land. Sustainable development in cities very often translates into stable, incremental improvements for people, artifacts, public services, the environment, and market values.

Happiness is the sweetest nectar promoting total quality of life.

Happiness floats! Propped up by positive health and education, with security felt through the absence of terror, happiness also has ties to freedom to act without compulsion and a deep feeling of belonging. Happiness can be produced with little expense, or it can be neglected in luxurious surroundings.

Jefferson’s theme of pursuit of happiness is energized by access to basic needs, upon which are superimposed eco-political arrangements. Serenity, associated with a satisfying contemplative life, is very important for those not requiring full employment or active roles.
Happiness, well-being, satisfaction, welfare, "livability," and quality of life are outcomes whose popular meanings are almost synonymous.

However, studies by social psychologists enable survey researchers to put the questions so as to obtain somewhat different components that change from society to society. Happiness comes in flavors, and the preferences for one or another show up most strongly in people's internal evaluations, but also appear subtly in actions in public places and in the images displayed in the cityscape.

New information about preserving happiness, once it has been achieved, may presage a variety of strategies. Probably the paths to happy communities will have to be empirically rediscovered through experiments and continuous surveys.

In more developed cities happiness is virtually uncorrelated with income, wealth, or political power (Veenhoven 1989). The Japanese, already 90 percent urbanized and relatively wealthy, are less happy as a people than those in the quite rural societies around them, according to collected surveys in the databank (Veenhoven 1990).

Nor is happiness highly associated with success in economic development; economically progressive Korea and Taiwan are found to be less happy than some much poorer neighbors.

Why should higher levels of happiness be found in:
- the economically frustrated Philippine Republic
- troubled Indonesia
- militarily involved Sri Lanka

Why, also, should Iceland be about the happiest area so far surveyed, and Denmark be ahead of other countries in Western Europe? Some scientists have suggested semi-seriously that these trends may be due to the existence of a gene in the population that can be expressed in compatible social environments. In any case, happiness does not seem to be expensive, nor need it exhaust scarce natural resources, once the basic necessities have been made accessible.
Experts have put some of these questions to various publics so that they can make some distinctions (Veenhoven 1990). For the sake of comparison, about 30 percent of Americans have quite consistently declared themselves to be "very happy," while only 10-15 percent say they are "not too happy," which is the lowest choice on the scale.

Those who are happy are outgoing, interactive, optimistic, and in control of their inner lives. Mysteriously, the fraction of "happy" Americans has declined somewhat since 1957. In the intervening period the overall per capita wealth doubled, but the gap between the poorer and the richer expanded much more. Does envy of those who are visibly better off affect the happiness of the others? Or are other correlating factors coming into play?

We have no tested hypotheses as yet for planning cities with happiness of the people as a goal; still it seems highly desirable to consider the possibility.

A recognizably good general solution, if one is ever found, should spread like a cure for cancer; otherwise, the first cities to prove such a formula would be overwhelmed by immigrants. It is also possible that the conditions required for being happy will become boring, so they may be put aside by individuals who favor adventure, excitement, and exploration of the unknown -- new flavors for happiness that could evolve.

Each of the major world religions has created institutions with an inspired internalized discipline that rejects consumerism and excitement. Members endeavor to achieve a serene life, which fits their version of contentment.

Serene living is frugal, often ascetic; it makes fewer demands for services provided by mass society; and it is strongly resource-conserving. Proposals for integrating community forms for enhancing life satisfaction within future city life are strongly associated with happiness. They will be taken up again in chapter 9, when considering long-run futures.
Chapter Seven  Section Six

Life Satisfactions: Who Is Less than Happy and Why?

Once minimum adequate levels of living have been achieved, and relative peace is not threatened, the remaining reasons for unhappiness in a community are more subtle.

Sample surveys will reveal the most problematic components of the population. These groups are now studied intensively. The issues often are as difficult to solve as violent crime, insecure social status, gender discrimination, racial and religious prejudice, homelessness, and the rise of privileged classes.

The most truly unhappy community members typically make up 10 to 20 percent of the whole, with twice as many women reporting unhappiness.

Happiness that is not shared throughout a community breeds stresses that threaten sustainability of school, organization, and communities. Perhaps this is why psychotherapists (in India) observe that it helps to practice laughing in public!

The happiest people have high self-esteem, personal control, and optimism, and are extroverted (Myers and Diener 1997), but they often also feel guilty for being so lucky.

Those who are least happy feel self-destructive, depressed, and unable to contribute to community affairs; they may require treatment to treat their depression. The most sustainable communities are happier than the average, but the happiest communities may be lifted to their peak on a bubble that can burst, dropping the least autonomous individuals into despair and depression.

This is an area of concern in which research should pay off handsomely.

Once minimum adequate levels of living have been achieved, and relative peace is not threatened, the remaining reasons for unhappiness in a community are more subtle. Sample surveys will reveal the most problematic
components of the population. These groups need to be studied intensively. The issues often are as difficult to solve as violent crime, insecure social status, gender discrimination, racial and religious prejudice, homelessness, and the rise of privileged classes. The most truly unhappy community members typically make up 5 to 15 percent of the whole, with more women than men reporting unhappiness.

Happiness that is not shared throughout a community breeds stresses that threaten sustainability. Perhaps this is why psychotherapists observe that it helps to practice laughing in public! The happiest people have high self-esteem, personal control, and optimism, and are extroverted (Myers and Diener 1997), but they often also feel guilty for being so lucky. Those who are least happy feel self-destructive, depressed, and unable to contribute to community affairs; they may require medication to treat their depression. Policies will be discussed in the final chapter, because they have important long range consequences.

The most sustainable communities are happier than the average, but the happiest communities may be lifted to their peak on a bubble that can burst, dropping the least autonomous into an abyss of depression.

**Quality-of-Life, Illness and Treatment**

The correlation between quality of life and health was found in the course of studying well-being through people’s assessments of their own lives.

Subjects were asked a question such as "How do you feel about life as a whole?" followed by a number of similar questions regarding family, befriended patients, home, work or school, neighborhood, natural environment, etc.

They were asked to rate their answers on a seven-point scale with "delighted" at the top and "terrible" at the bottom (Andrews and Withey 1976). Judgments about many living conditions, and their effects upon each other, can be obtained in a similar survey. Such reports are remarkably reproducible until personal conditions change, following something like a death in the family or obtaining a better job.
Behavioral approaches to acquiring judgments are necessary when people are conditioned to hide their feelings from anonymous interviewers or even doctors; those who are most prone to do so are most likely to be depressed and unhappy.

Planning goals regarding health care are quite different from the goals of public policy at present. Currently the public focus is upon treatment of illness -- the negative side of health -- rather than the production of wellness.

What can be said, starting from community ecology variables, about the ecology of wellness (Bubolz et al. 1980)? The community ecology approach to health would assure a comprehensive, future-oriented outlook.

What kinds of planned interventions can be suggested to improve an approach that is too often satisfied with looking at one disease at a time?

Some individuals are less well endowed than the norm; many are significantly at a disadvantage in behavior, appearance, or physical health. In determining well-being for them, how do we tell the difference between temporary depression, illness, injury, insanity, criminality, wickedness, or cultural imperatives?

The treatment depends upon the diagnosis. Similarly, others in the population are "supernormal." They are physically strong, confident as problem-solvers, and serene in outlook. They deal successfully with the social and natural environments for most of their lives.

Almost all people believe that, when abnormality is diagnosed as an illness, they should succor the affected in the community. In the case of injury they patch up the victim, while sometimes punishing the person causing the injury or repairing the object responsible for it.

In contrast, if the condition is called insanity, we often isolate the individual before providing treatment. Wickedness, or criminal behavior, is of course dealt with by the police, followed by an appearance in court and potential relegation to prison. Because there are many borderline cases, quite a few ill
people are found in prison, and a substantial share of the criminals go to hospitals.

Sub-cultural differences are responsible for much of this ambiguity.

Nevertheless, in the interests of justice, these differences should be tolerated or, if disturbing to others, the deviants can be admonished and sometimes "treated" with education intended to modify behavior. However, health in a community extends beyond that of the humans to the condition of every other participant, from trees and buildings to machines, as is evident in Box 7-3.

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**Box 7-3**

**Growing Food can be Fun Instead of a Grind**

One of the newer information technologies--video gaming--has been courted, but not yet assigned a serious task. Hitherto dedicated to fantasy, visual perception, and compelling action, gaming simulations designed to date could not reach pre-literate peoples, the condition of most subsistence farmers in the world.

Simulations could reach many of the unschooled, but there was no appreciation of what could happen when villages sprout telecom centers that open channels to markets, education, health services, and entertainment.

Ecological systems thinking can point the way. WIRED magazine has offered a retrospective on the industry that started in the arcades of the 1970s, capturing coins from the bored youth, later invading the toy stores as a highly valued item, and finally engaging a clientele of millions while still lacking a foundation in theory.
The commercial producers of games tried to attract the attention of girls, but the results were feeble. This is a pity, because more than half of the food growers in the most needy parts of the world are also female. In those cultures the woman’s role is predominantly that of nurture.

An urban ecosystems proposal for simulating growing plants starts with nurture—preparing the soil for a fertile seed. This assures the availability of nutrients, scaring off the birds scratching for morsels, protecting the sprout from invisible nematodes, defending the seedling from competition with fast-growing weeds, engaging in Mortal Kombat (a favorite game in the ‘90s in America and Japan) with caterpillars, beetles, and locusts. This prevents the spread of viral epidemics, harvesting the fruits of ones labor before changes in the weather destroy it, frustrating the hungry rats and weevils that want to feast on it, and finally, outwitting the sharpsters in the marketplace.

All this needs to be simulated visually, with spoken terms to make it possible to communicate precisely with pre-literates. A series of choices must be made along the way. The ideal design of a simulation would judge the impact of the choices on the bottom line, and report back to the player how the scorecard could be improved, but esthetics intervene. Learning the images of threat, technical vocabulary, and optimal strategy can build up very quickly.

Ten or twenty trial runs of a 10-30 minute duration simulation should result in a reproducible high score, but vital details will be forgotten. This requires consulting the DVD player machine later to extract crucial information for the current stage of growth. The telecom center library would accumulate disks labeled, perhaps, Spinach 2.0, Chillies 3.0, and Maize, sweet white, 3.1.
How is a trustworthy simulation produced? For this step we have to go back to the experiment station that develops the seed, along with the farmer selected to multiply the seed for distribution. The team that introduced the seed would have to add a film maker and an editor to its membership. Together they would receive the complaints and the suggestions for improvement from the growers. Those reports could reduce by a half or a third the time required to achieve optimal production permitted by the genetics, climate, and soil.

(It is interesting to note that early simulators in California learned to set forecasts of yield at 10-20% less than their expectations, but still notably greater than previous seed on the market, so that virtually all growers co-operating in the experiments could feel that their skill was "above average". Then everyone was more satisfied with their efforts, but still learning.)

The true value of the food is in the pleasure of eating, so this prospect is not complete. How could the good life be enjoyed without the extra attention, the tasty sauces, the fresh spices, and the small fruits that celebrate the holidays and mark the family events? Every grower will add to her/his repertoire, and master new recipes as well as specialized crops. Quality of life will rise notably thereby, and the cities will pay in cash for systems that lead the way. Good food is one of the quickest routes to social well-being, which the scientists call "happiness."

The cooking instructions can go beyond a recipe, since they also can be demonstrated on a simulation, so that near professional results can be obtained, after a bit of practice (Dolan, 2001; Plant and Stone, 1991).

Treatment of illness now comprises a branch of information technology. Improvements arise from highly instrumented research and development,
and the clinical data are very carefully scrutinized to discover whether inferences from them can be released into general practice.

Information about innovations is centrally recorded, and there is potentially a rapid diffusion of findings to the practitioners.

Currently most technology-driven medical service breakthroughs are transmitted to institutions in the poorer countries with a lag of ten to twenty years.

However, in less technologically developed cultures there is a widespread belief that the underlying assumptions that have generated the burst of new technology are quite inappropriate. Authorities in such places often insist upon verifying whether the innovations seem worthwhile. For them the human touch in healing, and the wisdom needed for the local prevention of illness is being lost, because of the intrusion of technology. They believe that health can be regained primarily through interaction at the community scale. LaBonté (1993) calls this stage conviviality, which means a condition of sharing and caring.

Health professionals use the term social support. When the community is concerned about health, its residents experience death and disability rates at one-half to one-quarter of those otherwise reported. This support operates at the workplace, in neighborhoods, in politics, and in traditional institutions such as churches and schools. Duhl (1990, 1993) identifies this kind of self-help in the Healthy Cities Programme of the World Health Organization. He believes it should be proactive and stimulated by "social entrepreneurship."

This is the feasible path to sustainable health.

One example can eloquently illustrate this point. A psychologist in Bombay (when it still had that name; now it is known as Mumbai) noted a strong tendency toward depression and unhappiness among people with organizational responsibilities. He called together a group of these people to meet before work at an accessible point in the beachfront park and laugh together. After some time, those in the group no longer need jokes to set
off the mirth that prevents negative happiness. One volunteers a start, and another laughs at his attempt, and the others join.

In the United States, consulting psychologists can help individuals change their attitudes toward tedious but necessary jobs by interjecting fun, cartoons, and humorous episodes. Caregivers at hospices, where people with incurable illnesses go to die, continually lose their friends, so they badly need humor and fun. A humorous approach often pays off financially as well, because the cost of hiring and retraining caretakers can be saved.

A community with un-enforced jolliness is a happy place.

Medical centers where expensive and complex procedures are undertaken frequently add specialists in ethics and social science to their staffs. These experts can negotiate the demands upon the systems and evolve a flexible set of guidelines that reduce conflicts among stakeholders. New technical knowledge has generated a variety of unprecedented ethical problems.

Ethicists must engage in discussions that reduce expense to the public as well. Wisdom must be introduced to manage the uses of Knowledge.

Doctors use an ethical "second opinion" to fend off pressures from the families of patients and, not infrequently, the health maintenance organizations (HMOs) need such advice continuously.
Serenity, happiness, and delight may be identified as the prerequisites for a good life. Most people assume that the community is there to help them survive and be happy. Individuals and households are in "pursuit of happiness," as asserted in the words ascribed to Thomas Jefferson in the American Declaration of Independence (Myers 1992).

That quest presumes that the members of a community already know how to improve the quality of life and have a strategy of some sort for doing so, but they do not know how to achieve it at minimal cost, because happiness has not been measured by designers.

Money is hardly a major contributor to the level of happiness when the basic necessities are at hand—an observation that has been confirmed repeatedly (Diener, Diener, and Diener 1995; Diener and Diener 1996).

What does it take to improve quality of life in terms of expending energy, time, and space for living or maintaining human relationships?

Social psychologists do not ask questions in this way, but at a more fundamental level they have found that recent happy events for those interviewed contribute the most to their sense of happiness (Seidlitz, Wyer, and Diener 1997; Suh, Diener, and Fujita 1996).

That finding suggests a management task more than planning. It has also been reported that more people in the world are happy than unhappy (Diener and Diener 1996). How, then, might struggling poor communities, whose members are fatalistic, sad, or downright unhappy, plan for such basic prerequisites as health, education, associations, and public order so as to arrive at a state of happiness sooner rather than later (Meier 1999)?

Surprisingly, the most frequently used social indicator for happiness in a society is stability over a period of months or years. Some societies and
communities are consistently happier than others (Veenhoven 1996). Research indicates that the Filipinos are happier than the Japanese or the Koreans, and the Icelanders come off happier than other European societies, even the wealthiest. We can only guess at what inexpensive inputs brought about this state of bliss.

An astonishingly promising effort to measure happiness was undertaken in concert with a scheduled transition -- the passing of apartheid in South Africa (Moller 1997). A picked team mounted a multidimensional measurement of changes in opinions, attitudes, and well-being during and after the event. The group and its sponsors were undertaking to guide the government through a period that had no precedents to help decision makers.

Happiness is an expression of subjective well-being and overall satisfaction with life. Serenity, which has been less frequently studied scientifically, is a special case that seems to be less aggressive in its demands, and ultimately more resource-conserving than happiness. All major religious systems sponsor communities to foster serene living, but the Buddhist and Hindu efforts are the largest. In these communities, people who report being very happy seem to be more active, and their mood is quite infectious.

The third measure of a good life, delight, is a "high" state that is sought by a significant fraction of a population. But achieving delight often has a downside later for the family and community, especially when it is achieved by engaging in infrequent activities.

Social well-being for individuals is genetically determined in part (Lykken 1995), perhaps even more so than intelligence. Thus it appears to be similar to educational achievement; learning and its benefits can be acquired more easily by those who are better endowed for intelligence at birth, although virtually all can achieve high levels of well-being with perseverance and discipline.

Recently accumulated findings are quite substantial (Diener et al. 1999). Exciting potentials for late-blooming societies and their constituent communities enable much more rapid advancement. They can aim directly at achieving several attractive flavors of happiness and forego a lengthy
transition to a "tiger economy" in order to reach fully developed status (Meier 1997, 1999).

Simultaneously, presently developed societies could improve their social well-being by dispensing with conspicuous consumption and directing more attention to the participation in happy "happenings", which becomes a new responsibility for managers (Figure 7-2).

Two other crises related to positive health are population growth and a long list of addictions following short-term "highs," ranging from tobacco, alcohol, and hard drugs to gambling and personal automobiles as a way of life. The first of these can be addressed, but the second awaits a great deal more insight before a clear path can be found.

**Remedies for the Unhappy Minority**

While knowledge is breaking into new territory, it is difficult to choose the key articles that stand up for the long run. The up-to-date follow-up can be traced most easily on the Internet.

What follows is a narrative showing the rapid changes in prospects for those people who would be left out when plans for promoting happiness are successful. The story is more important than the documentation.

The January issue of the Journal of the American Psychological Association bravely announced that the turn of the century would herald a new era for their profession. Instead of focusing upon mental illness and deficits, case by case, psychologists would concentrate upon wellness in communities, organizations, societies, and populations.

That first issue was dedicated to the new potentials for positive psychology, with the lead article laying out the possibility of promoting Happiness as their foremost professional challenge.

That was a prescient forecast! It was followed, only months later, with a burst of announcements of promising new findings.
If Happiness in different degrees and flavors is to be regarded as a normal human state, then people have to accept the co-existence of some unhappiness. The absence of Happiness has been called the Blue Plague, termed medically as clinical depression, in which the people who are afflicted have obsessive moods that detract from full attention, and greatly lessen performance. These human capacities are cognized as prerequisites for the kind of complex society we see ahead of us.

Many exciting new proposals have arrived for dealing with lack of enthusiasm for life so characteristic of people reporting that they are unhappy.

The new synthetic drugs controlled added neurotransmitters and hormones in the immune system, allowing a noticeably closer approach to an internal steady state.

Preliminary results were very promising, but the skeptics are yet to be fully persuaded. Could the cost be held low enough to be affordable in the poor societies of the world? Meanwhile the calculation of total social costs by the Harvard club of economists undertaking the estimation of losses attributable to various diseases raised clinical depression to Number Two among the challenges to public health planners in America. Costs are anticipated to drop precipitately around 2010, when the patents run out.

People suffering from low self-esteem, morale and shyness, commonly associated strongly with depression, soon rebel against the doctors’ prescriptions. Disappointed that, though they feel better, they do not reach the higher levels of well-being, and stop the pill-taking. The Prozac family of drugs, where the patents are ready to expire in the early years of the century, has already headed down.

A month later came an opening barrage of large studies on the effects of aerobic exercises. Five hours per week of organized exercise virtually abolished the symptoms in a few weeks for at least as large a share (about 80%) as the best combination of pills with therapy, and requiring much less time than has otherwise been possible.
Laboratory studies of the brains of exercisers identified the probable causes for the changes in health. How the therapies worked became much more understandable to investigators.

That will leave it to families and communities to motivate the unhappy enough to leave their gloomy corners and rocking chairs. For the poorer societies it appears that vigorous dancing should be the preferred choice. Many happy people dance purely for fun, so they are likely to set the pace. It would be up to the community planners and managers to set up the occasions for vigorous dancing for peacemaking. In many places, such as Israel, with the Druze, and the Palestinians, or elsewhere, with the neighboring tribes in South Africa, joint dances were organized to moderate the intensity of ethnic conflict, but they could serve as well for achieving equity in social well-being.

Occasions that serve multiple common purposes are most likely to be highly rewarding.

Until now some people had to be advised on ways of accepting long patches of unhappy times as a normal burden that people had to bear, because the folk remedies helped very little.

A predominant share of the unhappy suffered from the Blue Plague, technically termed clinical depression.

The symptoms are various. They include:

- sleeplessness
- severe premenstrual stress
- extreme shyness
- alcoholism
- feeling worthless
- eating disorders
- hikiko-mori (Japan)
- “stir crazy” during long winters
- suicidal episodes
- bi-polar mood disorders
Economic costs run into many billions of dollars per year (100+ in the US alone), and they are rising steadily. Almost two thirds of the victims are female.

An assessment of the overall impact in the United States has raised clinical depression to the second most important threat to health. In very poor countries it is brought on by many other illnesses, domestic violence and family crises, so that the incidence is higher.

In the earlier discussion of social indicators for ecological accounts, happiness was selected as the kind of well-being that might be accepted as a substitute for consumption in the short to middle run. Happiness-producing outcomes could be designed into projects to balance out delays in benefits.

(Example: In 1980 I was investigating the South Korean Sae Maul Undong rural program, which seemed to have achieved an extraordinary rate of increase in agricultural efficiency. I noticed that each 3-6 month project held a lavish 1-2 day celebration upon completion. At the time I thought it was a waste of capital, so I had to look deeper. I was soon persuaded that these “good times,” held when they could eat, drink, and show off their personal medals and trophy caps, were calculated to stimulate creative solutions and breakneck races to completion of project stages.)

In the 1970s the cities of Korea were making world records in economic growth, but most of the normally lagging agricultural regions were, very surprisingly, ahead of them. The men were so proud of their achievements that the women appealed to the president to be given a chance for creating micro-enterprises.

After less than a year of equal opportunity, almost everyone seemed immensely satisfied with life.) Much later I learned that South Korea did not rank highly among developing societies for level of happiness.

Conclusion: Happiness production is quite compatible with efficiency improvement.

To understand the impact of the new range of options, the advances in medicine must be reviewed.
Mood depression is attributed to variations in the uptake of several neurotransmitters in the brain. For serotonin Prozac appeared in the 1990s, to be followed by Zoloft, Paxil, and Luvox. They were effective for about 70-80% of the cases, especially when accompanied with some psychotherapy.

Then, around 2000, RU486 helped those with cortical problems who were feeling “constantly stressed and agitated,” at much lower doses than those used for its famous abortive action takes. Venlafaxine appeared in 2001 for nor-epinephrine control. Due to patents running out, all should be cheap by 2015 or earlier.

Most important of all, it was then shown in several studies that three hours of aerobic exercise per week quelled depression quicker, and for a larger share of the participants, than pills. Organized public dancing can overcome the Blue Plague.

It looks like it is possible for urban societies to assure at least a moderate degree of happiness for 95% of the population. Virtually no one is deprived! The tiny remainder will know that they have been unlucky enough to have been the victim of an accident that may prevent the full experience of happy living. They await the super-pain killers.

A future with less than 5% of the population responding “less than happy” to social surveys now seems feasible. We know, for example, that quadriplegics, and other people with major physical disabilities, are about as happy as the norm. The residue is much more likely to be reduced incrementally by better painkillers, so the future offers real hope for everyone. These economic possibilities suggest that happiness could join the club of universal human rights that already assure that:

- potable water
- food for the hungry
- shelter
- freedom from violence

ought to be provided to every living human.

It offers a very interesting outlook for planning that may be implemented over the next generation, taking social, economic and political development into a totally unexpected direction.
Chapter Seven Section Eight

Food and Population Growth

The most enduring contribution to positive health worldwide is famine prevention.

A United Nations consensus declares that an urban population needs two thousand calories a day per capita when a scarcity exists, but local authorities face the problem of distributing that amount according to need throughout the population. Rations are sometimes sold in the black market or not delivered at all.

A certain amount of inadvertent waste, due to spoilage and accidents, is to be expected, and tolerated. In Dhaka, Bangladesh, one of the poorest cities of the world, where responsible officials estimated consumption at eighteen hundred calories a day per capita overall, a visiting expert could still go through the neighborhoods without seeing any swollen bellies, shrinking muscles, or the apathy created by insufficient calories over a sustained period. Perhaps eighteen hundred calories should be taken as the irreducible minimum that could be tolerated over a few months during an emergency, and two thousand calories per day could be seen as a goal that allows people to pay attention to matters other than whether the next meal is obtainable.

The basic need for food (as seen in Box 7-2) lies somewhere between this absolute minimum and the long-term, three thousand-calorie satiation level.

For context, it should be remembered that for most mammals, including humans, a constrained caloric intake, with balanced protein-vitamin-mineral composition, is believed to be very healthy. People and fauna seem to live longer on lean diets than when they eat up to the limits set by appetite.

Is longevity a proper goal for community planning?

In most, but not all, cultures, planners can depend upon urban residents to choose the commodities and the regional cuisine that fits their own metabolism and tastes. The result is good health, though probably not the
best. Even "junk food," popular in the West, can be relatively balanced, particularly when it is varied over weeks, months, and seasons.

Large cities such as Hong Kong and Singapore have come into being under conditions in which they expect to buy food on the global market.

Under those circumstances the basic two thousand calories per capita with the associated vitamins and minerals is not too difficult to obtain. The poorest urban residents normally spend 40 to 50 percent of their livelihoods for adequate nutrition, and that share declines to 20 percent as family productivity and income rise, even though the frequency of festive occasions increases and a few luxuries are added to the regular diet. Satisfaction with the quality of life vastly improves among the masses with the enhanced availability of these extras.

But the middle class regards access to them as entitlements and looks beyond the community for exotic delights.

Sustainable nutritional prospects make population planning necessary, and in many respects it has become a responsibility of the community with its component households and organizations. The practical solution to the threat of famine is to reduce population growth at the same time that efficiencies in food production and distribution are introduced.

However, the direct approach, through shaming, sermons, and variety in the provision of contraceptives, is much too slow.

Education for Population Planning

The hard core of the world’s population planning problem has yet to be addressed. Excellent coverage of effective social policy is provided in the pages of the Population and Development Review, while reports on implementation worldwide can be found in Studies in Family Planning. Causes of "unmet felt need" for contraception vary widely according to religious and folk beliefs, as well as lack of information (Bongaarts and Bruce 1995).
These sources observe that birth control is not adopted rapidly enough when communities skimp on the education of girls.

Investments in human resources must be more balanced between the genders if family size reduction is to become institutionalized. Rural ways of life, based upon high birth rates balanced by high death rates, have been transformed in the last two generations through vastly reduced mortality.

The slowness of the birth rate to follow the decline of the death rate is a principal cause of the present population explosions.

It took demographers a long time to realize that the techniques for preventing births that are accepted in Europe did not fit into other cultures so readily. Improved folk methods of contraception -- diaphragm, condom, withdrawal, and abortion -- were not convenient or encountered local objections.

In the West, the taboo placed upon speaking publicly about such things and the prohibitions of the Catholic Church thwarted the rapid dissemination of what the Europeans had learned very privately.

Practitioners in developing countries now recognize that they have to allow people to draw upon the full range of contraceptive techniques that have been invented, rather than introducing one or two that are felt by technical assistance missions to be most appropriate. That includes implants, injections, pills, intrauterine devices, sterilization (of males as well as females), and safer forms of abortion (Caldwell and Caldwell 1992).

Because the cost of pregnancy is most heavily borne by women, they have the greatest incentive to consider the alternatives.

But what about the males? How can they be motivated?

India, in particular, took this route. The government under Prime Minister Indira Gandhi provided financial inducements for eligible men to offer themselves for sterilization. The authorities found it useful to provide "finder's fees" to other men who would round up these eligible for attendance at out-of-town sterilization camps.
All sorts of rumors were circulated about greater sexual potency without responsibility, but only 10 to 20 percent of the eligible males responded in the cities with programs.

For two to four days' pay and a half dozen good meals, some men would give up their capacity to procreate. Although vasectomy is theoretically reversible, the reverse operation was very seldom attempted. However, the reductions in the birth rate achieved by this means were only a few percent, and increased incentives would be too costly for society. The program also changed the political climate by adding to authoritarian controls over private lives, and it contributed to a reduction of trust in government.

Each stage in the education of rural girls seems to make a contribution to the reduction of the birth rate. Numeracy (ability to use numbers) allows women to undertake micro-enterprises, thereby achieving some independence from male heads of households.

Literacy makes it possible for them to gain information about opportunities from outside the neighborhood. General elementary education allows much greater participation in the community. Secondary school education offers a chance for careers in organizations independent of the traditional roles.

In much of Asia and Latin America the number of births per woman has been reduced to three or less when a majority of women had acquired an elementary education. However, in Moslem nations and in most of Africa, that amount of education has not been enough to push the rate below four to five live births per woman (a rate that would cause the population to double in twenty to twenty-five years). Recent findings from Africa suggest strongly that a high school education does bring about a rapid change (LeVine et al. 1991: Caldwell, Orubulove, and Caldwell 1992; Lloyd and Blanc 1996).

Those parts of China that have slighted the education of girls were initially obedient to national dicta imposing one-child families, but now there is a new kind of illegitimacy based upon unregistered births, disproportionately male (because female infanticide is part of the tradition), and a pent-up fertility awaiting the relaxation of authority (Hermalin and Liu 1990).
Education planners in poor countries find secondary education, starting from present female literacy rates of 15 to 30 percent, impossible to achieve in less than three decades, given the time lags needed for increasing taxes, training teachers, and building schools.

During that amount of time the population in the poorest regions would double or triple and would still be expanding significantly after diminishing to replacement levels (2.2 per woman), because of the extraordinary proportion of youth present. In Western Europe, North America, and Japan, where women have been able to obtain secondary school training or more, the reproduction rate has fallen to between 1.6 and 1.9.

The problem is greatest in rural communities, so the cities must reach out and find a means of accelerating education far beyond their suburbs and satellites, as well as making educational provisions for migrants settling just outside the formal boundaries.

Until now there has been little discussion of shortcuts to increasing education that bypass the schools, despite the existence of techniques of programmed interactive instruction, mind-opening television, and community organization approaches.

Conservatives in the local elite would object that these accelerated educational policies threaten to destroy the family and create social havoc. They are right to foresee rapid social change, but they forget that the relentless growth of population induces even more painful breakdowns in the social order.

More regions will surpass local carrying capacity, making them able to survive only on the largess of parts of the world that still have access to sufficient food and fuel. So far the "basket case societies" (those unable to help themselves) have rebounded when they experience good weather and political stability, but fertility reductions have come very slowly. Places such as:

- sub-Saharan Africa
- Pakistan
- Nepal
- Burma
• Iraq
• Afghanistan
• Haiti

will become much more populous, and isolated regions elsewhere will require substantial external support. It will be noted that the Catholic Church is no longer the obstruction that it was, mainly because the predominant majority of nominally Catholic couples privately ignore the dictates of the church about birth control.

The goal of health for the ecosystem leads planners in strange directions. When this analysis began, who would have thought that the funding of shortcuts in the education of young women would be the most crucial step toward that goal?

Economic research on the World Bank reveals that its best investment in the development would be in the education of females of very poor societies, but how can the bank activate establishments that are responsible for education? It does supply elementary scholarships in Bangladesh and promises to finance the separate schooling required by custom in Pakistan and other strongly patriarchal societies, but these countries quickly run out of schools, teachers, and budget. The best hope is to support the women’s NGO movement -- a remarkable growth phenomenon in village, town, and city in recent decades.

With technical and financial support the NGOs could bypass the formal public school system and manage new, economical, accelerated learning technologies (Meier 1996).

Personal knowledge of all kinds about future livelihood in poor communities can now be advanced more rapidly by informal methods than by years of state-supported schooling.

An astonishing finding regarding self-help adds real hope. The policy of making small-scale loans to mostly illiterate women who engage in micro-enterprises after learning numeracy has had a dramatic effect upon fertility in Bangladesh -- about a 40 percent reduction within a few years.
More than that, a kind of positive epidemic was launched, because non-borrowers in the same community simultaneously reduced their fertility about 20 percent (partially reported in Mita and Simmons 1995). New programs for the stimulation of micro-enterprises, almost entirely for women, are spreading rapidly around the developing world.

Land use planners and community designers, educated with Western curricula, have routinely mapped out optimal locations and arrangements for:

- schools
- playgrounds
- markets
- transport

in new and redeveloped communities, but it is shameful that so far they have forgotten to identify a site for a family planning clinic (preferably with a door for men separate from that for women and babies).

Ideological doctrine has been a major constraint, but it is aided and abetted by planning practice that is neglectful in this respect and often also blind to feminist issues for the communities they serve.

Professional planners have not been paying attention to the findings reported in family planning journals, and not enough to the feminist agenda in any part of the world.
Chapter Seven Section Nine

Life Cycle Endings: Preservation, Risk, and Dignity in Dying

When something valuable to a community is "at risk" of not surviving, a project for investment in its preservation is usually put forward.

A minority of people interested in connecting the past with the present and the future introduces the project for public consideration.

The idea behind preservation planning is that the life cycle of the physical entity, represented in the media by the image, can often be greatly extended through the careful investment of effort.

Box 7-3

Growing Food can be Fun Instead of a Grind

One of the newer information technologies--video gaming--has been courted, but not yet assigned a serious task. Hitherto dedicated to fantasy, visual perception, and compelling action, gaming simulations designed to date could not reach pre-literate peoples, the condition of most subsistence farmers in the world.

Simulations could reach many of the unschooled, but there was no appreciation of what could happen when villages sprout telecom centers that open channels to markets, education, health services, and entertainment.

Ecological systems thinking can point the way. WIRED magazine has offered a retrospective on the industry that started in the arcades of the 1970s, capturing coins from the bored youth, later invading the toy stores as a highly valued item, and finally engaging a clientele of millions while still lacking a foundation in theory.
The commercial producers of games tried to attract the attention of girls, but the results were feeble. This is a pity, because more than half of the food growers in the most needy parts of the world are also female. In those cultures the woman’s role is predominantly that of nurture.

An urban ecosystems proposal for simulating growing plants starts with nurture--preparing the soil for a fertile seed. This assures the availability of nutrients, scaring off the birds scratching for morsels, protecting the sprout from invisible nematodes, defending the seedling from competition with fast-growing weeds, engaging in Mortal Kombat (a favorite game in the '90s in America and Japan) with caterpillars, beetles, and locusts. This prevents the spread of viral epidemics, harvesting the fruits of ones labor before changes in the weather destroy it, frustrating the hungry rats and weevils that want to feast on it, and finally, outwitting the sharpsters in the marketplace.

All this needs to be simulated visually, with spoken terms to make it possible to communicate precisely with pre-literate. A series of choices must be made along the way, The ideal design of a simulation would judge the impact of the choices on the bottom line, and report back to the player how the scorecard could be improved, but esthetics intervene. Learning the images of threat, technical vocabulary, and optimal strategy can build up very quickly.

Ten or twenty trial runs of a 10-30 minute duration simulation should result in a reproducible high score, but vital details will be forgotten. This requires consulting the DVD player machine later to extract crucial information for the current stage of growth. The telecom center library would accumulate disks labeled, perhaps, Spinach 2.0, Chillies 3.0, and Maize, sweet white, 3.1.

How is a trustworthy simulation produced? For this step we have to go back to the experiment station that develops the seed,
along with the farmer selected to multiply the seed for distribution. The team that introduced the seed would have to add a film maker and an editor to its membership. Together they would receive the complaints and the suggestions for improvement from the growers. Those reports could reduce by a half or a third the time required to achieve optimal production permitted by the genetics, climate, and soil.

(It is interesting to note that early simulators in California learned to set forecasts of yield at 10-20% less than their expectations, but still notably greater than previous seed on the market, so that virtually all growers co-operating in the experiments could feel that their skill was "above average". Then everyone was more satisfied with their efforts, but still learning.)

The true value of the food is in the pleasure of eating, so this prospect is not complete. How could the good life be enjoyed without the extra attention, the tasty sauces, the fresh spices, and the small fruits that celebrate the holidays and mark the family events? Every grower will add to her/his repertoire, and master new recipes as well as specialized crops. Quality of life will rise notably thereby, and the cities will pay in cash for systems that lead the way. Good food is one of the quickest routes to social well-being, which the scientists call "happiness."

The cooking instructions can go beyond a recipe, since they also can be demonstrated on a simulation, so that near professional results can be obtained, after a bit of practice (Dolan, 2001; Plant and Stone, 1991).

Its longevity expectations can be achieved by first investigating the causes of death for that kind of image (for example, fire, decay, modernization, accident, or habitat

How will the next generations be able to appreciate the best of the past? Preservation needs imagery, flows of funds, and long-term attention to meet
the obligations incurred.

Image categories that have been nominated for preservation range from natural wonders to great artifacts, endangered species, and satisfying rituals (Meier 1980).

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**Box 7-4**

**Preservation Process: Ecological Fundamentals**

**Identify:**
1. an authentic cluster of images for the thing that is to be preserved
2. human sub-population of appreciators
3. expected life cycle of that kind of thing

**Find:**
4. natural forces leading to destruction through neglect
5. the predators, invaders, looters
6. a promising strategy for protection

**Plan:**
7. a flow of contributions from appreciators
8. a long-lived institution or foundation to be responsible

**Design:**
9. the authentic image to be maintained
10. the setting that reinforces the image

**Manage:**
11. collection of data indicating success and failure
12. procedures for changing preservation strategy

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To formulate a preservation project, the first problem is to find a source of funds to support the long-term effort, and thereafter an organization long-lived enough to manage the project.

- museums
- zoos
- parks

have been set up to serve this purpose, but when the image is an historic structure, such as a:
• temple
• palace
• monument

Some kind of foundation or trust must be formed.

Tax-free status is inadequate, although it may temporarily reduce the stress on the item to be preserved. Entrusting the thing to be preserved to government will almost surely result in neglect when succeeding generations of political appointees have been installed in these preservation "sinecures."

Some societies have preserved large things by entrusting them and their maintenance to a monastery, an artisan guild, or a noble family with a long lineage, each of which was believed to have a longer life span than was possible for the government bureau itself.

Non-ecological justifications for taking action to preserve are exceedingly clumsy (Stirling 1993; O’Dougherty 1993).

Sustainability for a city depends upon continuous urban renewal as the respective life cycles of each component come to an end.

The crooked lanes and irregular plot boundaries of an old village or townsite (the medinah in Arabic-speaking countries) are almost always stubbornly defended by multigenerational families. After being surrounded by more modern urban settlement, the effects of poor sanitation, lack of access to cost-effective vehicles, and other inconveniences pile up.

Only when a people’s industrial or commercial commitment becomes widely evident can a land readjustment scheme be agreed upon and implemented, because by then the land value increase will allow each owner to be a winner and contribute to the future glamour.
Preservation of Human Life

By far the most sophisticated preservation program has been created for humans themselves, and their pets. It is worldwide policy to maximize longevity of life for individuals, often at the expense of the taxpayers and the poor.

Preservation of the elderly at the very least saps the resiliency of the community to meet other threats.

Postponing death to later ages is considered a quantitative indicator of social progress. An affluent community could afford such a policy in the twentieth century but, as the baby boom bulge reaches retirement age, not for long.

Costs for maintaining life supports at present levels of expectations will escalate to about double. With fewer workers at hand to service the aged, Social Security crises will reach a crescendo during the 2010-2020 period in Japan, Europe, and the United States.

Medical scientists expect that current research and clinical development will greatly reduce degenerative diseases, heart and vascular disease, and neurological disorders.

Human life expectancy would then be extended from the present of seventy to eighty years to about eighty-five years for men and around ninety years for women. Does this mean that in the future, for both affluent and developing societies, about half of an individual’s lifetime would normally, according to present expectations, be spent in a dependent status, instead of a quarter to a third as is now the case? Can so much dependency be afforded?

Before and during senescence a superior solution could be embraced.

The good health experienced by the majority during their post-retirement decades is an asset that could be of value, if it is used for production. Most new employment does not require muscle, since the jobs now being created are service-oriented and dependent upon computers with instrumentation.
that requires attention. Machinery can do the really hard work, making the management of productive activity a relatively simple, ecological solution for enhancing resiliency.

That policy would also require many more small, local enterprises. Then the dictum could be, "Work at your own pace until you drop!" Following that injunction would at least provide for the cost of living and part of the care for infirmity.

Social security programs all over the world are projected to have insufficient funds to meet the long-term demand (Economist 1998). Elderly people tending niche enterprises could be productive enough to be largely self-supporting for most of the rest of their extended lives. For them work is preferable to idleness.

However, decades of heated political discussion supplemented by education are to be expected before the mystical ideologies can be overcome by simple, ecological arguments.

The most acceptable response is to ask for an expansion of part-time productive work for the aging starting early in the twenty first century.

A policy that would mobilize half of the elderly could prevent the loss of services, and allow time to reform both pension systems and the health management institutions. In an era of "entitlements" for a population of elderly with a low level of computer literacy, this option has yet to be actively discussed.

Such an arrangement will be much more practical by 2005 or 2010, perhaps sooner in Japan.

Assisted death, or euthanasia, may have to be reinstated for people suffering from irreducible pain and feelings of complete uselessness, so that they could die with dignity. A serene ending for life is strongly preferred by the community. Although this way of dying is an ecological solution for enhancing resiliency, it will take many years of debate to persuade a majority to vote for it in a Euro-American democracy. It is a solution likely to be postponed at considerable cost to the living.
Such optimal policies about aging arising from ecosystems thinking come as a shock to many people.

Ecological concepts represent a kind of common sense, but a variety that is often repeatedly denied for political and faith-based reasons. Some of the elderly are influential stakeholders and reluctant to change their positions, while many others defer to them.
Chapter Seven Section Ten

Risk vs. Risk in Urban Ecosystems

The spread of environmentalism and increased sensitization to indicators of loss in the natural environment bring a heightened sense of danger (Slovic 1987).

A notable increase in the frequency of potential catastrophic events and new phenomena to be concerned about has developed a mistaken impression of the changing odds. Frequently a relatively mild source of risk, such as "earth warming" will create pockets of hysteria, particularly among young people.

This is a natural consequence of the growth of communications and networks--a phenomenon most concentrated in cities that are linked by the media to other cities. Comprehensive data show that, on the whole, cities are safer today than ever. Despite the bulk of the evidence, environmentalists do not agree; they take a strongly alarmist position and are thus repeatedly in active pursuit of "phantom risks" (Foster, Bernstein, and Huber 1993).

The global momentum toward over-regulation that incurs huge amounts of ecological waste, and much more is threatened. Resources that could be used in upgrading infrastructure in ways that would save people’s time and contribute to quality of life in the neglected neighborhoods are spent unnecessarily sanitizing the environment, while natural hazards such as cliffs, water bodies, windstorms, and earthquakes remain unquestioned. Background levels of natural risk should set a standard for risk in the planned and designed environment.

This enhanced sensitivity can be ascribed to the new amplification possibilities presented by the communications media, where one guilt-inducing photo sequence on television can change minds. How might the image flows be directed to induce moderation? Bjorn Lomborg (2001) offered a spectacular set of confirmations of the arguments set forth in the preceding paragraphs. It is anticipated that they will not change beliefs very much in the following several years.
Scientifically designed experiments point the way to programs that can reverse the trend toward paralysis caused by an overshoot of rising concern. A team led by Granger Morgan (1992) chose the strongest, best understood carcinogen, radon, a major source of background nuclear radiation.

For communicating about risk, they propose the following steps based upon their explorations:

1. Open-ended interviews eliciting people's beliefs about a hazard; allowing the expression of both accurate and inaccurate concepts.

2. Structured questionnaires designed to determine the prevalence of the most salient beliefs.

3. Development of messages based upon what people need to know to make informed decisions (as determined by decision analysis) and upon a psychological assessment of their current beliefs.

4. Iterative testing of successive versions of those communicated messages using open-ended, closed-form, and problem-solving instruments administered before, during, and after the receipt of the message.

Example: Radon is one hundred to ten thousand times more carcinogenic than other air pollutants that are strongly proscribed by law. However, because it is "natural," lack of prevention measures cannot be litigated and only negligent intense exposures come before the courts.

Many billions of dollars per year are being spent to enable people to avoid photochemical smog, SOx, NOx, chlorinated hydrocarbons, and other pollutants with only trivial amounts of measurable health effects. Therefore, the highest possible priority should be given to thoroughly planned educational programs.

These might enable re-regulation in places where the present resource waste is extraordinary:
- Los Angeles
- Tokyo
- Eastern Europe
• South and East Asia
and the payoffs for reform are greatest.

The term radiation has, over a fifty-year span, become a terror-inducing image for humanities-educated people, because of its association with nuclear warfare and an imminent holocaust. Unfortunately, its meaning had evolved in the preceding fifty years as a technical term assigned to electromagnetic waves.

It has become so entrenched that the term rarely has substitutes and now appears in a wide variety of scientific contexts. Electromagnetic waves in their weakest, most innocuous form are non-ionizing. They are also a by-product of high-voltage transmission of electrical power to cities, where they are referred to as ELF-EMF -- a rapidly rising bugaboo that also affects occupational use of some computers.

Environmental alarmists prefer to ignore the 950 or so publications on the subject that justify a low level of concern, preferring to exaggerate the significance of the unanswered questions in the remaining fifty or fewer. Juries have sometimes awarded huge damages after hearing "junk science" testimony, because "common sense" suggests that exposures to radiation must be destructive of health.

Many environmentalists demand massive research and preliminary regulation for EMF, even though no dose rate for physiological effects can be found.

As new threats arise and fears are raised to a fever pitch by uncensored media, the dooms of yesteryear are buried, to be resuscitated only if a serious event recurs. Overshoots of attention to specific images of danger leave behind a thicket of regulations, restrictions, safeguards, and mandates that hamper flexible adjustment and consume scarce attention.

Within corporations and unofficial organizations, these safeguards are eroded away by managers with fresh brooms after bankruptcies, reorganizations, and "reinventions" of companies and agencies. In cities saved from revolution, the cobwebs of unnecessary concerns keep accumulating.
A simple device has been invented as a preventive -- the "sunset provision."

Suppose all such rules would be declared non-binding after a given period of experience, say five years. For those that are truly important, a new sunset can be scheduled five or ten years further into the future, but they should also be updated for clarification and to minimize conflict, while also reducing cost of enforcement. The renegotiated rules could be passed through the legislative bodies in batches and recorded more efficiently.

Sometimes strategic name changing is possible. Take the case of nuclear magnetic resonance (NMR), which promised to be able to see into the human body after irradiation with harmless microwaves that then send out minuscule bits of telltale radiation while under the influence of magnets.

These bits illuminate abnormal structures in a way that X-rays cannot do very well. However, the scientific name was expected to repel users. So the term nuclear was abolished, and the technique was called a magnetic resonance imaging (MRI). It thereupon became a favorite procedure for practitioners of internal medicine within a few years, and protests about this kind of radiation are lacking.

Greater progress is being made with respect to calculable risk, because once the information about frequency of loss and its seriousness is available, financial or other resources can be set aside in advance (Graham and Wiener 1995).

Eventually, with more actuarial data, an environmental risk becomes insurable. Thus increasing emphasis is placed upon detailed information. Then the new information technology comes to the rescue, as with other planning problems, by expanding the "risk if you do vs. risk if you don't" calculations. Benefit-cost ratios for comparing one project with another are useful only when the likelihood of loss and gain can be closely estimated.

This is the expectation of the United Nations Scientific Committee on the Sources and Effects of Ionizing Radiation (UNSCEAR, 2000) in presenting an unbiased report expressing international consensus. Information technology also makes possible the prevention of much loss from such elemental catastrophes as hurricanes, famine, drought, and breakdowns in
public service, because citizens who act after being warned in advance with maps reduce their losses by 70 to 90 percent, as compared to the uninformed.
Chapter Seven Section Eleven

Information Technology for Self-Help

Telecommunications are a bridge to self-help for realizing economic and social possibilities. This technology offers powerful tools for development in the most needy places.

A responsibility arises for planners to stimulate investigations in areas where information required for development is lacking. Providing telecommunications capability would also enable informed community leaders to portray what can be planned and executed in the immediate future.

Telephones can be used effectively in the least developed regions by the poorly educated, which are more often women than men. Women’s traditional social roles fit the medium more closely, because their conversations tend to be more detailed and therefore longer. The telephone is highly useful for creating new, local, nonpolitical organizations. People are much less suspicious of information obtained by a telephone conversation than that coming from corporations and governments.

Economical, digital telephone capability is scheduled to be available in all cities anywhere in the world by 2005 and everywhere else just after 2010. Communities that are not otherwise electrified or wired will soon be closely connected.

Migratory peoples herding livestock from oasis to water hole to mountain pastures can be served at costs they can afford. Clusters of low-flying, interconnected communications satellites will tie Pacific isles rain forest hamlets into the global net. Service should become cheaper and often of higher quality than that of present-day urban networks of copper wires with exchanges linked by cables.

Standing satellites, parked twenty-five thousand miles above the equator, have a limited capacity that may be reached earlier, but the low-flying cluster satellites offer almost infinite capacity for the foreseeable future. Fiber optic cables and optical switches are currently increasing their
carrying capacity overland a thousand-fold. Shallow water barriers are inexpensive to overcome. The supply side offers a cornucopia of options.

Consumers are enthusiastic overall, but selective. They have to invent their own small group uses. Some responses to digital phone capabilities are quite predictable, because of the high payoffs involved for the firm and the community. Sometimes invasion of privacy raises alarms, but they are overcome by new technology and acceptance of tradeoffs. Very likely they will be a necessity for both the poor and the rich by 2020.

The new global networks are inevitable, but planners have yet to conceive of priority programs for socioeconomic development. Whatever is posed today will probably seem trivial as compared to something like the reconstruction of medical service, or the decentralized educational administration that might eventuate.

A New Ecosystem Emerges from the Information Revolution

Ecosystem phenomena are now encountered in a new dimension. They result from breathtaking expansions of interactive potential that are taking place year by year consecutively. An emerging virtual ecosystem will be particularly influential when considering sustainability management issues.

Briefly,
- How did it come into being?
- How does it seek a balance?
- What can it do to advance a desirable future?

Boulding’s fundamental trichotomy for flows and stocks—information, energy, and materials, is extraordinarily useful for economic analysis of stocks and flows. Around the year 2000 the aggregated demand for both energy and materials consumed by an average person living in a developed urban community started gradually declining. Message flow, however, is steadily increasing, and information embedded in artifacts (manufactures) will continue to grow exponentially.

Prior constraints upon scarcity of the basic information resource (electromagnetic spectrum) and the carrying capacity of copper wires
infrastructure in the built environment, have been removed quite suddenly. A series of brilliant innovations based upon some recent fundamental science were responsible. Information flows will continue to increase rapidly, until they are slowed by human capacities for paying attention. (see Figure 7-4).

That advance leads to the next evolutionary level that bonds communities together. The largest university libraries, along with geographical details and technical know-how, were opened, for a fee, to the serious "surfer." It is the transfer of predigested and translated Knowledge that enables the explosive growth in transactions (called hits in this universe of bits), which expanded 15 to 50 percent annually over the course of the 1990s.

All is not rosy, however, because the Internet has been afflicted by epidemic plagues and by brigands.

In the 1980s rogue specialists called hackers invaded private data files just to prove their expertise. The greater the challenge (in most cases similar to those facing mountain climbers when the peak presented itself), the greater the thrill experienced when overcoming it.

Others invented paralysis-inducing "viruses" that spread through the Web into private networks.

Disinfection procedures and immunological treatments had to be invented and then extended to meet the threats from new virus species appearing monthly. Defenses are quite adequate now, but vigilance cannot be neglected. Special automata called browsers were created to search for particular kinds of data. They were sometimes blocked by rapidly rising traffic around some Web sites, so other automata were designed to remove them, thus creating another kind of predator.

Other search engines or "travelers" were invented for different duties. They were assigned names after analogs in real world.

They evolved their own ecosystems, and they learned by doing. An outburst of embedded devices for the more static-built environment also appeared. These "brains" in vehicles, homes, parks, and offices waited, watched, recorded, learned, and had progeny that adapted to the changing populations
of the respective species. Thus we see set into motion a rapid rate of co-evolution—the process that speeded up the appearance of new species in natural history by as much as a thousand fold (Leonard 1997). A suggestive mental image is offered in Figure 7-5.
In the eyes of software designers, the Internet has become a diffuse actor in the ecosphere. Attempts to map it in only two dimensions retain the same general appearance, but its relentless growth in cyberspace imparts a sinister interpretation.

Organizations install servers to expedite internal communication, and provide addresses (websites) for outsiders to reach them. When information is valued, it is protected by filters from storms of spam, and from ferocious hackers probing for vulnerability to shutdown, by ‘firewalls’. The Economist, April 14, 2001.

Figure VII-5.

Systems knowledge originates from the web.
Congested nodes on the Internet are becoming increasingly numerous. They are traffic bottlenecks forcing roundabout paths for the flow of messages. Delays, crashes, and errors result. Extra capacity to be installed is fortunately low in cost, as compared to the physical world where vehicular traffic bottlenecks must be overcome by concrete clover-leafs.

Fiber optic "freeways" are being laid down to connect destinations ("portals") in high demand, such as research universities and Yahoo gates. Various "toll gates" being introduced into this virtual domain collect subscriptions and royalties from debit cards.

Some Web sites reward the inquiring agent robots with "cookies" for the information about their origins and activity. Actor species in this new eco-structure have only begun to populate the "City of Bits". Hundreds of more specialized versions are to be anticipated to fill the niches opening for designer-entrepreneurs.

At the turn of the millennium the Internet is an infant that has reached less than 5 percent of its projected size and perhaps 20 percent of its eventual acceptance among Americans.
Money transactions became electronically globalized more rapidly than any others.

It is worthwhile to remember that the human nervous system requires at least 70 milliseconds to respond to a simple signal with a click of a mouse at the computer and that it takes an equal amount of time at the speed of electric signal transmission to contact the most distant places on Earth.

Markets now respond to surprising events in a fraction of a second. Financial transactions should be regarded as votes of confidence made by traders with screens, who number about a half million worldwide. They convey several trillions of dollars from one pocket to another every day.

National responsibility for issuing currency, which has been one of the most fiercely guarded features of national sovereignty, has been lost, and it cannot be regained. The international money system still has vulnerabilities, as indicated by the revaluation of the Mexican peso in 1994, presaging the "Asian flu" of 1997 through 1999.

A huge virtual currency, called eurodollars or euroyen, has grown to become an important share of global money supply, even though it has not been authorized by any national bank.

Its principal marketplace, the city of London, competes with New York, the center for U.S. dollar funds, and Chicago, the top trader in food commodities. Tokyo, Hong Kong, Singapore, and Bahrain, on the other side of the world.

When the world money system went global, it outgrew its regulatory controls.

Neither the U.S. Treasury nor the huge petroleum multinationals can do more than give the markets a small nudge. The scale of trading is so large
that a transaction toll of 0.01 percent, regarded as trivial, could finance all the international institutions that are now considered necessary for long-term global stability. How could it be collected? To whom would it be paid? How should such funds be disbursed? These questions need to be answered to assure sustainable crash-free ecosphere relations (Tobin 1996).

Planners and managers should expect a rapidly increasing population of virtual organizations that employ artificial intelligence with improving specialized IQs (intelligence quotients).

They are conceived by teams of people interested in the information resources opened up by the growing Internet. Many of these planners are engaging in patching, mending, and maintaining the global financial system, so they too will be numbered among people we will later label as world-servers.

A complementary task would stimulate equitable distribution of telecommunications and public health services to back up development in the lagging parts of the world.

The world is only beginning the period of reliance on practical, voice-activated computers. An ability to interact with the stock of Knowledge conveniently available on the Internet is a strong incentive for all educated people to learn this skill and use it in daily life for school, telephone communication, letters, and news media.

In this manner another feature of the sovereign state, control over the official language, will slip away from it, modified by practical, technical conventions.

Along with the standard national language will go the standards of performance on examinations, since schools are already pushed to match the achievements of other educational systems.

These changes are demanding and drastic, so we must expect many visible transformations in urban behavior stemming from them.
**Pragmatic Suggestions from Ecology**

As noted, an understanding of ecology causes sharp changes in attitudes toward big threats and opportunities.

- What should communities preserve for succeeding generations to appreciate? How should a community respond to dangers affecting itself and its significant actors?
- With respect to repetitive risks, are there better ways of taking out insurance against large, unlucky losses?

Introducing the concept of sustainability, or survival of entities and images over the long run, raises these issues in a way that has not been considered systematically.

Briefly, the aim of ecosystem development is to create resilience -- in as many dimensions as are relevant--by applying foresight.

For example, resiliency in the face of earth-warming threats would consider prevention of loss from windstorms and other abnormal weather forecast to be not only a consequence but also a psychological accommodation along with minimization of damage. Most important would be the institution of reliable forecasting and alarm systems that would allow individuals, families, and neighborhoods to take care of themselves.

That bottom-up information policy reduces most of the resulting destruction of property.

As alarms about earth warming are publicized and slowly being acted upon at the lower-than-national level, related threats are appearing on the horizon.

Probing Earth's climatic history frozen in the layers of glaciers and sediments reveals a new risk -- that of a rapid excursion into earth cooling, which appears less likely but happens more quickly and is much more expensive to meet.

One architectural solution that is applicable to both extremes -- earth sheltering -- has been tested in practice (Moreland 1979, 1981), but is
studiously ignored by the profession, due mostly to the lack of an attractive, salable image. However, that is a story that takes us too far afield, and other solutions are appearing on the horizon.

Building community resiliency requires the accumulation of savings to cover exigencies beyond the narrow monetized sense. It emphasizes not only human capital:

• education
• skills
• health

but also a knowledge base that a community shares with many others, a support network of obligations extending beyond the community boundary, and organizations with stored experience for dealing with a widening range of situations.

Building community resiliency is obviously a collective effort, and many community development efforts already under way have taken up the challenge and endeavored to speed up the process with the aid of education and telecommunications.

Planners and managers should recommend investing relevant credits (referred to as accumulating surplus in chapter 3 and elsewhere sometimes as social capital) so as to contribute to desired services but also to build up the institutional capacity to withstand large, unexpected shocks -- a definition for community resiliency.

Simulations of catastrophe are being used to train people to deal with "downside" scenarios, but poor communities also need practice in taking quick advantage of fleeting "upside" opportunities.
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Brown, Lester. 1995. Who Will Feed China? Wake-up Call for a Small Planet. New York: W. W. Norton,


Hawken, Paul, Amory Lovins and Hunter Lovins, 2000. Natural Capitalism, Boston: Little Brown,


Mitchell, Donald D., Melinda D. Ingco, and Ronald C. Duncan, 1997. The World Food Outlook, New York: Cambridge University Press,


Richard E. Plant and Nicholas D. Stone, 1991, Knowledge-Based Systems in Agriculture, New


