

In this book I do not propose that we all go back to living in mud huts or living like pre-civilized cultures. I propose that our modern culture adopts a new approach of how we obtain our carbohydrates, proteins and oils — our staple food crops. In the chapters to follow I will explain how humankind can achieve all of the benefits of natural, perennial ecosystems. This can be done by creating agricultural ecosystems that imitate natural systems in form and function while still providing for our human needs.

Now, we face the challenge to design and manage cropping systems that can reverse local problems of acidification, catchment-wide problems of salinization and nature conservation, global problems of population pressure and climate change, and assure food safety. The solution to this more complex challenge is made further difficult by the dramatic change in the profitability of farming that remains in continuing decline. Salary earners have largely kept pace with the increasing price of food but the returns to farming have not. Rather, those farmers that have survived have done so by expanding the scale of their operations and becoming more efficient. There is concern of insufficient investment to maintain the resource base of agriculture at a time when there is increasing concentration of profit higher in the food chain.

*Cropping Systems for Enduring Productivity by David Connor,  
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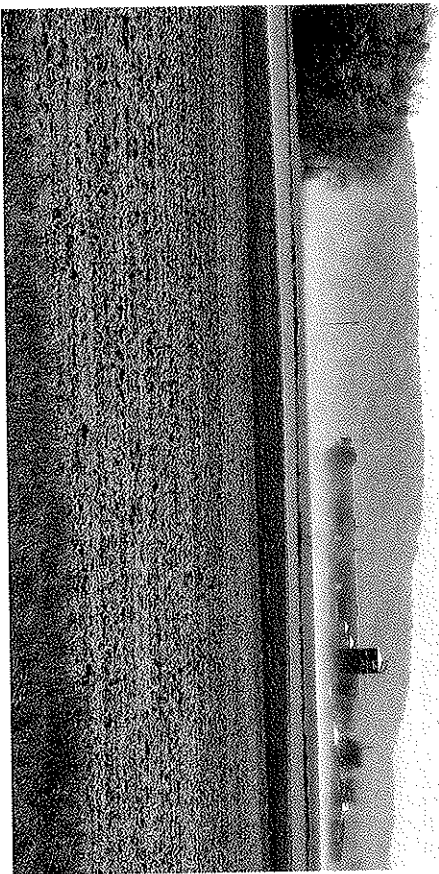
## CHAPTER 1

# The Perennial Agriculture Vision

I stood on a ridge in southwest Wisconsin looking into the sharp, dry winds and watched the clouds of dust rise up in the afternoon heat above a small metallic swarm of combine harvesters. As far as the eye could see the landscape was the same — parched, compacted soil, lifeless as pavement with row upon endless row of corn stubble. To the horizon in the west, to the north, and to the east, nothing could be seen but barren, dusty, corn stubble. Aside from the combines, the scene was as lifeless as the moon. In fact it could have been on the moon with the same driver of the spacecraft safely ensconced in a climate-controlled life support machine, complete with GPS satellite guidance system and cell phone communication. The only birds I saw in this barren, dusty “moonscapes” were turkey vultures circling high overhead, possibly hoping that the combine had spit out a crushed rat, one of the few creatures able to thrive in a desert of corn.

Here I was standing in the midwestern United States, the self-proclaimed breadbasket of the world, and what did I see? Instead of a landscape reeming with life and overflowing with bounty, I saw dust and stubble. Here where there once was life in abundance, springs gushing out from every hillside, passenger pigeons in flocks so large they blotted out the sun, beaver so thick in every stream that the valleys were a crazy-quilt of their handiwork, there was now only #2 yellow dent corn, bristly ran corn stubble, and the hard packed crust of what was once some of the most fertile soil on earth.

As a child I had been taught that the story of America was the story of progress. Once upon a time our ancestors came to this land and wrestled an existence from the cruel taskmaster called the “wilderness.” They lived lives of squalor and sacrificed much in their lives so that we might live “better” than they did and so that we might enjoy more material things. My European



*How many millions of acres of healthy, intact ecosystems have been cleared and burned in order to plow and plant but a few annual crops?*

ancestors cleared the great eastern forests of their previous inhabitants as best they could (both animal and human), burned the stumps off and began to plow. Then they marched from the shores of the Atlantic driven not by promise, as we have been told in our history books, but because they had devastated their resource base. By the early 1800s eighty percent of the New England states had been shorn of their primeval forests. The thin, rocky glacial soil quickly eroded exposing more rocks and in many places the bedrock itself. Even this epic wrestling against nature failed to provide for the growing populations. The American expansion westward was driven as much by want and privation as by dreams of progress and a glorious utopia.

In the Midwest, how many *millions* of acres of "useless brush" have now been cleared and burned in order to plow and plant but a few annual crops? The miles of barren cornfields before my gaze represented only a few generations of this so called "agricultural progress."

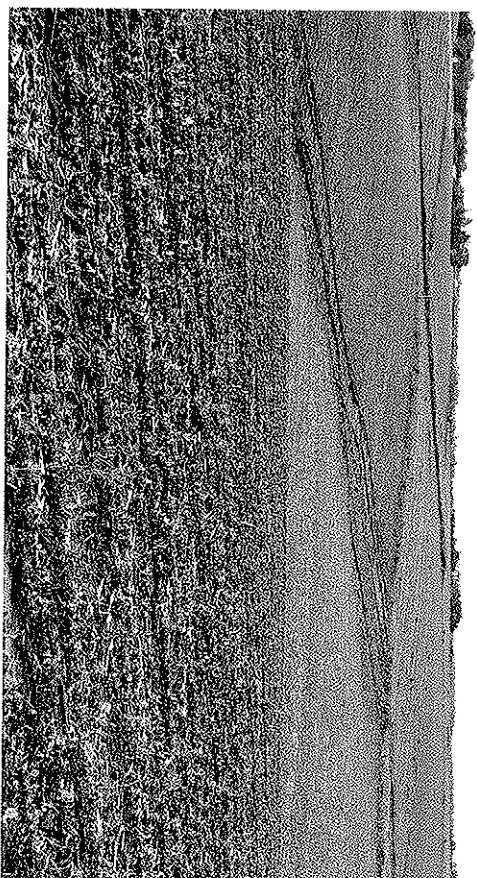
In this area of southwest Wisconsin some families still reside on the land homesteaded by great-grandfather and they still remember the stories most often told about clearing the land, the deprivations of the Great Depression and the Dust Bowl years. The Dust Bowl isn't just history here. It's a very recent family memory for many.

But what kind of progress was I looking at on that ridge overlooking the combines in the cornfield? The ridge was approximately half a mile from the center of Ash Ridge, Wisconsin. A neat green sign with the town name and

"unincorporated" is about all that marks the location today. Only a generation ago this was a bustling community with a feed mill, post office, a store, a fix-it shop and two churches. The "town" of Ash Ridge is now home to five residents: a disabled retiree, an over-the-road truck driving couple and two commuters nearing retirement age who work in "town" 25 miles away.

Where is the progress in this? Is our progress as a society to be measured by how big our sport utility vehicles are? Or is our progress measured by the fact that we have a 72-inch widescreen plasma TV in the living room with 300 channels of programming? Is it progress to be able to buy a 40-ounce "Big Buddy" soft drink at every corner and have a Walmart store within 30 miles of every citizen?

Do we measure our progress by the number of extremely overweight Americans that there are in the country? The United States has one of the highest rates of heart disease (#13) and diabetes (#3) in the world according to the World Health Organization. Is progress measured by the fact that Americans are so unhealthy that the latest Army statistics show that 75 percent of military-age youth are ineligible to join the military because they are overweight, can't pass entrance exams, have dropped out of high school, or



*A mere generation ago much of agricultural America was bustling with vibrant communities, and now?*

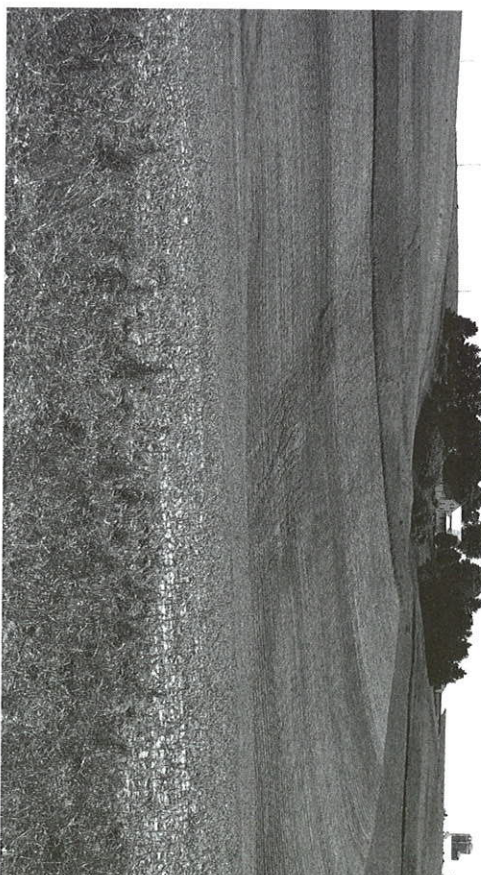
had run-ins with the law? “We’ve never had this problem of young people being obese like we have today,” said General John Shalikashvili, former chairman of the Joint Chiefs of Staff.

There’s a crisis running through the heart of America and clinging to its coronary arteries. It ripples out in all directions into everything we do, everything we feel and everything we think. Some may say it’s a political crisis. Some blame the most recent batch of immigrants, others blame religion (or lack thereof). In each case, the proponents of one solution over another share some very basic common traits with their opponents. These commonalities are such deeply held core beliefs that they are nearly invisible to both sides. No matter who is to blame for our current health predicament and no matter who is morally or ethically “right” when it comes to finding solutions, we all share the same crisis. Our crisis has its roots in how we get our food.

How a human being obtains his or her food has a direct and very real impact on the biological health of the planet. What you eat creates the market forces that cause farmers to grow crops to satisfy your demand. What a farmer grows and *how* those crops are grown directly affect the ecological health of the soil, plant and animal life of a place, the atmosphere, the hydrology and even the patterns of human settlement. What you eat is indirectly responsible for nearly every single crisis that humanity faces and with an economy that is global in scale today, the food choices of one individual (you or me) are compounded by the billions and change the world like no other socioeconomic juggernaut ever known. We are eating our planet away to the bare bedrock bones and changing the conditions of our home planet into something that would be unrecognizable to our great-grandparents.

Humankind has reached a phase in development where we must have the courage to uncover our blind beliefs and make the efforts to fundamentally change the face of agriculture. By fundamentally changing the face of agriculture, we change the food system. By changing our food system we change the health and well-being of the populace, and as I will point out in this book, by changing the face of agriculture we can change the ecological health of the entire planet. The “progress” that we have made as a nation has been built on a food system that has denuded continents for millennia. With the discovery of liquid crude oil, the invention of the internal combustion engine to power farm machinery and with the development of fossil fuel-derived synthetic fertilizers, the ecological destruction has shifted into overdrive.

In the short span of one human lifetime, the change in Ash Ridge, Wisconsin, rural North America and around the world has been extreme.



*What you eat and how that food is grown is responsible for nearly every single crisis that humanity faces today.*

In 1910, there were 6.4 million farms in the United States. The average farm size was 138 acres. Most farms were owned by the farmer and his family (back then most farmers were male). These small family farms provided a modest but healthy livelihood for its inhabitants which were typically large extended families.

Since 1910, the number of farms in the United States has plummeted from 6.4 million to less than 2.2 million in 2008. The average size of an American farm has ballooned to 461 acres. Despite the fact that half the number of American farmers are now tending seven times the landmass that my grandpa did, he or she is now earning *less* today (in inflation-adjusted dollars) than way back then.

The United States Department of Agriculture statistics very accurately track these changes. The changes began somewhat gradually and have accelerated with the increased availability of fossil fuels and the mechanization of farm equipment. The tractor is a relatively new invention in the world of agriculture. My grandfather farmed with horses. My uncles learned to farm with horses and adopted the tractor as soon as they could afford one. “Affording one” was a part of the problem. At the dawn of the age of tractors, a horse or mule-powered farm was a profitable venture. My grandfather raised a family of six children solely on the income from a 60-acre farm and helped send three of them to college. As tractors became more common, farm prices first went stagnant. Then they began to fall.

The advent of chemical nitrogen fertilizers (manufactured by a re-tooled munitions industry following World War II) had a short-lived boost on yields, but instead of improving the bottom line for American farmers they had the opposite effect. More crop meant lower prices. Fertility, which once came from livestock raised on-farm, now came in a bag from the agricultural company down the road. In less than one lifetime, farms went from being self-contained ecological production systems, to debt-ridden, input-dependent "agri-businesses" that soon required massive government subsidies to keep them afloat. In less than one lifetime, farms went from being biologically diverse systems that relied upon animal husbandry, crop rotation and perhaps additions of mined substances (calcium, for example) to specialized single-crop systems that were merely extensions of the chemical companies who manufactured the toxic brews to be spread on American soil.

In order to afford to buy tractors my uncles had to borrow money. In order to make payments on their tractors they had to buy more land in order to grow enough crops (at declining prices) to pay for the new equipment. More land meant more borrowing. More borrowing required a larger cashflow which called for bigger tractors which meant more borrowing and the cycle continues to this day. The seemingly inevitable upsizing of the American farm and the bleeding of the American farm economy shifted into overdrive in 1973-74 with what appeared to be caused by a wheat crop failure in the former Soviet Union.

Ken Meter, an agricultural economist at the Crossroads Resource Center in Minneapolis, Minnesota, has repeatedly shown how critical this time period was for the American farmer and the entire U.S. economy. In a report written for the Indiana State Department of Health in 2012, Meter writes:

It was not until 1973-74 that American farmers would experience bountiful prosperity. This occurred in the aftermath of the OPEC decision to restrict oil production. This had the effect of raising the price of oil, and since most of the oil America purchased at the time came from the Middle East, our purchases funneled dollars into the hands of the oil industry there. At the time, Middle Eastern oil producers did very little to reinvest in the United States, so these dollars flowed steadily away from our shores.

In an effort to bring dollars back to the U.S. economy, and to offset higher prices induced by oil costs, the White House created what they said would be a "win-win-win" solution. The government asked American farmers to produce more grain, promising them "permanent export markets abroad" if only they

would ramp up production. The Soviet Union agreed to purchase considerable wheat and corn, using dollars they held in savings accounts; this was necessary because crop failures and distribution breakdowns had made many Soviet citizens hungry. According to the plan, Soviet consumers would eat better, farmers would make more money, and the treasury would recover the dollars that had been sent overseas.

Many farmers remember Secretary of Agriculture Earl Buttz standing in front of microphones asking them to "plant fence row to fence row." Further, he encouraged farmers to expand their operations, saying "Get big or get out of farming." Both federal and private lenders responded accordingly, encouraging farmers to take on additional debt. This analyst interviewed several farmers in the 1980s who had approached lenders asking for a loan of, say, \$250,000, and were rejected because they asked for "too little." As one farmer recalled, the lender responded that he would not consider making a loan unless the farmer asked for \$400,000 at minimum. Given the promise of permanent export markets, these farmers felt they had no choice but to go along.

However, in 1974, the Soviet Union stopped buying massive quantities of grain, saying they had restored their own capacity to feed themselves. Suddenly, markets for grain commodities collapsed. As sales plummeted, so did farmgate prices, since there was no other buyer who could buy in quantity. Rural elevators across the Grain Belt loaded grain high onto immense cone-shaped piles on their lawns, since storage was full. The "permanent export markets abroad" had been an illusion.

Farm income returned to levels similar to those prior to the oil crisis, but with one big difference. Farmers now had higher debts to pay — loans they had taken on, at times under duress, thinking prices would stay high. Farmers now found they could not repay their debts. It took a decade for this to become obvious to the rest of the nation.

*From the article "Hoosier Farmer? Emerging Food Systems in Indiana" by Ken Meter.*

The "get big or get out" policy very quickly led to the real estate canibalism of rural America. A farmer who got bigger, typically bought out a neighboring farmer who, for whatever reason, decided to sell. In the 1980s, when farm real estate prices no longer rose fast enough for farmers to roll their debt forward by "riding the inflation train," the farm economy fell into a severe credit crisis. This was the outgrowth of the only two years of substantial prosperity for farmers since the early 1950s and was caused solely by the federal government. Not even farmers with the best agricultural practices were immune to this government-caused catastrophe. Net cash income for

farmers fell close to zero from 1999 to 2002, and only in the past few years have producers experienced positive returns.

As this process of rolling debt forward continued, the biggest farms and the ones most able (or willing) to take on more debt got bigger. The people who farmed the smaller farms, raised families, sent their children to the local schools, went to the local houses of worship and shopped at the local stores; simply moved away. In any population, whether it is white-tailed deer, squash beetles in a cucumber field or a human community, there is a certain point when the population is no longer viable. At some point in time, and that time was not always obvious, when enough people leave a town or city, there are not enough people to sustain that town. This process has been going on since the dawn of civilization and will be discussed later in this book. As people left rural America, a “population viability” threshold was crossed and small towns and cities began to collapse. Some places, like Ash Ridge, Wisconsin collapsed to the point that the only memory of its existence is that small, green sign saying Ash Ridge (unincorporated).

In the post-World War II years, displaced farmers frequently found employment in the industries that sprang up near big cities. Some people, in fact, theorize that the depopulation of rural America in the 1900s was due to industry’s desire to provide a large, desperate workforce for itself.

My grandfather left the family farm in rural Vermont in 1947. It simply wouldn’t pay. Where my great-grandfather had been able to raise a family of ten on 40 acres of land, my grandfather could now no longer afford to raise and feed a family on 60 acres. He moved the family from semi-wild, rural Vermont to industrial Massachusetts where he could find work in the factories. I never got to meet my grandfather. Either one of them in fact. Both of them had died from illnesses linked to chemical exposure. One grandfather worked in a tannery. Breathing tannery chemicals eight hours a day in the years before workplace safety laws were in place, turned his lungs into shoe-leather. He died at age 55. The other died of prostate cancer at a similar age.

Statistics are faceless, but the crisis that humankind faces is not. The food crisis has names and faces. It’s a family crisis. It writes family stories and creates the reasons for our actions. The agricultural crisis is really an environmental crisis. This crisis embeds itself visibly and invisibly into the very fabric of our lives. The agricultural crisis is what is written indelibly into my own personal history. Where I was born and grew up, is a direct result of U.S. farm policy. The stories that I heard from my parents and grandparents were the stories

of survival in tough times. The dreams that they had that were instilled into me, were born out of the crisis of annual agriculture.

When I was a youngster growing up in central Massachusetts in the 1970s, my brothers and I would play a game whenever we got into the car. That game was, “Guess what color the river is today?” I grew up on what today would be called a “hobby farm.” We lived on the top of a hill that was surrounded on three sides by a wide, meandering loop of the Nashua River. In the river valley to the north of my childhood home was the birthplace of John Chapman, popularly known as Johnny Appleseed. To the south was the birthplace of Luther Burbank, plant breeder extraordinaire who developed the Russet baking potato, Shasta daisy, and the thornless prickly pear cactus. Burbank and Chapman have influenced my life to an extraordinary extent as you will see later in this book.

In my childhood years, the same river in which John Chapman fished for salmon had become the waste disposal system for the industrial mill towns upstream in southern New Hampshire and northern Massachusetts. The river would run red, green, cobalt blue, orange (the color of a “Creamsicle” ice cream treat), but never clear. The word “Nashaway” in the language of the first people who lived there meant “stream with a pebbly bottom.” The Nashua River of my youth did not have a pebbly bottom. For one, the bottom of the river was only visible close to shore where the water was the most shallow. When you could actually see the bottom, it was a thick, grayish-green slime. The identity of this thick, grey slime was revealed in the springtime after a flood. When the spring floodwaters receded, the river left a coating of papier-mâché on the banks to mark the extent of the floodwaters.

Upstream several miles away were large paper finishing factories that would receive bulk rolls of paper from the Maine pulp mills where the forests were chipped, ground, chemically dissolved then re-constituted into paper. This primary paper would then be rolled up into what resembled eight foot tall rolls of toilet paper. Indeed, much of what was produced *was* toilet paper. These upstream factories would re-process this bulk paper and turn it into the “products” that we all enjoy — writing paper, wrapping paper, newsprint, napkins and more. In the 1960s and 1970s it was common practice that the leftover dye and waste water from the paper mills be simply dumped into the river. Tanneries, suppliers of shoe leather to the many shoe manufacturers in the region, also dumped their dyes and used

tanning chemicals into the river. The “wastewater treatment plant,” believe it or not, was a new invention then, and companies who were benefiting from the free waste disposal available to them in the form of a river, were reluctant to try this “unproven” and “expensive” new technology; the adoption of which in their minds would no doubt result in the ruin of the economy and cause a socialist takeover of the political system or whatever argument the wealthy businessmen were using at the time.

It took dozens of years, public pressure, political pressure, and even some environmental sabotage to finally get the polluting industries to install wastewater treatment plants to purify their waste, or rather to most of the time, render it less toxic to a “statistically significant degree.”

The Nashua River with its red, blue, green, and sinking toxic waste stream taught me something — something more significant than anything that I was taught in school. I could say that it taught me that organizing “the people” around an issue to raise awareness and funds and to apply political and market pressure to affect change is the “American Way” and that this was proof that our political system actually works, but that wasn’t the real lesson the river taught me. The real lesson that the river taught me, that I took to heart, was that nature *heals!*

Given the opportunity, there are forces in place in the natural world that are as dependable as gravity, forces that lead toward health, healing, diversity and stability in an ecosystem. The Nashua River was all but dead when I was a youngster in the 1960s, but by the time I was in high school in the 1980s the river ran clear! The sewage plant aroma of the river was replaced by a not-so-horrible smell (it still stank though!). Then after a few years of flooding and scouring, most of the papier-mâché coating the bottom had been washed “away” (where it now lies no doubt on the bottom of the Atlantic Ocean off the coast of Merrimac, New Hampshire) and the pebbles described three hundred years ago began to be visible again! Nature really does heal itself.

All that was done in the case of the Nashua River was to remove the main sources of pollution. Nothing was added to the river and no additional cleanup help was rendered to it. River banks that formerly looked like an industrial wasteland soon began to sprout vegetation. Plants began to grow *in* the river and by the time I had graduated from high school people were canoeing on the river again. In the mid-1980s I saw my first fish in it.

It had a grotesque, cancerous growth behind its gills, but it was an actual *fish* and it was alive in the Nashua River!

The same resilience that I saw in the Nashua River during my youth I have

seen many times since then, from clear-cut mountainsides in Maine to parking lots in Chicago, toxic waste dumps in Detroit to the sterile dusty ridge of farmland where I stood in southwest Wisconsin.

The combines finished shaving the last crew cut of corn from the hard-packed fields and were pouring their golden harvest into tractor trailers parked at the side of the field. I turned from looking at this dry, barren landscape to behold another quite different example of the power of regeneration. Turning around I found myself walking over an embankment that had been piled up from the excavation of a series of water collection swales. I was now walking in a place called New Forest Farm, where dozens of miles of water collection, distribution and retention ditches (swales) had been excavated. On the way home I walked through a young forest of pine nuts and chestnuts and passed a “pocket pond” where I spotted three different types of frogs and heard the sounds of at least five different species of frogs and toads as they sang in the newly formed spring.

Birds flew in and around the branches of the trees: bluebirds, phoebes, meadowlarks, shrikes, swallows, kingbirds, and the common “LBBs” (short for little brown birds!). Butterflies flitted in the breeze, grasshoppers, crickets and a host of other insects chirped and trilled in a delicious cacophony that made me smile. The place where I was walking was *alive*. The grass beneath my feet was firm in the dry autumn heat, but softer than the pavement I had experienced in the cornfield. In addition to all of this, I was surrounded by *food!* The hazelnut shrubs I passed had already been harvested, as had the cherries, mulberries, kiwis and pears. Apples in a bounty of red and gold were being harvested into pallet bins while the nearby chestnuts finished ripening, awaiting their turn for harvest. Several steers grazed on the abundant grass and pigs snuffled about under the hazelnut bushes looking for dropped precious gems. I was walking through a working, food-producing farm. A farm that was *alive* with soft, rich soil, water, and an abundance of plant and animal life, including frogs! This place, New Forest Farm, had been a bare-dirt cornfield a mere fifteen years prior, but it had been transformed! It had been actively healed and restored to a state of greater productivity.

In an incredibly short period of time, we can restore and heal our farmland. We can re-create some of the abundance that our ancestors saw when they first moved to this continent. Instead of just stopping the insult, like in the case of the Nashua River, we can become active participants in the transformative, restoration process. We can do it while still farming and pro-

ducing food. As we heal our farmland we can heal our planet. And when we heal our farmland we heal ourselves and our families.

Here though, is where a distinction must be made. Fifteen years ago this “working farm” (well, technically it *wasn't* working economically and that was why it was abandoned), produced roughly the 160 bushels of corn per acre that can be expected in these parts on the rough, hilly “highly erodible” (as the USDA calls it) land. Prior to the corn farm being abandoned in the early 1990s, it was a net contributor to the American food supply. Anyone who has eaten today will tell you how important food is to our well-being. Anyone who has *not* eaten today knows this painfully even more so. If we are to restore health and natural fertility to our agricultural lands, we must do so while continuing to provide food for ourselves and to the world. This book describes how we can accomplish vitally needed ecological restoration while simultaneously producing food.

Here is also where a second distinction must be made. What is being demonstrated at New Forest Farm is the production of staple food crops — the bulk calories, carbohydrates, proteins and oils in our diet that come from farm-scale production systems. There are many who claim that it is possible for individuals to grow all of their food in a small, suburban lot. At best I have found that these are people who have produced a significant portion of their annual consumption of vegetables in their suburban lot (and some with a large percentage of their own fruits and berries), but nowhere has there ever been an example of someone producing their own *food* in a suburban or urban situation.

Rice, corn, the wheat in our bread and pasta, beans, lentils, chickpeas, and dozens of other legumes and grains make up our staple food crops. These are the calories that keep our bodies metabolizing, the proteins that make up our muscles and feed the livestock that we raise for meat. We are *all* dependent upon the large-scale production of staple food crops for our sustenance. The Oxford Dictionaries definition of a farm is, “An area of land and its buildings used for growing crops and rearing animals.” We all need farms. Even the most devoted grow-it-yourselfer sometimes eats rice and beans grown on farms.

Given the lack of real examples of backyard systems where a family can grow all of their own food, (not just fruits and vegetables), and since we obtain the majority of our staple food crops from farms anyway, we need to turn our attention to the process of obtaining our staple foods from fully functional, perennial ecological farming systems.

How can we as a nation feed the majority of our population that lives in cities where most people don't even *have* a front yard? Our families need food. Staple food crops are currently grown on farms. If the American farm is in a crisis, doesn't that mean that our food supply is at risk? How can we produce the staple food crops that feed the world using sustainable, ecological systems that don't pollute, that build soil rather than destroy it, that are once again biologically based systems and that are not totally dependent upon fossil fuel imports from far away? What are we to do?