STRATEGY FOR AN ALTERNATIVE
AGRICULTURE SYSTEM:
A LANDUSE MODEL
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A FIFTH YEAR LANDSCAPE ARCHITECTURAL TERMINAL PROJECT

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1. PROBLEM STATEMENT

The United States’ agricultural production/consumption system is the most productive the world has ever seen. Ironically, it is also one of the most destructive systems of all times. To provide this bounty, we are destroying the natural systems in which food production takes place and the way of life of those who produce that food.

Our present food system doesn’t work economically, socially, politically, or environmentally. Now is the time to evaluate where our agricultural system has been and where we think it is going, and to abandon the current food system in favor of a more abundant, healthier, less expensive, and more sustainable system.

2. HISTORY OF AGRICULTURE IN AMERICA

To understand this problem, one must understand the current issues that are plaguing the American farmer and the historical events in agriculture that have attributed to these issues.

In order for his readers to gain insight into the scope of his book—Whereby We Thrive: A History of American Agriculture, 1607 - 1972—John T. Schlebecker wrote this:

Since this history deals mainly with the work of ordinary people doing everyday tasks, it becomes basically social history. But American farmers consistently strove to make money, so agricultural history also developed as a form of economic history...In short, this history of American agriculture becomes a history of commercial farming.

This interpretation is important to the understanding of how American agriculture has evolved into the industry it has become today.


From the settlement of Jamestown in 1607 until the settlement of Savannah in Georgia, the thirteenth colony, in 1733, economic growth was slow but not stagnant. The principle concern for the early settlers during this period was, of course, survival itself. These settlers were able to learn from the Indians how to plant Indian corn (maize) and tobacco. The former was used for food, and by 1640 the latter became a salable commodity in Europe. By the end of the Revolutionary War, the productivity of the hunter-farmer had allowed him to surpass the subsistence level and to reach a level of surplus that made a few coastal farmers wealthy.

From then to the end of the 18th century and well into the 19th century, the development of grain and livestock commerce
in the North and the practice of slavery in the South allowed American farmers to produce surpluses of food and fiber that could be marketed abroad. As a result, farms became bigger in size. Better implements also allowed farmers to farm more of the various commodities.

At the same time, seaboard cities grew and the coastal population expanded. The need to fill the new domestic market pushed a stream of pioneers over the Appalachian Mountains to start farming in new territory.

At first this new pattern of settlement was also confined to a subsistence level of agriculture. But when the full brunt of the Industrial Revolution from Europe hit the United States, it provided improved transportation and communication between these settlers and the East Coast and provided improved agricultural technologies. American agriculture was again producing a surplus. By 1860, this surplus constituted about 80 per cent of the total exports of the United States. Also at this time, the rural population accounted for 80 per cent of the total United States' population.

From this point on, advances in agriculture happened rapidly. During the Civil War, the Homestead Act of 1862 opened the West to more pioneers. The sod prairies beyond the Mississippi River seemed ideal for producing wheat and other grains. Vast acres of prairie were tilled under as technological advances met the needs of farmers to produce more and more.

Farming became more commercialized as farmers became more dependent on railroads for transportation of products and on other big businesses for seed and machinery. This dependence produced a counter need to have more political control over these commercial giants. To implement this control, Grangers, Greenbackers, Populists, and other interest groups and political parties were organized.

Late in the 19th century, one technological development served to change farming altogether. This technological impact was the tractor. Of course machinery had to be redesigned to meet the needs for higher speed and greater power as provided by the tractor. The land that formerly was used to feed draft animals was plowed under and planted to commercial crops. Again the size of farms increased as farmers spent less time to produce more food. The number of farms and farmers declined as some farmers could not keep up with the technological innovations.

The turn of the century brought a prosperous time for the American farmer as the city populations expanded. World War I brought an even greater demand for American agricultural goods, but it also brought more technological advances, an unprecedented need for rationing, and, more importantly, wage and price supports. For the first time, the consumer
played an important role in agriculture—that of demanding steady or lower food prices. From then on, government exercised more and more control on farm prices.

The Great Depression between the two world wars established government as the caretaker of the American public. The drought and subsequent Dust Bowl disaster on the prairie was highly detrimental to the farmers, as many were forced out of business. Government again became active in all realms of American life. Price supports, subsidies, crop controls, land use and tenure policies, and soil conservation acts were implemented by the federal government to save the floundering American farmer.

World War II likewise spurred agricultural production. More technological innovations such as new fertilizers, pesticides, herbicides, hybrid seeds, and new methods of disease control increased productivity to the point of record harvests. However, more innovations meant two things to the farmer: first, better technology meant that those who did not apply the innovations were forced out of the business of farming; and, second, better technology meant that fewer and fewer farmers were needed to work the land.

After World War II, production continued at record levels as newer technologies entered the market. This "Green Revolution," as it is popularly called, increased supply well above demand as farmers were prodded to produce even more food.

It was not until the Oil Embargo of 1973 that production began to slow. Doubled oil prices meant increased cost of the chemicals that the farmers had relied on and increased cost of running the now-monstrous machinery on scarce fuel. Again many farmers were in trouble and were forced to quit farming.

This drastic change occurred at a time when world demand for America's agricultural supplies reached an all-time high. Those farmers who managed to stay out of financial trouble caused by energy deficiencies fared well in the latter part of the 1970's and the early 1980's. The result, once again, meant an increase in size of the farm because of the demand to produce more food efficiently. But fewer farmers could afford the increased capital outlay for energy and supplies; and the constant exchange of real estate raised the land values.

The resulting land use changes due to the improvement in American agriculture can be summarized as follows: As farmers adjacent to the cities quit farming, their land was bought for residential development, which throughout the nation has resulted in the phenomenon of "urban sprawl". Prime agricultural land is being converted into cities and suburbs at a rate some experts believe is exceeding three million acres annually. The other important land use change has been the gradual and almost complete shift to
centralized food production, so that certain geographical regions have become known for the specialized food crops that they produce. Part of the Midwest, for example, has become known as the Cornbelt for the large fields of corn that its farmers produce. The Central Plains farmland is known as the Nation's Breadbasket because large amounts of this nation's wheat is grown there. The Southwest has specialized in fruit and vegetable production. American agriculture has indeed been industrialized.

In summary, then, American agriculture in general, and farmers in particular, enjoyed growth and prosperity through the turn of 20th century, at which time it peaked and was later to be known as the "Golden Age of Agriculture". As the Industrial Revolution gained momentum, cities became the centers of growth and economic prosperity. This had two immediate effects on the American farming system. Life in the city (with its raised standard of living) looked attractive to the rural population of farmers. Many people quit farming to engage in a "better" way of life. Secondly, increased mechanization meant the need for fewer farmers to produce the same volume of foodstuffs.

As city populations increased, the national government took on the responsibility of controlling agricultural policy and production to ensure national economic security and low consumer food prices. From World War I to the present, American agriculture has suffered through hard times. This disparity and its resulting changes in the face of the rural landscape is best summarized by Gilbert C. Fite in his book, American Farmers, the New Minority:

The most important factor responsible for the rapid decline in the number of farms after World War II, however, was the almost constant cost-price squeeze on farmers. Many producers could not continue farming, because they were unable to adjust to that age-old disadvantage of having no control over the price of the products they sold or purchased...

The cost-price squeeze was at the heart of the drive by farmers to get bigger, to increase efficiency, and to lower unit costs. So with the increased mechanization and industrialization of agriculture, the intervention of government policy, and the constant drive to produce more, American agriculture today has become an automated, centralized system with only 3 per cent of the total United States population producing all of this nation's food and fiber with enough surplus to constitute 20 per cent of this nation's total exports.

3. CONSEQUENCES OF AMERICAN AGRICULTURE

Most Americans have been taught through the media and through our government that our modern American agricultural industry is the best and most efficient food-producing system in the world. It is indeed true (as reported by U.S. News and World Report, "2.4 Million Farmers: Their Impact," May 30, 1983) that agriculture is this nation's biggest industry.
Every farm worker creates jobs for 5.2 other workers, which totals 21 million jobs, or one-fifth of all civilian employment. And farm goods account for about 20 per cent of all exports. It is also this nation’s most efficient industry. Farmers’ output per hour of work grew 4.4 per cent a year from 1972 to 1982—more than six times the rate of non-farm businesses; and one farmer produces enough food to feed 78 other people. But there are huge drawbacks to this industrial system which, though not as well known to the general public, cast a dark shadow on today’s agricultural system.

These drawbacks effect the four basic cultural categories of today. These categories include social, economic, political, and environmental contexts.

The social and economic ramifications of modern American agriculture are best summarized in a thorough literature review by G. M. Berardi for the research-oriented magazine, *Rural Sociology*, entitled “Socio-Economic Consequences of Agricultural Mechanization in the United States: Needed Redirections for Mechanization Research”:

One of the major direct effects of agricultural mechanization has been labor displacement; as agricultural operations are mechanized, the total agricultural work force has decreased, reducing the numbers of hired farm workers and seasonally-hired farm workers as well as farm family workers. Work conditions in general became better; the working day was shorter, and there was less “drudgery” associated with farm work, although certain dangers to health and safety increased...Indirect consequences of mechanization included a shift in values, life styles, farm skills, and decrease in family ties.

Many people moved to poorer farms or remained in the open countryside. Other displaced workers, of course, migrated from rural areas. Usually migration was selective for the better educated, younger members of the community...Those who did move...not only took their belongings with them, but their patronage of local businesses, resulting in a loss of community functions.

One of the most dramatic effects of rural outmigration was increased racial tension, ghetto riots and other uprisings of the 1960’s...Outmigration of rural poor to urban areas also resulted in increased demands on urban social services, such as welfare and unemployment...Effects of mechanization on urban society also included changes in the cost, quality and variety of our food supply...with increasing concentration in production and food processing, less competition and higher food prices result...Increases in the price of energy have also resulted in food price increases.

The political consequences of mechanization of American agriculture first became highly evident shortly after World War I when farm income dropped sharply. Many attempts have been made by means of government programs to improve the income conditions of farmers. Government policies have had very mixed success in stabilizing prices of some farm commodities. However, the cost to the government for these policies has been high.

*U.S. News and World Report* stated on May 30, 1983, that “federal outlays to subsidize farmers may reach a record $21 billion this year (1983)—more than five times as much as in 1981. An additional $20 billion is spent...
on government outlays for food, which tend
to prop up prices."

In his book, *The Development of American
Agriculture: A Historical Analysis*, Willard
Cochrane discussed the interrelatedness of
these three contextual factors (social,
economic, and political), revealed how
these factors have contributed to the farm
problem of today, and extended the current
trends into the future to determine where
American agriculture could quite believably
lead the consumer:

The farmer, as a farmer, is on a
treadmill from which he cannot get
off. Any gain in income to American
farmers, whether it emanates from a
technological advancement that serves
to develop the farm economy, or from
an increase in farm exports (as in
1972-73), or from governmental pro-
grams of price and income assistance,
or from some combination of all of
these, must be dissipated in the
competitive process through falling
product prices and/or rising prices
of the scarce factor of production
(i.e. land). Government programs of
price and income support have contrib-
uted importantly to price and income
stability in the farming industry, but
they have not been successful in lift-
ing profitability rates in farming,
except in the very short run. The
income gains, or benefits, of these
programs have quickly been bid into
higher land prices, which have raised
the cost structure of all farms and
thus acted to push all farmers toward
a non-profit position. Further, in
this competition for land for farm
enlargement the strong have consumed
the weak in a cannibalistic process.

...p. 394

It is impossible to say whether
this process will come to an end with
500,000 viable commercial farms in
the United States or 300,000 or
100,000 or 50,000... But if the number
of viable commercial farm operations
decreases, to say 100,000, it should
be possible for, say, all wheat
farmers or all dairy farmers to meet
in convention and agree upon various
monopolistic practices. Such monopo-
listic practices would almost cer-
tainly include restricting entry into
farming, establishing shares of the
market for individual farmers, and
fixing the minimum selling price of
their product... Thus it will be a
dark day for consumers of food in
the United States and around the
world when the number of operators
in the farm economy declines to the
point where that economy ceases to
be competitive in an atomistic sense.

...p. 413

The fourth and most often overlooked by
the American public, and which is just as
important as the other three contextual fac-
tors, is the ecological contextual factor.
American farmers are often referred to as
husbands of the land, implying a caring
attitude for the ecological principles that
govern the earth. However, this is often not
the case, as modern American farming prac-
tices have had a negative impact upon the
earth. Wendell Berry, a modern champion for
cultural and agricultural reform, discussed
this problem in his book, *The Unsettling of
America: Culture and Agriculture*.

Berry maintains that agriculture, in
essence, is the sustenance of life cycles.
One of the intrinsic characteristics of all
life cycles is the notion of diversity. It
is the almost total disregard for this basic
ecological principle by modern American farm-
ers that Berry believes is the cause for the
disaster into which our agricul-
tural lands are falling.

Confining animals for higher productivity
removes those animals from the source of
their food. Their manure, then, instead of becoming fertilizers, becomes waste and then a pollutant. Confinement also requires the feeding of large quantities of grain. Pasture is removed from the crop rotation and more land is exposed to erosion.

Technological advances have lead farmers to plant large acreages of land to single crops. These monocultures are highly susceptible to invasion by pests and diseases and are therefore dependent on chemicals which threaten and pollute our food and environment.

Soils themselves are not treated as if they were alive; consequently, farmers plant the same crops on the same soils year after year. This depletes the soil of its minerals and nutrients which requires farmers to add expensive and often environmentally-hazardous fertilizers. Soil is also mistreated by poor farming practices that allow the soil to be eroded away at rates beyond which nature cannot repair itself fast enough to allow continued crop production on that land. Currently, soil is eroded from agricultural lands at a rate equivalent to 3 million productive acres annually.

Eroded soils carry with them large quantities of nitrogen and phosphorus and other farm chemicals. These chemicals are then deposited in waterways and lakes, creating unnaturally high levels of nutrients and sediment that prematurely "age" that body of water.

As a result of the changes in agriculture, we, the American public, are a part of an agricultural food production/consumption system that ignores the guidelines of nature, that has shifted from local to centralized, government control, and that disregards the uniqueness of life--both human and non-human.

4. ROOT OF THE PROBLEM
But what is at the root of these changes and their subsequent ramifications, and why?

Wendell Berry, the ardent spokesman and critic of American culture and agriculture, in *The Unsettling of America*, attributes the current agricultural degradation to a complex but innate characteristic in American culture. This characteristic is one of rootlessness, of not intending to be where we are. This rootlessness, in persons, manifests itself as a need to be conquerors or "exploitors" of other men and the environment in each new location. This attitude of the general populace is the opposite of the attitude of man as "nurturer", the correct attitude necessary for a healthy and sustainable agricultural system. In Berry's words:

The standard of the exploiter is efficiency; the standard of the nurturer is care. The exploiter's goal is money, profit; the nurturer's goal is health--his land's health, his own, his family's, his community's, his country's. Whereas the exploiter asks of a piece of land only how much and how quickly it can be made to produce, the nurturer asks a question that is more complex and difficult: What is its carrying capacity?
This continent had its share of "nurturing" peoples in the form of native American Indians and the subsistence general farmer. These peoples stayed put to develop self-reliant communities based upon the guidelines of nature. They lived close to the land, protecting, caring for, and respecting the land that they inhabited. However, these peoples were exploited and swallowed up as the momentum of our industrial society left them and their values behind.

5. BIOREGIONALISM: A CONCEPTUAL SOLUTION

What is needed, then, in order for a new, more appropriate agricultural system to survive is a change in cultural values. For without a change in values, our present agricultural system will be allowed to become an even bigger detriment to our society and environment than it is today.

The devolutionary mode for bringing about this new value system and its subsequent culture change is known as bioregionalism. This movement takes up where the ecology movement left off in the early 1970's. Bioregionalism is a concept of "staying put" on the land--of making where you live your home. "Bioregionalism" is from the Greek bios (life) and the French region (region), itself from the Latin regia (territory). So bioregionalism means life territory or place of life.

The first central theme of bioregionalism is the importance given to natural systems. A natural system contains a community of living populations and non-living elements and the interdependent processes that are vital to the health and well-being of both.

A second element of bioregionalism is anarchy. Anarchy is based upon a sense of intra-community dependence and self-reliance. It allows the community to make its own decisions and forces that community to be responsible for the consequences of those decisions. By decentralizing or consolidating the decision-making process at a locally controlled level, each community can act more quickly and with more knowledge and care in relation to the natural system in which it is contained.

The third element comprising the bioregional notion is spirit. This spirit is a profound regard for life, both human and non-human. In this view, the human and the non-human are of one creation and there is a distinct connection between the natural world and the human mind.

The three elements combined result in a decentralized, self-reliant, and self-determining social organization based upon the respect for and protection of ecological principles and systems, and all life forms.

A bioregion, then, is a geographical area with distinct ecological and even social boundaries. Most bioregions are delineated by watershed boundaries. Knowledge of this bioregion and its various components and
systems is used to make appropriate decisions with regard to food, shelter, energy, health and environment.

6. PROJECT GOALS & OBJECTIVES

With the acceptance of, and the knowledge of, one’s home firmly embedded into the value system of our culture, a decentralized, self-reliant, sustainable agricultural system becomes a natural extension of this concept. Such a system would be regionally unique, locally controlled, and based upon ecological principles. Such a system could potentially solve the problem wrestled with at the beginning of this discussion.

The goal of such an undertaking would be to identify and/or develop an alternative, sustainable agricultural system based upon the concept of bioregionalism.

The study can be further developed by fulfilling the following study objectives:

- to search for ideas on alternative agricultural systems both past and present to be developed into a system that is compatible to the bioregional notion.
- to use the knowledge of the problems of the American farmer to further develop the concept.
- to combine the needs of the farmer and the guidelines of alternative agricultural systems into a compatible, bioregional agricultural system.
- to apply landscape architectural skills and understanding and the new system to a representational part of a bioregion in order to identify and develop an appropriate system of agricultural land use.
- to mold this representative land use structure into a general land use model that can be applied to other bioregions.
- to develop a strategy for change from the current system and land use structure to the proposed system and model.

7. THE CORNUCOPIA PROJECT: A CENTRAL CONCEPT

In the process of searching for ideas on alternative, decentralized agricultural systems, the Cornucopia Project by Rodale Press surfaced. This project fits into the bioregional concept. The emphasis of the Cornucopia Project is on local control (for increased farmer profits and reduced consumer costs) and a regard for the protection of natural systems (for reduced environmental degradation and reduced farmer costs).

A summary report of Empty Breakbasket by the Cornucopia Project appears in Appendix A.

The book is divided into two parts. The first part is a detailed criticism of the current agricultural system in the United States, while the second part offers guidelines and recommendations for an alternative agricultural consumption/production system. A synopsis of the criticisms of the current food system is valuable at this point. These points help validate the research of the agricultural problems discussed to this point.

On economic structure . . . "Farm debt is now over $216 billion, an average of $90,000 for every farm in the country."

On soil abuse . . . "America’s crop, pasture and range lands lose 4.4 billion tons of
topsoil annually to erosion . . ."

On food transport . . . "For every $2 we spend on energy to grow food, we spend another $1 on energy to transport it . . . the average molecule of processed food in this country travels 1300 miles before being eaten."

On monoculture . . . "At least 500 major vegetable varieties were cultivated in ancient times, but today only 20 species are used in field cultivation. About 95 percent of our food now comes from 30 plants."

On energy . . . "On the average we burn 6.4 units of commercial energy for each unit of food energy that reaches our plate."

On mineral base . . . "We now apply an average of 86 pounds of synthetic fertilizer per acre of cropland each year, about 155 pounds for every person in the country. Without this fertilizer, yields would drop an estimated 50 percent."

On environmental impacts . . . "The increasing use of herbicides, pesticides, and chemical fertilizers has led to the contamination of our soil and water, the destruction of wildlife, and health problems for farm workers."

On water . . . "The western U.S. . . . consumes 85 percent of the nation's water. The main reason is irrigation, which takes 81 percent of all the water used in this country."

On climate . . . "Most climatologists are predicting the next few decades will be a period of great variability, leading to substantial disruption in food production."

On nutrition and health . . . "The further we have strayed from fresh, simple foods, the more health troubles we have had."

On food processing . . . "And about 1000 calories of energy are expended for every calorie of processed food we consume."

And on and on and on . . . the current food system is vulnerable. "The individual parts of the food system may seem to be behaving rationally, but the whole system is irrational and non-sustainable."

The Cornucopia Project's thesis, based upon its goals for a new agricultural system, can be summarized as follows: The foundation upon which our current agricultural system has been built is falling apart. By turning away from our current food system that improperly uses our rich topsoil, our pure water, and our non-renewable petroleum and mineral resources, and by developing an alternative system that understands and implements the Earth's ecological guidelines, our food system could be "transformed into a sustainable, efficient, and economical organism which could create enormous benefits for American farmers, consumers, and businesses."

In their book, Empty Breadbasket, the Cornucopia Project established recommendations for all of the actors in the food system: farmers, consumers, food industry, cities, state governments, and national
government. In keeping with the study objectives, the following recommendations were extracted for their importance as land use implications which can be used to begin to develop an appropriate land use model:

for farmers
1. stop soil erosion
2. diversify food production
3. reduce debt

for consumers
1. support local farmers
2. grow more of their own food

for food industries
1. regionalize food purchasing
2. promote consumption of fresh, locally-grown foods
3. take food seriously

for cities
1. develop and encourage above at the community level
2. preserve farmland
3. facilitate access to food supply
4. recycle wastes

for state governments
1. promote and encourage above
2. regionalize food supply
3. recycle wastes
4. conserve water
5. develop in-state food processing

for federal government
1. promote and encourage above
2. regionalize food supply
3. eliminate subsidies to non-sustainable agricultural systems
4. help eliminate global food insecurity

In order to limit this study to a manageable size, only one segment of the food system was chosen for further development. With the burden of the implementation of a new agricultural system laying upon the shoulders of the American farmer, and since the resulting land use decisions will occur in the rural landscape, the farmers' segment of the food system was chosen for further study.

Closer inspection of the recommendations by the Cornucopia Project revealed detailed specific land use implications and policies as well as their importance to a new system.

1. Stop soil erosion.

This policy must take effect to ensure the future productivity of our agricultural lands. The following techniques and strategies can be utilized by farmers to reduce and stop erosion on crop lands: terraces, contour plowing, reduced or no-tillage practices, shelterbelts, grassed waterways, crop rotations, soil-building practices, and elimination of cropping on unsuitable soils.

2. Diversify production.

This follows after the ecological adage that diversity leads to stability. This concept can facilitate the potential for regional food self-reliance. The opportunity also exists for the reintroduction of specialty and native crops. This concept can be applied at the regional level as well as at the individual farm level.

3. Reduce debt by cutting inputs.

This concept is important as the basis for controlling the future of agriculture. Diversifying crop production guards against total failure due to natural circumstances, as at least one crop or livestock product should survive. Cutting chemical costs
could eliminate a major input and make the farmer more independent. Animal manures serve as fertilizers. Integrated pest management reduces the need for pesticides. Planting green manure crops also reduces the need for fertilizers. Crop rotations reduce the need for herbicides and pesticides. Double-cropping with live mulches reduces the need for herbicides and fertilizers. On-farm energy source development can include the use of draft animals, the use of greenhouses for vegetables, and the use of renewable energy sources such as sun, wind, hydropower, and grain for fuel. Alternative marketing options such as farmers' markets, roadside stands, food subscriber networks, and marketing co-ops can increase profits by reducing the middle man.

8. EXTRACTED CONCEPTS: PROJECT DEVELOPMENT KEYS

These recommendations suggest an organic farming system similar to the general farming system that thrived at the turn of the century. It is important at this point to introduce a definition of organic farming:

An organic farm, properly speaking, is not one that uses certain methods and substances, and avoids others; it is a farm where structure is formed in imitation of the structure of a natural system; it has the integrity, the independence, and the benign dependence of an organism.

(W. Berry, The Gift of Good Land)

Organic farming implies more care and attention for the land. Care means more time spent in the field. This means more people in the rural landscape.

Another thread that weaves itself through the above system is diversity. If diversity leads to stability and therefore would be a key to the survival of a new agricultural system, the opportunity then exists for the incorporation of both large- and small-scale farms in the rural landscape. Large-scale farms can continue to produce cash-grain crops for both regional and world markets. Because of their large acreage requirements, these farms must utilize biological stewards (natural controls as listed above) to increase care, diversity, and survivability. The smaller scale farms could be reincorporated to produce vegetable and specialty crops and livestock products needed for a self-reliant, regional system to survive. These farms must utilize human stewards to care for the intensive use of the land in order to ensure sustainability.

Although the Cornucopia Project may be a valid concept for an alternative agricultural system, it is the belief of this author that all reality cannot be abandoned. Large-scale cash-grain farms are going to continue to exist well into the future.

9. ASSUMPTIONS

At this point, a few assumptions need to be made to help give focus and understanding to that which follows.

Assumption 1.

The Cornucopia Project’s proposal
is a valid concept for establishing a basis of study for an alternative agricultural production/consumption system.

**Assumption 2.**

A land use model of agricultural production areas is a natural extension of the Cornucopia Project's proposals.

**Assumption 3.**

A land use model of agricultural production areas would begin to paint a "broad-brush" picture (based on the natural systems of a region) of the potentials for agricultural product diversity which in turn could lead to regional food self-reliance.

**Assumption 4.**

This regional food self-reliance would lead back to Cornucopia Project's thesis that a new agricultural system based on ecological principles would have immense social, economic, political, and ecological benefits.

10. PROJECT PROGRAM

The next step involves the introduction of a program or list of components that will be involved in the formulation of a land use model. These components become the physical elements that help shape the face of a new rural landscape.

In keeping with the concept of diversity of farms, land use, and crop production, the large and small-scale farms mentioned above need to be defined specifically. The small-scale farms include fruit and vegetable farms and general farms. Ranging in size from a few acres for the fruit and vegetable farms to a couple of hundred acres for the general farms, these farms provide the bulk of the products for the regionally self-reliant food system. The large-scale farms, ranging in size from a few hundred acres to a couple of thousand acres, would continue to exist in the landscape but would take on less significance in a regionally self-reliant food system. Although these farms would produce some grain for the regional diet, they basically would be cash-grain farms producing basic foodstuffs for world markets. (See page for further descriptions of the practices involved on these farms.)

11. METHODOLOGY

The next step, in keeping with this study's objectives, includes the use or introduction of landscape architectural or problem-solving skills to help construct the land use model.

The object of a land use model is to determine the best use(s) for the land area and to determine the arrangement of those uses upon that area. The process used to realize this object involves the following steps:

- the determination of those natural and cultural elements that would have an effect (good or bad) upon the pre-programmed components (in this case, the three farm types). These elements become the data for further study.
- the drawing of different data maps such as slopes, soils, vegetation.
- the formulation of criteria to determine which of the maps are important.
- the overlaying of those maps.
PROGRAM

(COMPLEXES FOR A LAND USE STUDY)

1. **FRUIT & VEGETABLE FARM**

   Essentially an oversized garden. Farmer produces for a local market. Produce includes orchard trees plus various annual/perennial fruits & vegetables.

2. **GENERAL FARM**

   Similar to grandpa's farm. Farmer sells livestock & their products plus any surplus crops for a local market. This system utilizes the symbiotic relationship of mixed livestock & a crop rotation that may include corn, oats, wheat, hay, & pasture. This system produces its own energy & builds topsoil.

3. **CASH-GRAIN FARM**

   Essentially what appears in our local landscape today. Large in scale, these systems produce corn, soybeans, or wheat on the same land year after year. These "efficient" systems produce grains to help feed the world.
the making of analytical inferences from the resulting composites.

This process works fine for the determination of the suitability for one single land use. However, when the land uses are many and the needs and restrictions (criteria) for these land uses are varied, this simple process needs some modification, as the resulting extra work in redrawing data maps would be unnecessarily time consuming.

The hand-drawn data file process is one answer for the need for a quick and efficient process that still uses the personal touch of hand-drawn maps. Expanding upon the overlay process mentioned above, this process implements the concept of a file system of data for easy storage and retrieval utilized by computer systems.

A few steps are added to the above-mentioned overlay process. After the drawing of the data maps, the maps are reduced to the convenient size of 8½" x 11". The reductions are then reproduced on colored plastic transparencies. Color is used to make a differentiation between site attractiveness characteristics and site limitations or vulnerability to land use impacts.

If the attractiveness features are reproduced in green, and the site vulnerabilities or limitations are reproduced in red, the analogy of a stoplight can be made. Green means "go", or do it, and red means "stop", or don't do it. Each original map is reproduced in green and red in case some features are determined attractive for one land use but are determined a limitation for another.

If certain features are determined more important than others, multiple copies of each color can be made. In this case, after overlaying the maps, the darker green means "better", and the darker red means "worse".

These maps are then filed according to data feature and color. Storing and retrieving the data for reuse for the other land uses is the main advantage of this system. Another plus is that this system necessitates the formulation of criteria for the analysis of each land use. This formulation adds credibility and a sense of objectivity to the study.

Page illustrates the procedure used to get from the individual data files to the final land use model.

12. THE SITE

After determining the project goals and objectives, the program, and the methodology, the next step involves the introduction of the actual site upon which the study will be made. Criteria for site selection include:

- the site, in keeping with the bio-regional concept, must be a watershed.
- the site must already include a sizeable proportion of agricultural or potentially agricultural land.
- the site must be nearby for ease of study.
the site must be large enough to be able to accommodate the various scales of farms as stated in the program.

the site must be small enough to be easily reduced to an 8½ x 11" format and still remain legible.

A site that meets these criteria is the Mud Creek Watershed located just south of Albany, Indiana, in Delaware and Randolph Counties. This creek is a tributary of the Mississinewa River which is a part of the Wabash River drainage system. The Wabash River Watershed is the determining feature for the Wabash Valley Bioregion.

Indiana is part of the Corn Belt of our current centralized, specialized agricultural system. The Mud Creek Watershed, like most of Indiana, specializes in the production of corn and soybeans for feed for hogs. Most of the farms are large, cash-grain operations; however, because of the large available supplies of feed grains, some farms also produce hogs. This region produces very little in the way of food for human consumption.
13. SITE ANALYSIS CRITERIA

The next step involves the formulation of criteria for the inventory and analysis of the site. The attractiveness for fruit and vegetable farms, general farms, and cash-grain farms and the site limitations or land use impact vulnerability are the elements that will be analyzed. The major impact that any type of farming has on the natural system is one of erosion. And according to the guidelines of the Cornucopia Project, erosion must be stopped to protect the future productivity of the soil.

Elements for analysis can be generally placed into two major categories: Cultural and Visual Phenomena; and Natural Resource Phenomena. Since the function of agricultural systems is one of growing plants, the Natural Resource Phenomena become critically important. So one must determine which elements and systems from the natural environment are involved in growing plants. (For a detailed description of this determination, see page .)

From the soil surveys of Delaware and Randolph Counties, primary categories of those components for analysis can be determined. These data included soil reactions of pH 5.6 to pH 8.4, or from moderately acidic through and including moderately basic soils.

Topographic features were determined from the soil surveys, as specific soils are generally associated with specific landforms. These landforms include floodplains, flatlands, knolls and ridges, and slopes and breaks.

Natural soil drainage (also determined from the soil surveys) ranged from very poorly-drained to somewhat poorly-drained to somewhat well-drained to well-drained.

Non-arable lands were determined using a Landstat Infra-red photo of the site. Non-arable lands fall into the categories of roads, homesteads, streams and wooded areas. Wooded areas were considered non-arable, as they are already diverse ecosystems in themselves and should be left as such.

Going back to the description of the three types of farms and their respective crops, general criteria can be determined for each land use based upon site attractiveness and site limitations or vulnerability to land use impacts.

In general, fruits and vegetables grow best in moderately to slightly acidic soils (pH 6.0-6.8). Vegetables grow best on flatlands. Fruit trees grow better on slopes and other high lands where air drainage is adequate to prevent the settling of cold air or frost early or late in the growing season that would damage the fruit. Since many fruit and vegetable crops are perennial in nature, well-drained soils are a necessity to prevent the waterlogging and subsequent death of the plant root system.

Land use impacts, especially erosion, are
not of major concern on the fruit and vegetable farm due to the small acreage needed and the close human care and husbandry required by this intensive system. However, site limitations are generally opposite to those features that are considered attractive. These crops do not grow well in basic soils. Depressions and floodplains are not desirable because of the potential for standing water which would inhibit the farmers' getting into the fields early, as required by the long growing season associated with fruit and vegetables.

Corn, wheat, oats, and hay/pasture (the crops grown on general farms) require neutral soils. They can be productive on either flatlands or knolls and ridges. Knolls and ridges are not vulnerable to erosion under the management practices of general farming. More land is in constant cover due to the utilization of hay crops and pasture lands in the crop rotation. Also, these two crops actually are soil builders. As slopes do increase, however, erosion becomes a greater hazard.

Land use impacts do include erosion on steep slopes and breaks. Site limitations are similar to those of fruit and vegetable farms. Since two of the crops grown on the general farm are perennial (hay and pasture), and since the production of livestock depends upon the success of the crops, soils that are very poorly drained or soils that are inundated for parts of the growing season are considered site limitations.

Corn and soybeans are the main crops grown on cash-grain farms. These crops grow best on neutral soils. Lands that are flat in nature require less energy to cultivate. And very poorly-drained soils are generally the most productive, as they have been artificially drained sufficiently to allow grain production. In addition, these soils have accumulated a large amount of organic matter, which is a good source of nitrogen, a nutrient important for the growth of grains.

Site limitations include, oddly enough, well-drained soils which are, in general, low in productivity. Land use impacts include erosion, which is a major problem on cash-grain farms where the soil is fallow and relatively uncovered for a number of months out of the year. Knolls and ridges, breaks and slopes are of sufficient gradient (anything over 2%) to make them vulnerable to erosion.

Page shows a summary of these criteria and the direct step of choosing the appropriate colored transparency data file maps for the use in the subsequent overlay process.

Pages are representative of the maps produced by the overlay process. The shades of gray represent the various shades of green or red. The actual overlays are recorded on slides found at the back of this study.
WHICH NATURAL SYSTEMS ARE INVOLVED IN GROWING PLANTS?

(CHOOSING COMPONENTS FOR INVENTORY & ANALYSIS)

CLIMATE & SOILS

DETERMINES WHICH PLANTS CAN BE GROWN IN A GIVEN REGION

ASPARAGUS, BEETS, BROCCOLI, CABBAGE, CANTALOUPES, CARROTS, CAULIFLOWER, COLLARDS, CUCUMBERS, BEET, ENDIVE, LETTUCE, LIMA BEANS, MELON, MUSTARD, ONIONS, PARSLEY, PARSNIPS, PEAS, PEPPERS, POTATOES, PUMPKINS, RAISINS, EGGPLANT, SNAPE BEANS, SPINACH, SQUASH, SWEET CORN, SWEET POTATOES, TOMATOES, TURNIPS, WATERMELONS, etc.

APPLES, BLUEBERRIES, CHERRIES, CRANBERRIES, COGS, PEACHES, PEARS, PLUMS, RASPBERRIES, STRAWBERRIES, etc.

CORN, SOYBEANS, WHEAT, OATS, KITE, HAY, etc.

DETERMINES WHETHER OR NOT THESE PLANTS WILL GROW ON A LOCAL SCALE

EFFECTED BY SOIL MOISTURE, PH, ROOT ZONE, ENVIRONMENT, PLANT AVAILABLE NUTRIENTS

ALSO DETERMINES WHERE THEY CAN BE GROWN

CAN EFFECT FARM LOCATION OR LAND USE AREAS.

ELEMENTS CHOSEN TO ANALYZE

1. ARABLE VS. NON-ARABLE LANDS
2. PH → EFFECTS UPTAKE OF PLANT NUTRIENTS. SOME PLANTS NEED DIFFERENT NUTRIENTS THAN OTHERS FOR PROPER GROWTH
3. TOPOGRAPHIC FEATURES → MICRO-CLIMATIC EFFECTS & RELATED TO ABILITY FOR SOILS TO ERODE.
4. SOIL DRAINAGE → EFFECTS AERATION OF ROOTS & PRODUCTIVITY.
CRITERIA FOR ANALYSIS

VEGETABLE & FRUIT FARMS

- ATTRACTIONNES
  - MOD-SLIGHTLY ACID SOILS
  - FLATS
  - KNOLLS & RIDGES
  - SLOPES & BREAKS
  - WELL-DRAINED SOILS

- LIMITATIONS & IMPACTS
  - NEUTRAL SOILS
  - FLATS
  - DEPRESSIONS
  - FLOODPLAINS
  - KNOLLS & RIDGES
  - SLOPES & BREAKS
  - WELL-DRAINED
  - SOMewhat POORLY-DRAINED
  - VERY POORLY-DRAINED

GREEN
1A
2C (2)
2D
2E (2)
3D
RED
1C
2A
2B
3A (2)
3B

GENERAL FARMS

- ATTRACTIONNES
  - NEUTRAL SOILS
  - FLATS
  - DEPRESSIONS
  - FLOODPLAINS
  - KNOLLS & RIDGES
  - SLOPES & BREAKS
  - WELL-DRAINED
  - SOMewhat POORLY-DRAINED
  - VERY POORLY-DRAINED

- LIMITATIONS & IMPACTS
  - NEUTRAL
  - FLOODPLAINS
  - SLOPES & BREAKS
  - DEPRESSIONS
  - FLATS
  - WELL-DRAINED

GREEN
1B
2A
2B
3A
RED
2E
3A
3B

CASH-GRAIN FARMS

- ATTRACTIONNES
  - NEUTRAL
  - FLOODPLAINS
  - SLOPES & BREAKS
  - DEPRESSIONS
  - FLATS
  - WELL-DRAINED

- LIMITATIONS & IMPACTS
  - Ridges & Knolls
  - SLOPES & BREAKS
  - WELL-DRAINED

GREEN
1B
2A
2B
3A
RED
2E (2)
3D
14. SITE ANALYSIS

The "attractiveness" maps and the "limitations/impacts" maps were then overlayed to produce areas of red, green, and brownish gray. As stated earlier, the analogy is that darker the red, the worse the condition, the darker the green, the better, and the darker the gray, the greater the need for evaluation. These gray areas are areas where both limitations and attractiveness features overlap. (Please refer to the procedure diagram on page --again).

15. SYNTHESIS

To determine which areas are the most suitable for the three land uses, a new set of criteria will need to be developed to evaluate the analysis composites. If the object of the study is to determine the most appropriate or most suitable land use for the specific areas, then a process for determining "the best of the best" is used. This process involves tallying the number of site attractiveness features and site limitation/vulnerability features for each soil. The rank of suitability features is determined using the number of green points compared to red points. (See page for details). Any conflicting land use for each soil is marked with a circle. Criteria for resolving these conflicts include:

- the highest "best" order dominates; i.e., if soil 14 is in conflict, the land use that holds that soil in a higher "best" order supersedes.
- general forms dominate if a soil is held in the same "best" order under two or more land uses.

The resulting "best of the best" composite of composites is represented on page . Again, this map is better recorded on a slide, in the back of this study. Green areas are the most suitable for general farms. Brownish areas are the most suitable for fruit and vegetable farms. And the white areas are most suited for cash-grain farms. Black areas are areas of non-arable lands which include roads, homesteads, streams, and forested lands.

16. LAND USE MODEL

The next step is to take the disassociated, non-homogenous land areas and arrange them into generally homogenous land masses. This is desirable in the instances, for example, where a small, isolated, three-acre tract of land is shown to be suitable for a large-scale, cash-grain farm. The criteria for evaluating the "composite of composites" map are shown on page . The resulting land use model is represented on page , but again is better recorded in slide form at the back of this study. Cash-grain farms are white, general farms are green, fruit and vegetable farms are red, and non-arable land is black. In general, the fruit and vegetable farms should be located on the slopes and breaks which are adjacent to the streams. General
and cash-grain farms are found farther away on the uplands. General farms occur on roll-
ing topography, and cash-grain farms occur on flatlands.

17. CONCLUSIONS

As this study is theoretical in nature and involves the change of human values, a trans-
sition to a new agricultural land use struc-
ture will take time. The prime actors needed to be contacted with such a study would include, of course, the farmer. Although that farmer may not change, the legacy that the farmer leaves can be passed on, preferably to another family member, with the knowledge of what his land can produce. Zoning boards can be contacted to stress the need for local, self-reliant food systems and their subse-
quent need for a new agricultural land use structure. Realtors can also be key partici-
pants. They are in the business of knowing what a piece of land can "do".

At any rate, this study is a tool for evaluating cultural values. As values change, so, too, do the criteria which in turn changes the resulting land use model. This process allows one to "play games", to exercise options.

In conclusion, this study evaluated an existing agricultural landscape for the possibilities of diversification of crop production and farm size. This is important in a system ruled by "economies of scale" that say that smaller, less suitable lands currently utilized for cash-grain production are thought of as disposable and are therefore overlooked as potentials for alternative crops. These "less suitable" lands, according to this study and the guidelines of the Cornucopia Project, may hold the keys to the future sustainability of our food system and its resulting health and well-being of this culture's economic, social, political, and environmental resources.
FRUIT & VEGETABLE FARM
SITE ATTRACTIVENESS
THE "GREENER" THE BETTER
FRUIT & VEGETABLE FARM
SITE LIMITATIONS
THE "REDDER", THE WORSE
FRUIT & VEGETABLE FARM
COMPOSITE
GREEN — “GO FOR IT”
GRAYISH — “THINK AGAIN”
RED — “DON'T DO IT”
GENERAL FARMS
SITE ATTRACTIONNESS
THE "GREENER", THE BETTER
GENERAL FARMS
SITE IMPACTS & LIMITATIONS
THE "REDDER," THE WORSE
GENERAL FARMS
COMPOSITE
GREEN—"GO FOR IT"
GRAYISH—"THINK AGAIN"
RED—"DON'T DO IT"
CASH GRAIN FARMS
SITE ATTRACTIVENESS
THE "GREENER" THE BETTER
CASH GRAIN FARMS
SITE LIMITATIONS & IMPACTS
THE "REDDER, THE WORSE"
# Evaluating "The Best of the Best"

## Fruit & Vegetable Farms

<table>
<thead>
<tr>
<th>Cash-Grain Farms</th>
<th>General Farms</th>
<th>1st Best</th>
<th>2nd Best</th>
<th>3rd Best</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GREEN</strong></td>
<td><strong>RED</strong></td>
<td><strong>TOTAL</strong></td>
<td><strong>GREEN</strong></td>
<td><strong>RED</strong></td>
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## General Farms

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<th>Cash-Grain Farms</th>
<th>General Farms</th>
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<th>3rd Best</th>
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</thead>
<tbody>
<tr>
<td><strong>GREEN</strong></td>
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<td><strong>TOTAL</strong></td>
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<td><strong>RED</strong></td>
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## Criteria for Resolving Conflict

1. Highest "Best" dominates
2. General Farms dominate all land uses.
"COMPOSITE OF COMPOSITES"
WHITE — CASH-GRAIN FARMS
GREEN — GENERAL FARMS
BROWNISH — FRUIT & VEGETABLE FARMS
BLACK — NON-ARABLE LAND INCLUDING FORESTED LAND, HOMESTADS, & STREAM
CRITERIA FOR EVALUATING THE COMPOSITE OF COMPOSITES

PRIORITY IS BASED UPON PROXIMITY TO EACH OTHER: ATTEMPT TO FORM GENERALLY HOMOGENEOUS LAND MASSES.

1. FORESTED LANDS WILL REMAIN FORESTED AS THEY HAVE ALREADY ATTAINED A BALANCED NATURAL SYSTEM.

2. FRUIT & VEGETABLE FARMS WILL BE LOCATED ON SLOPES, KNOLLS & RIDGES ADJACENT TO SLOPES, & WELL DRAINED FLAT LANDS ADJACENT TO SLOPES.

3. GENERAL FARMS WILL BE LOCATED ON KNOLLS & RIDGES & BETTER DRAINED ISOLATED FLATS & DEPRESSIONS ADJACENT TO KNOLLS & RIDGES.

4. CASH-GRAIN FARMS WILL OCCUPY ALL FLAT & DEPRESSIONAL LANDS & SMALL, ISOLATED KNOLLS ADJACENT TO FLATS & DEPRESSIONS.
BIBLIOGRAPHY

Chapter 2. History of Agriculture in America


Fite, Gilbert C. American Farmers, the New Minority, Indiana University Press, Bloomington; 1981.

Schebecker, John T. Whereby We Thrive: A History of American Agriculture, 1607 - 1972

Chapter 3. Consequences of American Agriculture


Chapter 4. Root of the Problem


Chapter 5. Bioregionalism: A Conceptual Solution


Wabash Landschaft newsletter, several issues, 1983-85.

Chapter 7. The Cornucopia Project: A Central Concept


Chapter 8. Extracted Concepts: Project Development Keys


Chapter 11. Methodology


Chapter 13. Site Analysis Criteria


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APPENDIX A

The U.S. food system is the most productive the world has ever seen. Ironically, it is also one of the most destructive systems of all time. To provide our food abundance, we are burning up natural resources: soil, water, energy. In the midst of plenty, we seem bent on devastating our potential for future productivity.

In 1980, Rodale Press initiated The Cornucopia Project to study the entire U.S. food system. The goal was to document where our system is vulnerable, and then to suggest how the system could be transformed to sustain and conserve our resources. This summary report gives a brief overview of the results of that study.
INTRODUCTION

For most of this century, the U.S. food system has enjoyed unbroken success. Crop yields are at unprecedented levels. Supermarkets are packed year-round, with an amazing variety of food. America's farmers—just 2.4 percent of the population—work long hours, but provide more than half the agricultural products on the world market.

Based on this record, the path to a better future seems obvious: more of the same. And that is precisely the course most farmers, food companies, and supermarket chains are taking.

Yet beneath this success, there is another reality. The foundation on which our food system is built is crumbling. The cost of maintaining our system is soaring rapidly. The currency we are paying with is not farmland, non-renewable minerals and fuel, pure water, and future productivity.

Our food system was shaped during a time when land and resources seemed almost endless. In recent years, conditions have shifted quickly, but the system has not made adjustments. As a result, the same may mean not continued plenty, but disaster.

Already we have lost one-third of our topsoil. Since 1860, we have built up 45 million acres of agricultural land. U.S. farmers are in debt $75 billion. We have burned up most of our readily available oil and natural gas. We are running out of vital fertilizers and minerals. Some Northeastern states import more than two-thirds of their food. Small farms and food companies are being swallowed by larger ones, and control of the system is passing into fewer and fewer hands.

The U.S. food system has reached a critical point. We have what might be called a "window of opportunity." Despite our prefigury, America is as blessed with natural and human resources that our productive potential is still awesome.

The destructive practices that are undermining our food system can be stopped. We can build a sustainable food system that conserves resources instead of depleting them.

But this window of opportunity is closing rapidly. Every day, our choices become more limited. Small farms and food companies, once gone, seldom return. Shopping carts are now filled not under contract, but from a national food system that can no longer replace. Petroleum and fertilizer minerals cannot be recycled. Each additional step we take toward the present path makes going back more difficult.

The same will not do. What is at stake is the continued operation of our food system. The choices we make now—or fail to make—will determine the security of our children's and grandchildren's food supply.

THE CHALLENGE

The best way to understand the urgency of the situation is to take a brief look at the problems facing our food system.

Economic Stricture. American farmers are in serious trouble. Farm debt is now over $116 billion, an average of $90,000 for every farm in the country. Food, feed, and seed costs are rising rapidly. In 1980, net farm income plunged 70 percent to $19.6 billion. In 1981, net farm income is expected to fall to only $16 to $17 billion, despite large P/E payments.

The only source of income for many farmers is supplementary work in the city. The attempt to leave their land and seek their livelihood from the farm is a virtual guarantee of failure. This has, in fact, now happened. The U.S. Department of Commerce reported that the average income of farmers in the United States is one-third that of other U.S. residents.

Economic hardship has raised many farmers. Since 1930, we have lost more than two-thirds of our farms, while average farm size has tripled from 150 to 430 acres. Currently, one percent of the total farmland owners control 50 percent of all farmland.

A similar consolidation is occurring in the food industry, where 49 companies control 80 percent of all food processing, and 44 companies control over 27 percent of all wholesale and retail sales. The result is limited competition, standardized products, and higher prices.

Cost of Food. Food production, processing, and distribution is rapidly being concentrated in the hands of fewer and fewer people. As the food system becomes more and more dependent on large-scale operations, it becomes more and more vulnerable. A disruption of just one of the main food chains could seriously affect the food supply to an entire country.

Land Use/Soil Abuse. America's cropland and range lands have lost 4.4 billion tons of top soil annually to erosion, enough to cover all the cropland in Maine, New Hampshire, Vermont, Connecticut, and Massachusetts with one foot of earth. In an average year about one-half of all cropland suffers erosion beyond the " tolerable rate: the maximum level at which the soil s fertility can be maintained. The productive capacity of our cropland is now only 70 percent of its potential.

In some areas, the problem is particularly acute. Iowa loses almost 10 tons of top soil per acre each year. For every pound of wheat harvested in eastern Washington, 20 pounds of soil are lost. In Texas, wind erosion alone, losses are over 13 tons of top soil each year of cropland. In the last 200 years, erosion has destroyed at least one-third of our topsoil.

Erosion has always been troublesome, but intensive chemical farming, with continuous planting of row crops, has led to losses of 25 per...
Environmental Impacts. The increasing use of herbicides, pesticides, and chemical fertilizers has led to the contamination of our soil and water, the destruction of wildlife, and health problems for farm workers. America's farmers now use about 16 pounds of pesticide and 60 pounds of synthetic fertilizer nutrients per acre of cropland. The environmental impact of these substances costs an estimated $539 million annually.

Increased pesticide use tends to encourage the development of stronger pests, which in turn leads to more powerful pesticides. In the past 10 years, while pesticide use has gone up 160 percent, crop loss to insects has increased more than 40 percent.

Water. The western U.S. receives about 27 percent of our annual rainfall, but consumes 84 percent of the nation's water. The main reason is irrigation, which takes 61 percent of all the water used in this country. The 15 percent of our crop land that is irrigated produces more than 25 percent of the total value of U.S. crops.

Initially, only surface water was used for irrigation, but now more than half of our irrigation water comes from groundwater. An estimated 26 percent of the groundwater we use is not being replaced, and lowering water tables in many places are making continued irrigation difficult. Already, farmers in Arizona and Texas have been abandoned because of high irrigation costs.

Pure drinking water is also becoming rare. The U.S. Environmental Protection Agency estimates that we generate 77 billion pounds of hazardous chemical wastes yearly, and only 15 percent are processed safely. Pollution from runoff of agricultural lands affects 68 percent of the river basins in the country.

Climate. During the past 70 years, when agriculture as we know it has developed, the climate has been unusually warm and favorable.
Most climatologists are predicting that the next few decades will be a period of great variability, leading to substantial disruption in food production. The 1979 drought lowered U.S. corn crop, a 27 percent decline in the corn harvest, and a 42 percent drop in the peanut crop.

Even minor weather changes can have a significant impact on agriculture. A cooling trend would wipe out some northern wheat, and a drop of just 2°C below the optimum temperatures of the 1960s would cut the growing season in much of the Midwest by 20 to 30 days.

Many scientists are fearful that the increase in atmospheric carbon dioxide will lead to a rise in the earth's temperature, through the so-called greenhouse effect. Even a moderate warming could melt large areas of the polar ice cap, raising world sea levels and flooding coastal cities and agricultural areas. In addition, a 1°C increase in temperature and a 30 percent decrease in rainfall would reduce the yield in the U.S. and the Soviet Union by 50 percent.

In recent decades, the American diet has changed dramatically. Since 1960, per capita consumption of fresh fruit and vegetables has fallen 22 percent, while consumption of soft drinks climbed 151 percent. The swing toward more processed food has contributed to nutritional problems. Forty percent of American women and 50 percent of American men aged 65 to 49 are overweight. Lack of fiber is suspected of promoting certain kinds of cancer. Increased consumption of sugar has led to more tooth decay, and the increased consumption of fats has led to excess saturated fat and reduced total cholesterol in the diet. These factors have increased the risk for heart disease, fresh, simple food, the more healthy course we have a choice.

Food Processing. More than 75 percent of the food Americans eat is processed in some way. In the last 50 years, per capita consumption of processed fruit and vegetables has tripled.

Food processing values almost one-third of the energy used by the U.S. food system, and about 100 calories of energy are expended for every 100 calories of processed food we consume. Packaging is a highly energy-intensive process. It takes 30 calories of energy to make a 12-ounce aluminum soda can that contains a drink with 100 calories of food energy.

Processing also harms food quality. Nourishment is destroyed and additives are added. Canning fruit and vegetables loses their vitamins, color, and refined white fiber—even after enrichment—lacks important minerals and fiber found in whole grain.

Fifty percent of the U.S. population lives in metropolitan areas. In the past, specialty crops such as vegetables, fruits, and nuts were grown close to big cities. Now, most crops are totally dependent on distant food sources.

Between 1967 and 1975, urbanization wiped out nearly 10 million acres of cropland. Failure to preserve agricultural land near cities only makes these areas more vulnerable to food shortages.

U.S. exports: 10 percent of the total agricultural products on the world market. Total food exports reached $14.8 billion in 1983. About 8 percent of these exports are in the form of food aid, the rest are sold on commercial terms.

The U.S. in the world's leading food exporter, providing about half the agricultural products on the world market. Export policies often make countries more dependent on our help than ever before. And along with our food, we are exporting habits. Most exports are row crops, which are particularly susceptible to erosion. In 1980, about 2 billion tons of topsoil was eroded from U.S. farmland growing export crops.

WHAT WE CAN DO ABOUT IT

Quotas. This brief look at the condition of our food system demonstrates that 1) the problems are much more complex and immediate than people realize; and 2) the combined effort of these problems could collapse the system before any one of them become critical. The individual parts of the food system may seem to be behaving rationally, but the whole system is irrational and non-sustainable.

The situation is far from hopeless. We are all part of the food system, and there is much we can do to direct it toward a more sustainable, efficient path. As a first step, we developed some general goals for a new system:

1. ABUNDANCE. The food system should provide every person access to adequate food—quantity, quality, and degree of choice.
2. DEFENDABILITY. The food system should provide every person with a reliable food source in the event of economic or environmental disruption.
3. SUSTAINABILITY. The food system should be culturally, environmentally, economically, and technologically sustainable in its production and all other aspects of the food system, including food quality, processing, and distribution.
4. SAFETY. The food system should not endanger workers, consumers, or the environment.

5. EFFICIENCY. The food system should incur minimal energy or other resource costs.

6. APPROPRIATENESS. The food system should be matched to both the limits and needs of its region and locality.

7. EQUITABILITY. The food system should be available for use by all in a fair manner.

8. WEALTH. The food system should generate sufficient income to rural people to provide a standard of living equivalent to that of other sectors of the economy to maintain vigorous rural communities and to enable farmers to fulfill their land stewardship responsibilities.

9. FLEXIBILITY. The food system should be open to change, growth, evolution, creativity, and experimentation.

10. OPENNESS. The food system's organization, patterns of control and course toward the future should be within public view.

Recommendations. The current U.S. food system is not near these goals, and for the most part, is not even heading in these directions. Transforming the system will require the support of farmers, consumers, food businesses, and governments at all levels. The following recommendations suggest some specific ways that different groups could work to solve the problems facing our system.

Farmers. Farmers can begin by reducing their debt to manageable levels. Finally, indebted farmers are trapped in a spiral of paying high interest rates, selling more acreage to increase cash flow, and relying on a heavy depreciation schedule to affect loans on the large volume of production. They need to talk to every possible renter from the land today with little thought for tomorrow.

Some possible ways to solve this include: stabilizing and market- ing on farm operations—include diversifying production, cutting chemical inputs, developing on-farm energy and fertilizer sources, and exploring direct market options. Erosion control must also become a priority to protect the future productivity of the soil.

Consumers. Consumers can become more aware of how the food system functions—and food comes from—and how it is grown and processed. Learning more about the system will allow them to make the choice to support local farmers and consume more fresh, locally grown fruit and vegetables.

One of the best ways for individuals to increase their food security is to take charge of a part of the system by growing a garden, raising small animals, or processing and preserving more food at home.

Food Industry. The food industry can give preference to farmers who use sustainable methods—processing fewer chemicals, minimizing soil destruction, rotating crops. Through advertising and promotion the industry can encourage consumption of local products, enhancing both consumer nutrition and the regional economy.

Companies can save energy—and lower prices—by processing food less, using minimal packaging, and regionalizing the purchasing, processing, and distribution of food whenever possible. By working with consumers rather than against them, the industry can anticipate need and preferences in years to come, and develop new products and services accordingly.

Cities. Cities can establish a Department of Food to encourage local food production and facilitate distribution. Through careful planning, preservation of local farms and farmland, and support for home and community gardens, the vulnerability of urban food supplies could be greatly decreased.

Citizens could also increase food availability and hold down costs by promoting direct market sales, providing or supporting community centers for food processing and storage, and supporting educational programs on nutrition, shopping, and personal food production.

States. States can increase local self-sufficiency and move toward a regional food system by encouraging production of a wider variety of crops. Planning, research, and tax incentives could assist with the gradual transformation to more diversified agriculture, along with development of more local markets and programs promoting the purchase of state-grown and processed foods.

The state can also work with farmers for effective soil and water conservation, preservation of farmland, recycling of organic wastes, and development of on-farm energy sources. Statewide education programs could help farmers, consumers, and food retailers see the value of a local, sustainable food supply.

Federal Government. The federal government can help develop a more sustainable food system by ending subsidies to non-sustainable agriculture, including policies that encourage groundwater mining, lead speculation, and huge farm debts. At the same time, programs for soil, water, and land conservation can be strengthened and expanded.

The federal government can initiate the development of a comprehensive long-range food plan for the country, which supports regional self-reliance, funds research into sustainable farming methods, and creates contingency plans for dealing with any food emergency. With a strong national system, we could then enhance national security by helping other countries increase their food supplies with appropriate technical and financial assistance.

CONCLUSION

These recommendations should be viewed as a flexible agenda rather than a rigid program. They are what we know today. Tomorrow, as we learn more, we can review our assessments of the problems and our options. We hope they part of our learning process will come from you, in the form of feedback on what we've need in this summary report.

The problems facing our food system are serious and complex, and we have no magic prescription to solve them. But we need not watch helplessly as our food system crashes. It is vital to realize that we have the option to change the system. It is equally important to begin exercising that option today.
More Soils (occupies...)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>BIA</td>
<td>Occupies broad flats on uplands</td>
</tr>
<tr>
<td>B1B</td>
<td>Occupies knobs, small ridges, and divides near small drainage ways on uplands</td>
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<tr>
<td>B1BZ</td>
<td>Occupies flats and depressions on outwash areas and terraces on uplands</td>
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<tr>
<td>FYB3</td>
<td>Occupies breaks within terraces and outwash areas (short slopes)</td>
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<td>FYC3</td>
<td>Occupies floodplains (recent stream sediment)</td>
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<tr>
<td>GEB</td>
<td>Occupies ridges and knobs on the plains</td>
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<tr>
<td>G2E</td>
<td>Occupies breaks along the major streams and the uplands and low terraces between</td>
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<tr>
<td>MGBA</td>
<td>Occupies upland and outwash areas</td>
</tr>
<tr>
<td>M0D</td>
<td>Occupies knobs and ridges in outwash and upland areas</td>
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<tr>
<td>MUB</td>
<td>Occupies ridges and knobs on uplands</td>
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<td>MB2</td>
<td>Occupies breaks and ridges in uplands (slopes are short and hummocky)</td>
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<td>&quot;</td>
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<td>MUB3</td>
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<td>MGB3</td>
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<tr>
<td>OCA</td>
<td>Occupies outwash and terrace areas</td>
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<td>PC</td>
<td>Occupies depressional and broad flats in uplands</td>
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<td>PK</td>
<td>Occupies depressions in uplands, outwash areas, and terraces</td>
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<tr>
<td>RC</td>
<td>Occupies depressional areas in lake beds, siliciclastics, and valley trains (lacustrine sediment)</td>
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<td>SH</td>
<td>Occupies floodplains (along smaller streams) (recent stream sediment)</td>
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<td>SOIL SERIES</td>
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<td>BLOUNT (DEEP)</td>
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<tr>
<td>BROOKSTON (DEEP)</td>
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<tr>
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<td>(FLOODPLAINS)</td>
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<td>MIAMI (DEEP)</td>
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**BLOUNT-PEWAMO-MORLET ASSOCIATION**
FORCED IN GLACIAL TILL ON UPLANDS

**MORLET-BLOUNT-PENAMO ASSOCIATION**
FORMED IN GLACIAL TILL & OUTWASH UPLANDS & TERRACES

**BROOKSTON-KOKOMO-FOX ASSOCIATION**
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Note: The table continues with similar rows for each subclass and yield values.
HAND-DRAWN DATA FILE

(ORIGINALS: REPRODUCED ON RED & GREEN PLASTIC TRANSPARENCIES FOR STUDY)

1. pH
   A. MODERATELY - SLIGHTLY ACID
   B. NEUTRAL
   C. SLIGHTLY - MODERATELY BASIC

2. TOPOGRAPHIC FEATURES
   A. FLOODPLAINS
   B. FLATS
   C. DEPRESSIONS
   D. RIDGES & KNOLLS
   E. SLOPES & BREAKS

3. NATURAL SOIL DRAINAGE
   A. VERY POORLY-DRAINED
   B. SOMewhat POORLY-DRAINED
   C. SOMewhat WELL-DRAINED
   D. WELL-DRAINED

4. NON-ARABLE LAND
   A. ROADS
   B. HOMESTEADS
   C. FORESTED LANDS & STREAMS

5. BASE MAP