The Land Report

25th Anniversary Prairie Festival

The Ecology of Sept. 11

Back to Food's Future

A publication of
The Land Institute

Number 71
Fall 2001

Contents

Cover: Scott Bontz.
Ann Zimmerman reaches to gently stroke the nose of Saga, held by her father, Björn-Ola Linner, outside the Big Barn during the Prairie Festival on Sept. 29.

Above: Kirk Riley. John Simpson, then a Kansas state senator, helped start The Land Institute in 1976. He is pictured with Wes Jackson at the festival after telling about that beginning.

Back cover: Scott Bontz.
Lauren Rentenbach, in the background, and Dan Hunt, who both studied with Natural Systems Agriculture advisor Tim Crews at Prescott College in Arizona, play Frisbee at the festival. Frieda runs interference.

Our Mission Statement

When people, land and community are as one, all three members prosper; when they relate not as members but as competing interests, all three are exploited. By consulting nature as the source and measure of that membership, The Land Institute seeks to develop an agriculture that will save soil from being lost or poisoned while promoting a community life at once prosperous and enduring.

The Land Report is published three times a year.

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ISSN 1093-1171

What Was in the Air

The Prairie Festival this year had things that others did not. It had 25 years of The Land Institute to look back on — and to build on. Instead of the often rainy weather of late spring, it had gorgeous days of early fall. It had prairie tallgrass filling with seed and turning from green to tawny. And to what the season's shift made of the air, it added portent.

After the catastrophes of Sept. 11, officials postponed and scratched public events across the nation. Some feared travel. The possibility of cancellation was suggested to us. But there is heightened sense of what is happening in the world, and we wanted, as much or more than ever, for people serious about sustainability to gather at the festival. We wanted them to think, with hope, about events, and about what to do. And a good number did. Despite what had happened, and scheduling of the festival — which is really more of a chautauqua — after the beginning of the school year, some 300 came Sept. 29-30 and marked The Land Institute's beginning in the autumn of the nation's bicentennial.

They filled the Big Barn for speeches. Some listened outside in the sun on the grass and bales of hay. They heard Angus Wright describe how poor Brazilians try to use ambiguous property law to win farmland. John Simpson told of his role in starting the institute. Marty Bender explained what the institute's Sunshine Farm has been about, and sketched what it has shown and what is yet to come. (See his story in the summer Land Report.) Wes Jackson argued that ecology hasn't freed the world from the view that Bacon and Descarte built. Gary Nabhan read from his new book, *Coming Home to Eat: The Pleasures and Politics of Local Foods.* Don Worster expressed John Wesley Powell's vision for democracy. And senior scientist Stan Cox revealed how The Land Institute has begun trying to perennialize major food crops. His talk is on page 19.

This edition focuses on that portent from Sept. 11. It wasn't on the program, but it was there at the festival. Speakers worked into their talks what has happened to New York, the Pentagon, the United States and the other side of the world. They tied it to what The Land Institute has been trying to work through for a quarter of a century.

Angus devoted much of his talk to what geography and politics have made of Afghanistan, and to the motivation and strategy of the attackers, and he argued that just as we can't manage global ecosystems, we can't manage global society. We present that part of his address here.

We also deliver three responses that were in print and popular at the festival under the title *From the Margin:*

- Wendell Berry says this marks the end of a technological and economic optimism founded on belief in unlimited growth, and makes more necessary than ever efforts toward decentralization, economic justice and ecological responsibility.
- David Orr examines the context of our actions, describes a religious fundamentalism pitted against an economic fundamentalism, and fleshes out how ecologists, with their big-world view, can help with what is happening.
- Maurice Telleen compares how the world has been turned upside down again as in the past, but now without as much time to set things right.

Also, Mari Detrixhe ties what has happened into a personal essay about conflict and commitment, myth and moment, that she read at the festival.

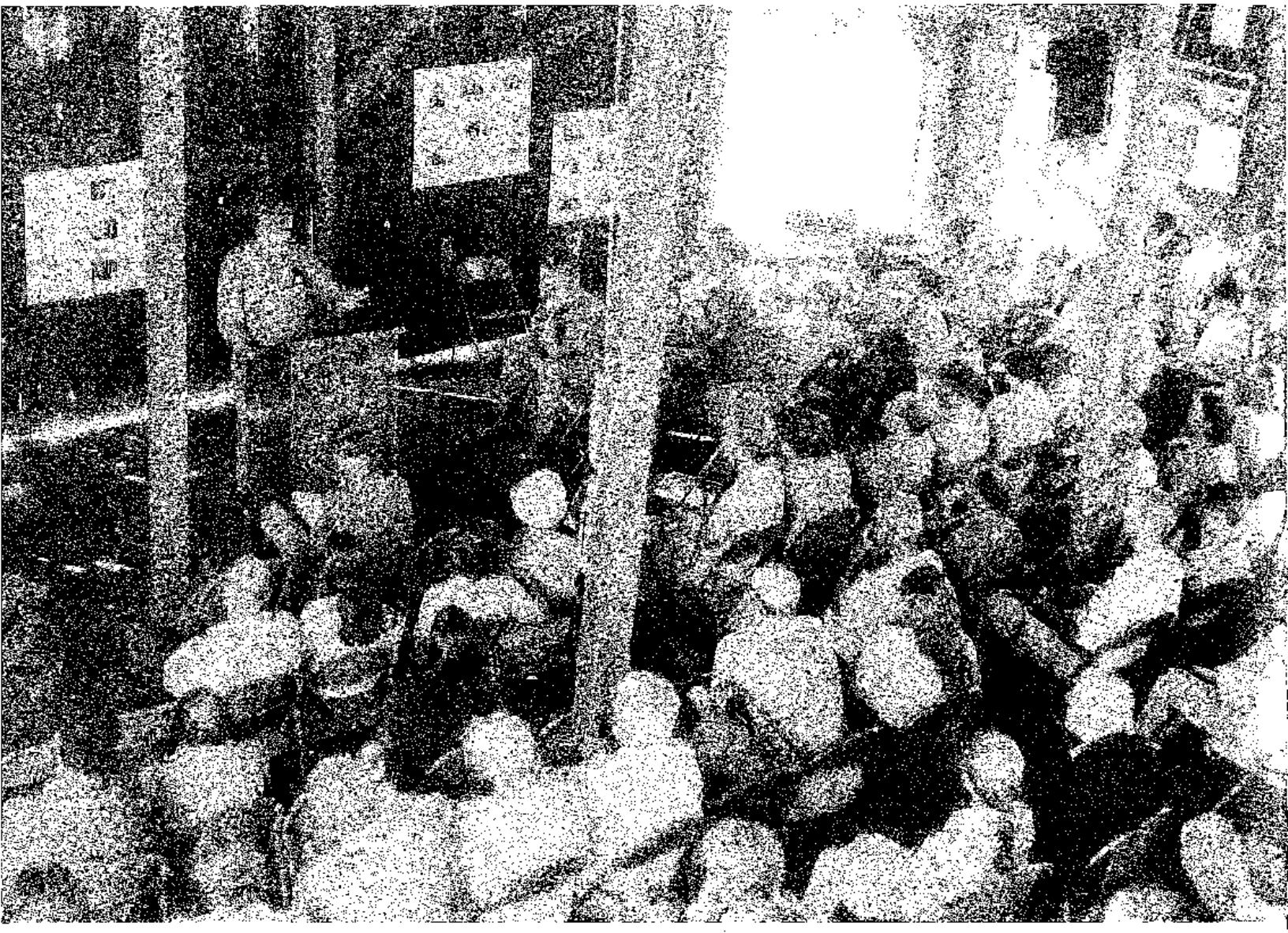
Among these and the other writings are photos of the people who came together for the festival.

Another different thing this gathering had: Two times the barn assembly broke up and regathered as smaller groups to engage in discussions, mostly led by former Land interns and mostly in the inviting open air. They took up the United States' effect on world population, the association of ecology and religion, efforts at direct marketing by farmers, the challenge of eating ethically, and finding hopeful messages for young people.

On Saturday night dancers refilled the barn and powdered the dirt floor into the air with celebration.

Great appreciation came for two organizations and an institute scientist. All are involved with the Sunshine Farm, which is in its 10th and last year of field operation to determine how extensively the farm could run on sunlight. The Austin Memorial Foundation and the Clarence E. Heller Charitable Foundation were major contributors. Marty Bender managed the research from start to finish, designing and compiling a database of information to analyze and make available to others. Several more years will be required for research papers and a book. The audience gave Marty a standing ovation. The Land Institute gave each honoree a large Terry Evans photograph of Kansas landscape.

We liked how the Prairie Festival worked and played in the fall, and are planning the next one for Sept. 21-22. From the coming year, and for beyond, there will be more to talk about, and, we hope, to celebrate.



Scott Bontz. Wes Jackson speaks in the Big Barn at the Prairie Festival.

Thoughts in the Presence of Fear

Wendell Berry

The time will soon come when we will not be able to remember the horrors of Sept. 11 without remembering also the unquestioning technological and economic optimism that ended on that day.

This optimism rested on the proposition that we are living in a "new world order" and a "new economy" that would "grow" on and on, bringing a prosperity of which every new increment would be "unprecedented."

The dominant politicians, corporate officers and investors who believed this proposition did not acknowledge that the prosperity was limited to a tiny percentage of the world's people, and to an even smaller number of people even in the United States; that it was founded upon the oppressive labor of poor people all over the world; and that its ecological costs increasingly threatened all life, including the lives of the supposedly prosperous.

The "developed" nations had given to the "free market" the status of a god, and were sacrificing to it their farmers, farmlands and rural communities, their forests, wetlands and prairies, their ecosystems and watersheds. They had accepted universal pollution and global warming as normal costs of doing business.

There was, as a consequence, a growing worldwide effort on behalf of economic decentralization, economic justice and ecological responsibility. We must recognize that the events of Sept. 11 make this effort more necessary than ever. We citizens of the industrial countries must continue the labor of self-criticism and self-correction. We must recognize our mistakes.

The paramount doctrine of the economic and technological euphoria of recent decades has been that everything depends on innovation. It was understood as desirable, and even as necessary, that we should go on and on from one technological innovation to the next, which would cause the economy to "grow" and make everything better and better. This of course implied at every point a hatred of the past, of all things inherited and free. All things superseded in our progress of innovations, whatever their value might have been, were discounted as of no value at all.

We did not anticipate anything like what has now happened. We did not foresee that all our sequence of innovations might be at once overridden by a greater one: the invention of a new kind of war that would turn our previous innovations against us, discovering and exploiting the debits and the dangers that we had ignored. We never considered the possibility that we might be trapped in the webwork of communication and transport that was supposed to make us free.

Nor did we foresee that the weaponry and the war science that we marketed and taught to the world would become available, not just to recognized national governments which possess so uncannily the power to legitimate large-scale violence, but also to "rogue nations," dissident or fanatical groups, and individuals — whose violence, though never worse than that of nations, is judged by the nations to be illegitimate.

We had accepted uncritically the belief that technology is only good; that it cannot serve evil as well as good; that it cannot serve our enemies as well as ourselves; that it cannot be used to destroy what is good, including our homelands and our lives.

We had accepted too the corollary belief that an economy, either as a money economy or as a life-support system, that is global in extent, technologically complex and centralized is invulnerable to terrorism, sabotage or war, and that it is protectable by "national defense."

We now have a clear, inescapable choice that we must make. We can continue to promote a global economic system of unlimited "free trade" among corporations, held together by long and highly vulnerable lines of communication and supply, but now recognizing that such a system will have to be protected by a hugely expensive police force that will be worldwide, whether maintained by one nation or several or all, and that such a police force will be effective precisely to the extent that it oversways the freedom and privacy of the citizens of every nation.

Or we can promote a decentralized world economy that would have the aim of assuring to every nation and region a local self-sufficiency in life-supporting goods. This would not eliminate international trade, but it would tend toward a trade in surpluses after local needs had been met.

One of the gravest dangers to us now, second only to further terrorist attacks against our people, is that we will attempt to go on as before with the corporate program of global "free trade," whatever the cost in freedom and civil rights, without self-questioning or self-criticism or public debate.

This is why the substitution of rhetoric for thought, always a temptation in a national crisis, must be resisted by officials and citizens alike. It is hard for ordinary citizens to know what is actually happening in Washington in a time of such great trouble; for all we know, serious and difficult thought might be taking place there. But the talk that we are hearing from politicians, bureaucrats and commentators has so far

tended to reduce the complex problems now facing us to issues of unity, security, normality and retaliation.

National self-righteousness, like personal self-righteousness, is a mistake. It is misleading. It is a sign of weakness. Any war that we may make now against terrorism will come as a new installment in a history of war in which we have fully participated. We are not innocent of making war against civilian populations. The modern doctrine of such warfare was set forth and enacted by Gen. William Tecumseh Sherman, who held that a civilian population could be declared guilty and rightly subjected to military punishment. We have never repudiated that doctrine.

It is a mistake also — as events since September 11 have shown — to suppose that a government can promote and participate in a global economy and at the same time act exclusively in its own interest by abrogating its international treaties and standing aloof from international cooperation on moral issues.

And surely, in our country, under our Constitution, it is a fundamental error to suppose that any crisis or emergency can justify any form of political oppression. Since Sept. 11, far too many public voices have presumed to speak for us in saying that Americans will gladly accept a reduction of freedom in exchange for greater "security." Some would, maybe. But some others would accept a reduction in security — and in global trade — far more willingly than they would accept any abridgement of our Constitutional rights.

In a time such as this, when we have been seriously and most cruelly hurt by those who hate us, and when we must consider ourselves to be gravely threatened by those same people, it is hard to speak of the ways of peace and to remember that Christ enjoined us to love our enemies, but this is no less necessary for being difficult.

Even now we dare not forget that since the attack on Pearl Harbor — to which the present attack has been often and not usefully compared — we humans have suffered an almost uninterrupted sequence of wars, none of which has brought peace or made us more peaceable.

The aim and result of war necessarily is not peace but victory, and any victory won by violence necessarily justifies the violence that won it and leads to further violence. If we are serious about innovation, must we not conclude that we need something new to replace our perpetual "war to end war"?

What leads to peace is not violence but peaceableness, which is not passivity, but an alert, informed, practiced and active state of being. We should recognize that while we have extravagantly subsidized the means of war, we have almost totally neglected the ways of peaceableness. We have, for example, several national military academies, but not one peace academy. We have ignored the teachings and the examples of Christ, Gandhi, Martin Luther King and other peaceable leaders. And here we have an inescapable duty to notice also that war is profitable, whereas the means of peaceableness, being cheap or free, make no money.

The key to peaceableness is continuous practice. It is wrong to suppose that we can exploit and impoverish the poorer countries, while arming them and instructing them in the newest means of war, and then reasonably expect them to be peaceable.

We must not again allow public emotion or the public media to caricature our enemies. If our enemies are now to be some nations of Islam, then we should undertake to know those enemies. Our schools should begin to teach the histories, cultures, arts and languages of the Islamic nations. And our leaders should have the humility and the wisdom to ask the reasons some of those people have for hating us.

Starting with the economies of food and farming, we should promote at home and encourage abroad the ideal of local self-sufficiency. We should recognize that this is the surest, the safest and the cheapest way for the world to live. We should not countenance the loss or destruction of any local capacity to produce necessary goods.

We should reconsider and renew and extend our efforts to protect the natural foundations of the human economy: soil, water and air. We should protect every intact ecosystem and watershed that we have left, and begin restoration of those that have been damaged.

The complexity of our present trouble suggests as never before that we need to change our present concept of education. Education is now properly an industry, and its proper use is not to serve industries, either by job training or by industry-subsidizing research. Its proper use is to enable citizens to live lives that are economically, politically, socially and culturally responsible. This cannot be done by gathering or "accessing" what we now call "information" — which is to say facts without context and therefore without priority. A proper education enables young people to put their lives in order, which means knowing what things are more important than other things; it means putting first things first.

The first thing we must begin to teach our children — and learn ourselves — is that we cannot spend and consume endlessly. We have got to learn to save and conserve. We do need a "new economy," but one that is founded on thrift and care, on saving and conserving, not on excess and waste. An economy based on waste is inherently and hopelessly violent, and war is its inevitable by-product. We need a peaceable economy.

The Modern Dilemma in Afghanistan

Angus Wright

The following is excerpted from a Prairie Festival talk.

Afghanistan is surely an example of the radical disjuncture between the needs of local communities and the pressures from international politics, culture and economics.

Here is a country that for about a century and a half has been repeatedly torn apart by powerful, ambitious nations, and before that subject to waves of conquest and rebellion, caught between powerful civilizations — Persian, Indian, Chinese, Mongol, Russian — and competing religious ideas — Buddhist, Hindu, Islamic and Christian, among others now largely forgotten. Its curse has been its location: landlocked, with crucial mountain passes linking the competing civilizations. Its blessing has been that steep topography: largely arid and so rough that its accustomed guerrilla fighters repeatedly chewed up seemingly much more powerful forces.

When a political party with ties to the Soviet Union took power in the 1970s, many conservative townspeople objected mightily to innovations such as encouraging girls to attend school, and women to drop their veils and enter the work world. The United States, concerned about the Soviets acquiring a position that might let them expand to the Indian Ocean, supported rebels. The Soviet Union backed the government. Afghanis became proxy armies for the great powers, who supplied fighter-bombers, tanks, missiles and mines. The Soviets sent troops in 1979. The Americans trained Muslim fighters from many nations — including a certain Osama bin Laden of Saudi Arabia — and called them holy warriors, mujahadin.

Afghanistan was chewed to bits. Hundreds of thousands died in the fighting, and more in the famines that accompanied and followed it. War destroyed thousands of terraces hacked out of hard rock and meticulously tended for centuries. Irrigation collapsed, and wells were poisoned. Land mines turned fields into treacherous traps and roads into barriers. Flocks of sheep and goats perished.

The Soviets retired in such disarray that most think the war contributed significantly to collapse of the Soviet Union. The United States quietly declared victory and left the now numerous well-armed and embittered factions to battle away at each other for years. Eventually one, that which was perhaps the most single-minded and the most fanatical, began to prevail. According to what I read, many Afghanis accepted rule by them not so much because they believed in their hysterical rendering of Islam, known through much of history for its tolerance, but because only people with the determination of the Taliban, led by doctrinaire religious students with guns, could bring peace. Now peace was all that mattered.

How would it have been possible to design a more effective program for the creation of an essentially fascistic regime prepared to harbor and support psychotic schemes for the restoration of a simple-minded idea of righteousness?

Afghanistan too painfully exemplifies the modern dilemma. Here is a poor, remote community of people whose lives have been made impossible by the terms of their interaction with the greater world. Now the consequent distress leads to an extremely dangerous and perhaps insoluble problem for the whole planet. To understand how the damage in a small, poor place can be translated into danger for the globe, we also have to answer the question of why terrorism is the choice by which embittered people think they can set things right.

I am quite sure that the terrorist groups that so viciously attacked the World Trade Center have one clear goal in mind other than simple revenge: That is, in a phrase I heard a great deal in the 1960s, to radicalize the struggle. In this view, those with great power, such as the U.S. government and global corporate capitalism, rule more through passive consent than through naked force. The opponents aim to break down that passive consent by radicalizing the struggle, first by forcing those with power to rule by violent force. That response has far more potential to do what the terrorists want than the terrorist can ever do for themselves: Multiply the victims, increase the horror, deepen the bitterness, create much larger potential armies of those whose desperation is bottomless, and force other factions and then other governments to yield to growing bitterness and fanaticism.

Then, they believe, it will be possible to strike back at the powerful with a force that has been magnified a millionfold. In this way, they believe, they can resolve their local dilemmas by acquiring an international power equal to the international power of the United States. They are quite likely deluded in this hope, and unimaginable disaster may result, but for them it seems the only choice left. Hard as it is for Americans to believe at this moment, the World Trade Center disaster is a recruitment strategy. If the U.S. government and the U.S. people do not understand that, and if they do not therefore proceed intelligently, craftily and carefully, the

recruitment strategy will likely work very well. It will work in almost direct proportion to the number of people we injure, kill and dominate through force.

It is hard to respond calmly. It is hard to find wisdom when one is so viciously attacked. But it has become clear to many people that the first mistake was to call our response "war." Those who attacked are criminals. This must be treated as crime. I urge everyone to read the eloquent essay by Hendrik Hertzberg in the Sept. 24 *New Yorker's* Talk of the Town section.

He writes, "The metaphor of war — and it is more metaphor than description — ascribes to the perpetrators a dignity they do not merit, a status they cannot claim, and a strength they do not possess. Worse, it points toward a set of responses that could prove futile or counterproductive."

For the fanatical terrorists desperate to translate the anger growing from their local distress into a global sense of alarm and a radicalized struggle, the World Trade Center surely stood out so strongly as a symbol not only because it was tall, but because the activities within it, like those in the Pentagon, are the ultimate globalizers, the large-system actions determining local events. These actions link the choices of grandma's mutual fund managers to the construction of dams in the Himalayas and the digging of iron ore in the Amazon. They ensure the flow of oil from largely Islamic countries to a people, us, with a bottomless, nearly hysterical need for it.

How is it possible to manage this vast activity of rapidly industrializing nations and an expanding international economy while ensuring local adaptations needed for ecologically healthy agriculture and healthy, stable communities? How can grandma's mutual fund grow in a way consistent with the needs of poor settlers in the Amazon or peace in the Middle East? Is it possible to maintain a petroleum-based agriculture and a petroleum-based economy consistent with a peaceful and ecologically livable world?

I believe that, whether we like it or not, just as it is not possible to "manage" global ecosystems, it is not possible to "manage" global society. Both are too complex. If we ask too much from, and if we try to control too much in such systems, we will introduce too many disturbances and too many conflicts between competing needs for the systems to continue as expected and accustomed. As environmentalists, we want to walk lightly on the earth because we respect it and love it. But part of that respect and love is founded on our awareness that other elements in that system have, for lack of a better term, a kind of intelligence embodied in their mutual evolution and adaptation to one another that is more subtle and complex than any substitute we can provide. The same might be said of the complexities of cultures and nations in their interaction with each other and with natural systems. We must walk lightly in the world as well as walk lightly on the earth.

Our attempts to manipulate people, events and governments in the Middle East have backfired over and over again. We backed a coup to place the family of the shah of Iran in power to protect our oil supplies. The brutality and corruption of his regime created a firestorm of reaction that has not yet calmed. We armed and supported Saddam Hussein for years in Iraq because he seemed like a secular moderate in a strategic position against increasingly radicalized religious regimes. We armed and trained many of the people who now have power in Afghanistan. What will it take for us to realize that we are not very good at this? We must give up the illusion that we know what we are doing when we attempt to manage events across great world regions.

As for alternatives, I have one modest proposal. While I don't have time to lay out the argument, it is surely clear that the main reason we have involved ourselves so heavily in the Middle East is because of oil. My modest proposal is that we move as quickly as possible to reduce our dependence on petroleum. The United States uses far more oil, and far more oil per capita, than other industrial nations with standards of living equal to or better than our own. We need to reduce that consumption to prevent its enormous environmental costs. We need to do so to reduce the dangers of global warming. We need to do so to free cities hostage of the automobile and restore their humaneness. We need to do so to create an agriculture that is more protective of soils and wildlife. And finally, as though we needed another reason, we need to do so because there is no credible way to ensure our continued access to the world's petroleum supplies without enormous costs of the kind we have just incurred. Great civilizations become shaky empires when their reach exceeds their grasp. We have clearly reached that point.

Class of '84

Phil Weaver. Former interns were encouraged to "warm up" the 25th anniversary Prairie Festival, and that is what the class of 1984 did.

Warm-ups were interns' regular morning discussions. At this festival, for an hour Saturday morning and an hour in the afternoon, the audience took a break from listening to speakers in the Big Barn and regathered in smaller groups to talk. There were five gatherings and topics. Interns from 1984 led three of them.

Six of that tight-knit group made it to the festival. Here they pose with family members.

Seated on the ground, left to right, are Walter Pickett, who was a plant breeder on staff in 1984, former intern Dana Price, Patsy Martin, her husband, former intern Tony Martin, and former interns Paul Adelman and Kirk Riley.

In the middle row are the Martins' children, Angie and Jacob, former intern Ann Zimmerman, Wes Jackson, Doug Calsbeek and his wife, Janine Calsbeek, a former intern.

On top are the Calsbeek children, Ann and John.

Seeing Pattern and Summoning Will

David W. Orr

Fanaticism consists in redoubling your efforts when you have forgotten your aim.
— George Santayana

In the immediate aftermath of the devastating terrorist attacks in New York and Washington, more than 90 percent of the U.S. public favored some kind of military action against the perpetrators. The president called the events an act of war. Some in Congress were ready to suspend a sizeable part of civil liberties to combat terrorism.

Those guilty of committing atrocities should be apprehended and punished. That much is clear. But little else is. This is a good time to reassess what underlies political discontent leading to terrorism, the vulnerability of modern societies, global poverty, and the relationship between these things and the deteriorating global environment. Why do so many of the poor around the world hate Americans? Why is the U.S. so vulnerable? Most important, what can be done to break the cycle of violence and lay the foundation for global security in the largest sense? That answer, whatever it may be, requires that we place the events of Sept. 11 into a meaningful context.

First, it is clear that they were remarkably cost-effective. For perhaps no more than a few hundred thousand dollars, the perpetrators used our equipment and facilities to cause hundreds of billions of dollars of damage, and to command the attention of Western media for months. They imposed a tax of billions more to pay for remedial actions and subsequent economic losses. We know that more devastating options throughout the United States, Europe and Japan are available to determined terrorists and to the merely deranged. Other attacks could involve suitcase nuclear bombs, chemical or biological weapons, and sabotage of basic services, communications networks, roads and industrial infrastructure. In such cases high-technology defensive weapons are worse than useless. At huge expense they create a false sense of security and preempt smarter, options that work.

From conflicts in Northern Ireland, the Balkans, the Middle East and dozens of other places, we know that there are points of no return where memory becomes myth, martyrs are deified, enemies are demonized, positions harden into bitterness, and disputes become perpetual. Inevitably, political discussions narrow to prevent lasting solutions to the underlying problems. Action and reaction displace logic, reason and justice, which is to say it is probable that a response in kind will trigger further violence. In such situations there is no possible victory for either side — ever.

Also, we know that the United States is the world's largest vendor of weapons, and that Osama bin Laden and Saddam Hussein once received U.S. military support and training. For 50 years the United States has engaged in political manipulation, trained and financed death squads, and funded repressive dictatorships. It has, thereby, contributed to a global pattern of violence and hostility.

This is not improved by the present U.S. administration choosing to ignore, violate and abrogate international agreements about climatic change, arms control, and chemical and biological weapons, but now demanding international cooperation. The United States cannot have it both ways. Either it is part of a global community or must act alone. If the latter, it will lose, and lose tragically, even if it can "win" a war with a particular terrorist.

Any effective response to the events of Sept. 11 requires that we comprehend, too, that the global economy has become highly stratified, with a small number of very wealthy at the top, and several billions, including some future terrorists, living in the desperation of extreme poverty. In this economy, corporations, with help from compliant governments, have created a tightly coupled world in which ecological, economic, political and technological effects of actions anywhere sooner or later touch everyone. It is a world vulnerable to disruption from a thousand sources. It cannot be sustained politically or ecologically. For all of the hype about freedom, the emerging world system is neither very free nor very democratic. It is, rather, governed by a plutocracy of distant and unaccountable corporations, global agencies like the World Trade Organization, and willing governments.

But in the end it is a world ruled by ironies of the sort that what goes around comes around. The United States aimed to be rich and powerful, and has made itself a very large bull's eye, more vulnerable and despised than most care to admit.

The events of Sept. 11, in short, dramatically underscore the clash between two kinds of fanaticism. On one side are those wishing to stop all change and freeze societies into extreme male-dominated and violence-prone theocracies ruled by the likes of the Taliban. On the other are the free-market fundamentalists who intend to change everything for everyone, everywhere, all the time. The one is a rear-guard protest against the modern world, and westernization in particular. The other is a global juggernaut driven by financial markets, technological dynamism and capitalism. It is easy to see the insanity in the former. But in more reflective times, perhaps the latter will be seen as the more sweeping kind of derangement.

In the no man's land between the acolytes of two fundamentalisms, good possibilities might be lost, and that of building a just, ecologically sustainable world society could recede into the background, making for a future ruled by fear and reprisal. If we are not to acquiesce to that dark future, it is time to re-examine old myths about

globalization, economic growth and national security.

What do those of us in the conservation community have to offer to such an effort? What powerful and unifying ideas do we have that might clarify the situation and help forge better policy? Failing to announce better possibilities, we risk becoming irrelevant, a quirk of history, in an increasingly militarized world divided into garrison states, fundamentalist sects, terrorist cells, drug lords with their armies and addicts, and global corporations with theirs.

We need not and should not be silent. In fact, we have a great deal to offer, beginning with a more coherent and accurate view of the world that could provide the foundation for more effective and humane governance, and smarter solutions to seemingly intractable problems.

In an ecological perspective, for example, there are few accidents or anomalies, only outcomes of systems and dynamics. Climate change and glittering malls, Calcuttan poverty and sybaritic wealth, biotic impoverishment and economic growth, militarism and terrorism, global domination and utter vulnerability are not different things but manifestations of a single system. Effective action requires, in Wendell Berry's felicitous words, "solving for [a] pattern" that is now global. There is no good way to separate policies for the economy, trade, energy and security from those affecting land use, climate, forests and soils. But to unify these requires the willingness to see connections and the ability to comprehend how a complex global system works. Eventually all actions of governments, including those to promote economic development and national security, affect natural systems and biogeochemical cycles, either compounding our problems or resolving them at a higher level.

The world community faces growing conflicts over access to fresh water, declining oceanic fisheries, climatic change, access to oil and other mounting effects of the loss of natural capital. The challenges of global poverty, feeding another 1 to 3 billion people, arresting climatic change, preserving biotic diversity *and* maintaining world peace will become more and more difficult, especially given the spread of the means of violence. In the 21st century no nation on its own can be secure, and no narrow definition of security will provide a foundation for safety. The idea of security must be broadened to include security for everyone against hunger, pollution, ecological degradation, poverty, ignorance *and* direct physical assaults. Anything less will not work for long.

Meeting human needs for food, shelter, sustainable livelihood and environmental preservation reduces the sources of conflict and the dissatisfaction that feeds terrorism. Real security will require a larger vision and the development of the capacity, international and local, to solve problems that feed violence, hatred and fear.

Second, an ecological perspective could help to dramatically decrease our vulnerability. The way we provision ourselves with food, energy, materials and water increases or decreases our vulnerability to system failures, terrorists, acts of God and ecological degradation. A society with many nuclear reactors is vulnerable in ways that one powered by decentralized solar technologies is not. Similarly, a society fed by a few megafarms is far more vulnerable to many kinds of disruption than one with many relatively smaller and widely dispersed farms. One that relies on long-distance transport of essential materials must guard every supply line. The military capability to do so becomes yet another source of vulnerability and ecological cost. In short, no society that relies on distant sources of food, energy and materials, or heroic feats of technology, can be secured indefinitely.

An ecological view would suggest more resilient and cost-effective ways to provision ourselves and create fewer targets for terrorists, while buffering us from other disruptions. An ecological view of security would lead us to rebuild family farms, local enterprises, community prosperity and regional economies, and to invest in the regeneration of natural capital.

We know how to design and build energy-efficient buildings, use current solar income, farm sustainably, rebuild greener cities and manage resources for the long term. The challenge is not know-how, but political will and leadership.

Third, I believe that we can help expose the lie in the assertion that "the American way of life is not negotiable." No way of life based on inequity, waste, economic exploitation, military coercion and a refusal to account costs fully is non-negotiable. Terrorists on Sept. 11 unilaterally negotiated the American way of life downward by several trillion dollars, and they could continue to do so. The question before the United States is not whether we can maintain a way of life based on imported oil and resources, great environmental damage and climatic change. We cannot. Rather the question is whether we can summon the intelligence to create a just, secure and sustainable prosperity that no terrorist can threaten and that threatens no other nation.

The ecological and security costs of military power are high and growing. But real security is more complicated. It has to do with the connections between the health of democratic institutions, the fair distribution of wealth, military power, *and* the protection of soils, forests and biological diversity.

There would be no better first step to ensure our security and that of others than a resolute announcement by President Bush that we will end our dependence on foreign oil — and all fossil fuels — by tapping the technological ingenuity to increase our energy efficiency and to harness solar energy. Thereafter our engagement in the politics of an unstable region might be by choice, not by permanent necessity. In the meantime we would have lowered our balance of payments deficit, reduced air pollution, created many new jobs along with the technological basis for a solar-hydrogen economy, reduced the emission of greenhouse gases and dramatically reduced our vulnerability.

Source: A. Lovins and H. Lovins. 1982. *Brittle Power.* Andover, Mass: Brick House.

The World Turned Upside Down

Maurice Telleen

First, three stories. The first one might be prettied up a little, the last one purely apocryphal, and the one in the middle sort of between. All contain an essence of truth. Their job is not to explain in detail, but to dramatize and crystallize.

> If ponies rode men and if grass ate cows,
> And cats should be chased into holes by the mouse…
> If summer were spring and the other way around,
> Then all the world would be upside down.

These are the words of the tune played by British military musicians as British troops and their Hessian hirelings surrendered to Washington at Yorktown, Va., on October 7, 1781. Lord Cornwallis and his men, both the homegrown and the hired, were caught between Colonial troops and the French on land and a French fleet offshore. The ships had wrecked Yorktown. Fires raged all about and death was everywhere, both civilian and military. Quite possibly the finest professional army in the world surrendered to what at a glance almost appeared to be a guerrilla force, but it was a superbly led and organized one. The British had thought they had the key in grasp to put down the rebellion five years earlier. That is when they took New York. The music was appropriate. The world had, indeed, been turned upside down.

Six and a half years before the surrender, Paul Revere rode to warn that the British were about to march on Lexington and Concord, way up in Massachusetts. His act was one of treason. The rider knew the penalty. The prescription for traitors was to be hung, taken down before they died, then disemboweled and their intestines burned before their eyes. The posthumous atrocity was to behead the corpse, cut the body into quarters, and mount the pieces on spikes for all to ponder. Barbaric practices have been stock in trade for people and governments all over the globe since we started keeping track of such things.

The third story is of an Englishman riding a train through the great basin of the Mississippi a couple centuries later and marveling at the abundance of it all. To no one in particular he was heard to mutter, "Damn George III." That was not a mean-spirited pun. George III was the stubborn monarch who, with other British politicians, had stonewalled the colonists' petitions. His prime minister resigned after Yorktown. A new government was formed to frame the peace, which was concluded almost two years later in Paris on September 3, 1783. George III later went insane.

On Sept. 11, 2001, the world was once more turned upside down. It has been upended time and again — sometimes by nature (go ask the dinosaurs), sometimes by the barnacles of time and complacency, but most often by humans. In many cases it ultimately takes the form of war, which by definition is merciless.

So to treat the events of Sept. 11 as unprecedented is not quite true. Some things about it were. The conversion of commercial airliners into guided missiles was unprecedented because airliners are relatively new. The scale of both the targets and the operation were stunning. The targets were symbolic. While the audacity was not new, the effect was. It was almost as though it were staged for television. It reminded people of movies!

But there was more old than new in it. The disregard for human life was not new. The suicidal nature of the hijackers was not new. The level of hatred that fuels such ventures was not new. The intrigue and secrecy of the undertaking was not new.

Our reaction, naturally, was one of shock, grief and outrage. President Bush's choice of the word "war" was not inappropriate. What that means in this case remains to be seen. There must be a response to assuage our hurt. The meek have not generally inherited the earth. Great societies produce warriors. They all have, as have we. But the nature of this conflict has also been turned upside down. "War" remains undefined in its particulars. So we turn to that maligned species known as the politician and hope for the best. Let it be a search for wisdom as well as a call to arms.

The question seems to be, "Why do they hate us so much?" Maybe for the same reason that the down-and-outers always resent the rich folks in the big house on the highest hill. Maybe because they feel their legitimate aspirations have been thwarted. Maybe because of our hubris born of decades of plenty, while others have grown up in refugee detention camps. And maybe because of that great old mischief-maker, fundamentalist religion. Nothing makes killing more palatable than a sense of holiness, with the promise of martyrdom.

Added to that combustible mixture is a new fundamentalist orthodoxy, globalization. This puts tremendous tensions on the established orders, economic, cultural and traditional. As Thomas Friedman argues in his book, *The Lexus and the Olive Tree*, "Finding the proper balance between the Lexus and the Olive Tree is the great overriding challenge of our times." To view the rush to globalization as fundamentalist might seem odd. But it is the recent prescription of choice for all that ails the world.

This tidal wave has stumbled on an old rock: "All politics are local." That rock has truth imbedded in it. Are nations, even regions, crazy to feel threatened by their loss of identity, culture and tradition? Are people who worry about a degree of self-sufficiency in food production, fuel and other mundane but essential things

Scott Bonta. Mabel Thaden and her mother, Ingrid, play by the supper line at the Prairie Festival.

Luddites? I don't think so. But this economic steamroller does seem to say, "My way or the highway."

A kinder, gentler British politics might have averted the Revolution, but the root causes would have had to be addressed before Lexington and Concord. We might be singing "God Save the Queen" instead of "God Bless America" but for that. And maybe not. It took a long time, but we have for some time considered ourselves brothers or at least kissing kin to the British, and repeatedly comrades in arms. With modern weaponry and science we no longer have that luxury of time to heal such grievous wounds.

Now we must have action, and I'm sure we will. This generation of politicians faces a herculean task. The catalog of possible horrors surpasses the military: deadly diseases planted in feed lots with thousands of steers, nerve gas deployed in subways, and on and on. We don't have 50 or 100 years to work out the kinks as we did with Great Britain. To meet this challenge without compromising inherited freedoms is going to be very difficult. But we must seek it. As for "eliminating evil," that is quite beyond the reach of any government anywhere, anytime. We will just have to do the best we can.

Prairie Dance

Patricia Schafer

Their wounded land asked them for slow, austere
Reserve. In silence, from sky-vaulted height,
They saw the evening's slow sun veil appear
And bend tallgrass in rhythms made of light.

At home their rhythms were the steady grind
Of hand-milled corn, the flare of gas-lamp's flame,
The patient kneading hands, the letters signed.
Then one, then some, then all the dancers came.

The hall, all ordered noise, skipped a beat.
A fiddler hummed the first note of the tune.
They danced in patterns grave, restrained and neat
Yet wild and glad. Their stillness came too soon.

Their being still together would not fill
The void stillness left. What's left? Will

The Experience of Being Alive

Mari Detrixhe

I follow the path through the eye-level big bluestem, Indian grass and switch grass, en route to the clothesline, a simple solar device banned by 35,000 California homeowner associations. No homeowner association would approve of ours, fashioned from scraps of metal by a family member after World War II, unless it be that of the wrens and bluebirds that make their homes in its hollow tubes.

My friend and mentor, Wes, called this morning — his demonstration of affection putting my German shorthair pointer Rex to shame. He had a favor to ask. Would I take Adam's place at the Prairie Festival under the topic, "25 Years in the World"?

"No," I answered. I met the age requirement, but other than that, what did I have to offer? I'm no scholar.

"Consider what you've been doing and thinking over the last 25 years. I'll call back in an hour." Who else but Wes would lay that on me?

Everything has changed. My 11-year-old son Ben and I were to have been in New York City this weekend on a long-planned trip. We postponed the trip, of course. Well, I thought, at least I'll get to see my friend Adam at the Prairie Festival. But now Adam is in and out of the hospital and I am taking his place. *Life is.*

As I stand at the clothesline, I ponder what it is that I have to share with others. Twenty-five years in the world. Ten as energy and environmental activist with The Land, and an energy consulting firm, and the Kansas Natural Resource Council. Fifteen as homemaker, and family and community member.

In the fall of '86, I moved to a farm near Clyde, married Ed, and entered an unfamiliar private life. I landed in an intricate web of farm, family, and community relations. I knew nothing about farming — at least nothing practical. And I knew no one other than Ed and his family. However, everyone soon knew me by name. An outsider in a small town gets noticed.

A year later, my friend Marsha asks about my insights in this new life. I don't know. They're not exactly appearing in packaged form. I struggle to relate to Ed, and I struggle to define myself in this new place. My imagination seems to be limited by my past experiences.

Even so, deep down, I have made a *commitment* to stay.

Through these days, I think of a quote by Wendell Berry from his essay "Poetry & Marriage":

"It may be that when we no longer know what to do we have come to our real work and that when we no longer know which way to go we have begun our real journey. The mind that is not baffled is not employed. The impeded stream is the one that sings."

I begin to perceive the importance of detachment. It's not about you, Mari. Yes, the move is humbling. Gradually I become more comfortable with that and trade my director/founder-type titles for homemaker and get to work.

Together, Ed and I build a solar home, and plant gardens, an orchard, vineyard and nut groves. Ten years earlier, Ed had begun to create wildlife habitat with grasslands, woodlands, and ponds. With our new home, our new life together, my life starts to make sense.

• • •

The monarchs are staging for migration. As Rex runs ahead through the cottonwood-willow draw, dozens, maybe thousands of monarchs lift into the air, their warm colors vibrant in the late sun. I love the seasons. The departure and return. The spiraling of time. My spiral here, at my home, has twelve circles rising. In '96, I saw over 1,000 monarchs on a single cottonwood tree.

Each day I walk the paths for a half-hour or more with Rex, no matter how full my day is, no matter what the weather. Sure I could save time by skipping the walk now and then, but time is life, not to be "saved," but to be experienced.

I think about the difficulty of those first few years. It was like picking cherries. You climb the ladder with a bucket in hand and start to pick. Within five minutes you are *crawling out of your skin* as you compare the pittance of bucketed cherries to the abundance on the tree. The urge to consider the picking "not worth it" is overwhelming. But at some point you stop fighting your circumstances and *surrender* to the task. And soon a marvelous realm opens where time does not exist.

And what does one surrender? Ego, for sure. ("I didn't get a college education to do this," one friend told me.) Expectations is another. *Life is. Be there.*

The rural life requires this type of transcendence — going beyond our limitations. The most basic difference between rural life and the rest of the culture is that we do not pick up and move on. This is it. And that is *hard.* It places hope in a different context. Not "maybe the next place or the next job will be better." Hope has to be about what is: "Maybe I have not yet perceived all that is."

This morning a strong north wind is blowing. The monarchs that rise up struggle in the wind. I look more closely about me. Many of the cottonwood "leaves" are monarchs hanging tight to the branches.

• • •

In the fall of 1990, Ed and I are en route to the Manhattan hospital for the birth of our son. By the time

we get to Keats, my back is aching severely.

"Can we stop somewhere so I can walk?"

Ed screeches to a halt at the side of the road.

"Uh, somewhere a little nicer, perhaps?"

He drives to the city park where magnificent burr oaks tower over the grounds. While I walk, Ed studies the trees. Later that day, Ben is born, and that evening Ed is planting acorns in our backyard. A junior burr oak of unparalleled beauty and stature now shades our patio.

Technically Ed and I are wheat farmers, but in fact we're horticulturists. Ed has planted thousands of hardwoods on our land — oak, hickory, walnut and ash. Planting trees is a curious undertaking. For years they provide no shade, no wind protection, no beauty and no income.

Perhaps someday these trees will provide a living for someone. But the trees are planted for their own sake, an action not measured in conventional or practical terms.

One other thing about trees: I believe Ed is the only farmer in our area who can be seen kneeling in his fields.

• • •

The fungi are thriving this week: The bizarre spiked ones in the burr oak patch, the flat-topped ones in the willow-cottonwood draw, the button ones with no apparent stem on the other side of the pond.

The first fall rains have come. Almost 2 inches fell last week and it's raining now. Trouble is, it's time to plant wheat. The ground is slower to dry out as the nights cool. By the sound of this rain, we won't be in the fields for another week and a half.

It's utterly embarrassing to drop in at the Coastal Mart in Clyde during morning coffee without having read the rain gauge. But we also are attuned to the level of sunshine with our solar home, the amount of wind with the clothesline, and the air pressure with my winemaking.

We long ago abandoned the notion that time is money. Neither of us value our work by the hour. Yes, we need to ensure our survival, but our greater concern is with the intrinsic value of the work. *Time is life, and life is to be lived fully.*

What is a jar of jam or a loaf of bread worth? I can't pencil it out even if I want to. Nothing in the stores tastes as good. This summer our plum trees bore their first crop. As I bit into my first, juicy plum, the world stopped. *This* is *a plum.* A distant childhood memory rose up within me and I remembered that sometime, a *long* time ago, I had eaten a fresh, flavorful juicy plum.

• • •

I hear the pings of hail as I sit and write this evening. Fortunately it is not amounting to much.

I remember April of 1991 when Ed was gone to the 3-I farm show: One-inch chunks of hail pound the roof, crops, and trees. While hail clunks ominously on the walkway and glances off the windows, I hear an eerie, primordial sound. A dozen cormorants circle repeatedly overhead. I hold Ben in my arms as we watch these birds land, settle on the pond, and take a beating.

When the storm ends, the cormorants move quickly to make their departure. I soon understand why they've not been here before. Each requires the full length of the pond to gain enough speed for the ascent. We watch as, one by one, they head down the runway.

I gather some hail and put it in the freezer to show Ed. Yes, we'd suffered damage, but nothing like what we would experience the next summer when winds reaching 130 mph would lift water out of the pond and rip the roof off the house.

Sometimes I understand Job's God. Nature terrorizes and torments with hail, rain, wind and drought. And then nature restores. All with indifference. Like Job at the end, we are overwhelmed with awe at nature's power. The sky in particular connects us to the eternal with its unspeakable power and beauty.

• • •

Four miles down the road from our home is Clyde, where 700 people live together at a bend in the Republican River. Together they maintain an attractive downtown, a grade school and a high school, an elevator and a noodle factory. The main street is paved in brick. Many homes are freshly painted and beautifully landscaped with flowers, trees and shrubs. The town boasts an arboretum, created and cared for by a group of its residents, and likewise, a recycling center that I've managed for ten years with the help of numerous volunteers. The city maintains a ballpark, a playground and a swimming pool.

Each morning, stories are traded over coffee at the Coastal Mart. The newspaper is a small town record for posterity what everyone already knows.

Small, healthy communities are woven together by their histories.

"Who is that?" my neighbor Vic asks her husband, Tom. Vic, too, is a non-native.

"It's George Elwood, Ric's boy. He married Joe Rousseau's daughter Ann, but she left him for someone in Salina, and then he married Lilly (she's a Blake), and they have five kids and the second one plays baseball in the minor leagues." That's a short response.

This is part of the intricate web I spoke of. At first I got to know people one by one, then by families. Now I'm in the spirit of Tom's answer. Ohhh. So Lilly is a Blake. Two large chunks of the puzzle come together with one piece of information. For many, the puzzle is nearly complete.

Despite Clyde's charm, its richness of history and story, and its quiet security, people have moved on. The city fathers and mothers mask this fact by tearing down decrepit houses so that the vitality and beauty of the community remain intact. But such tricks cannot conceal all. The counties in north central Kansas are losing 10-20 percent of their population each decade. Recently, the

Ford dealer closed his doors. Now the grade school must be closed.

We saw the dissolution of small town life coming. But we've been unable to stop it. Agriculture, its backbone, is consolidating at an overwhelming speed. Schools follow in the wake of this consolidation. Towns fold.

For 10,000 years, agriculture has supported village communities. It no longer supports the villages here or in many parts of the world. What will it mean to our civilizations to lose village life?

I believe village life is one of the best schools for understanding human nature. Here people of every age and every socioeconomic, intellectual and psychological background meet daily as workers and citizens, neighbors, parents and churchgoers, and do so for years.

I understand why William Faulkner chose to stay in the rural South, and why he never ran out of material. If I had the gift of writing, I could tell many stories which are better than any I could make up. There's the burly farmer who was crushed by a half-ton bale and the effect this had on many people. There's the girl saved from poverty only to return to it by choice through marriage. Or the mail-order bride who married our neighbor's son, inherited the farm within three years, and lost it in the next four. The children who struggle with insecure or threatening homes.

I know these people personally. I see the range of human character as revealed through their responses to change. I've learned, by listening and watching and doing, that not everything can be fixed. And I've learned that most people are neither good nor bad, but a complex mix of these qualities. And that courage is a rare and noble virtue.

This past year, communication and trust broke down in our community when the Clifton-Clyde school board voted after four months of secret debate to close the Clyde grade school. As the community protested and organized a vote, the fabric of life was torn by discord. Neighborliness chilled. The community polarized and old friendships were paralyzed. I thought of Vichy, France. When the vote came, Clifton and Clyde voted 2-1 to keep the school open. All three administrators resigned — but the papers did not print this news, because they had been intimidated by the administration to print nothing but district press releases.

I have faith in people as a whole. With open, honest communication and time, people can process an issue. I started a newsletter in April to address individuals' concerns about the school, to unearth facts, and to shine a light on the decision making. No one was to be vilified, but rumors would be verified or corrected. Critics needed to be acknowledged and their ideas explored. Towns are built on trust, and trust had to be restored.

In five months we've made progress in moving from villains and heroes to a guarded appreciation of each other as flawed human beings. The former board president has a deep care and understanding of our school system's plight, but he also has a hot temper and distrusts others. Flawed, like the rest of us. I feel fairly confident we'll achieve a rough consensus by next April and deal with our fate.

• • •

As we move from the world of the particular to the world of the abstract, we should feel some tension and uneasiness. Is my own garden cultivated? What are the unintended consequences of my policies and actions? I will touch on two other sources of tension.

Wes has spoken often of the duality that pervades our thinking, especially since Descartes. Duality is actually the cornerstone of the Western religions, Christianity, Judaism and Islam. Good and evil stand separate and clear, in contrast to the intermingling life found in the Buddhist yin and yang, each carrying within it the seed of the other. An outgrowth of this bifurcation is morality — siding with what is right. All three of these great religions are fundamentally moral and produce fundamentalists, as we call them. (Has anyone ever heard of

a Buddhist fundamentalist?) The more we separate right from wrong and side with what we deem right, the more self-righteous we become.

We say we want the dualities made whole, but I guarantee you that will bring tension: Meet the God of Job. A powerful God, an allegedly just and loving God who, however, was indifferent to the sufferings of his loyal servant.

Good and evil *are* intertwined in the whole. Alexander Solzhenitsyn gives this idea a troubling immediacy with these words:

"The line separating good and evil passes not through states, nor between classes, nor between political parties, but right through every human heart — and through all human hearts."

How does one live with this? Truth, a beloved ideal, often avoided, is entered through the twin portals of paradox and confusion. If we wish to take this path, we have no choice but to live with tension and complexity.

The terror we recently experienced in this country provides illustrations of good and evil intertwined in flawed humanity. Two moral cultures clash. Granted, the morality of the terrorists has gone awry as the extreme of hate has produced criminality — not unlike the anti-abortionist who murders the doctor. But the terrorists' actions emanated from a moral center. They believed in their righteousness to the extent that they were willing to lay down their lives for that belief! The power of such an action is nearly unfathomable — we witnessed its horror.

Moments later, many risked their lives to save lives. I think of the two men who carried the wheelchair-bound woman down from the 86th floor to safety. Were they the first to see her? Did others pass her by?

Within the hour, several men aboard Flight 93 chose to violently attack the terrorists aboard their plane. How could they have succeeded if they had not been violent?

Above: Scott Bonta. Prairie Festival participants break away from speeches at the Big Barn and circle for one of five simultaneous discussions, this one on ecology and religion led by 1990 intern Kathy Scharplaz.

These terrorists were ready for martyrdom, and *their* power would have to be met with a *greater* power. All on board died, but numerous lives were saved.

We ask, "Why do the terrorists hate us?" We learn that they hate us for who we *are,* but that our one *act* that cuts deepest into their sense of right and wrong is our presence in Saudi Arabia, country of their holy lands.

Meanwhile, the people of America fear flying, and thousands of people have lost their jobs in related industries.

"Fly. Get back up in the skies. Show these terrorists that we will not be terrorized," we are told.

We will, in time, and the big sucking sound in the oil fields will resume, and new terrorists will be born.

It doesn't matter if we approve or disapprove of "the war." Do any of us travel less than 10,000 air or ground miles in a year? The restless monster demands food, fuel. We must sacrifice our youths to the Minotaur.

And yet there is more tension: Throughout the folktales, myths and religious stories of the ages, the protagonist is warned, "Do not go through this door. Do not go down that path. Do not eat the fruit of the tree of the knowledge of good and evil." Joseph Campbell describes these admonitions as "The One Forbidden Thing." And in *every case,* the protagonist does "the one forbidden thing." These stories resonate through the ages because they reveal eternal truths about humankind, unlike the fixed-up fairy tales of modern times. As I read hundreds of these traditional stories to Ben in his childhood, when the admonition came, we would glance at each other with a knowing look: "We know where this story is going."

Nuclear power. Chemical warfare. Genetic engineering. Do not go down that path.

• • •

Zeus would punish Prometheus for stealing fire from the gods. But first he would take revenge on mankind for accepting the gift of fire. He ordered his son Hephaestus, god of the forge, to make a woman out of clay possessing the beauty of a goddess. Hephaestus created the first woman, and the gods and goddesses bestowed her with gifts of exquisite beauty, musical talent and the skill of persuasion to make her pleasing to man. They clothed her in silvery robes with a garland of flowers and a golden crown, and named her Pandora, which means all gifted.

Zeus, too, had a gift for Pandora: curiosity. He then gave her a sealed jar that he forbade her to open.

Zeus presented Pandora to Prometheus' brother, Epimetheus, whose name means afterthought. Though Prometheus had warned his brother never to accept anything from Zeus, Epimetheus was captivated by this beautiful woman and took her for his wife.

Epimetheus and Pandora enjoyed their life together, but Pandora was disturbed by the presence of the sealed jar. *Why did Zeus give me this jar if he did not want me to have what it contains?*

One day she could no longer resist the desire to satisfy her curiosity. She broke the seal on the jar. Out flew a host of evils: disease and suffering, anxiety and envy, hatred and revenge. In horror, Pandora slapped the lid on the jar, but it was too late. The evils had been released into the world.

Only one thing remained in the jar: Hope. When Pandora saw this, she set Hope free to comfort mankind.

Hope is openness. It begins with openness to life as a gift: this day, this person with me, this moment. Hope begins with a life of gratitude. One soon discovers how rich one's life is, and the idea of material sufficiency becomes imaginable.

Hope can be found when we do the work that we love, and when we do it not with expectation, but for its own sake. As Joseph Campbell says, "Follow your bliss." That is the power in Wes' work, or Alice Water's. And it's infectious. Granted, *our* undertakings may not seem worthwhile at first. "I should be out there working for the cause." But no undertaking is more worthwhile to humankind than one done with love. We see that in the artistically crafted table, or experience it in the delicious meal, or feel it in the kind attention of a nurse who is fully there for you.

Stop, immediately, work motivated by hate. Nothing good will come of it, to you or to others. For years I pondered Wes' maxim, "Be careful what you hate, for that you may become." But over the years, I have seen this repeatedly.

Finally, be patient. Be patient, but attentive and ready. Open up possibilities with hope as Wes has done so ably here. Keep the skills alive, the open-pollinated corn planted. Keep informed. Remember the stories. And wait. When the time comes that people are ready, have courage and be there. Share the hope you have gathered.

Above all, *live* the life you have been given.

It is early fall, 1997. The air is crisp, but not cold. The hedgewood fire in front of us emits sparks like the Fourth of July as we watch from our circle of lawn chairs. Our neighbors, Tom and Vic, and their children, Laurel and Mic, have finished a cookout dinner with Ed, Ben and me, down at the creek. Bellies full, we're sipping on beers and sodas and telling stories. Above us, through the clearing in the tall ash trees, we can see stars against a midnight blue sky. A barred owl calls out: Who who, who-whoooo. We listen. Another farther down the creek echoes a response. As the rest of us visit, Laurel, a young girl who is passionate about swimming, turns to Mom: "(Sigh) This is better than Water World!"

As Joseph Campbell reminds us, "It is not the meaning of life that we seek, but *the experience of being alive*!"

A Second Origin of Grain Agriculture

Breeding perennial grain crops over the next 25 years

Stan Cox

This was last of three Prairie Festival talks under the heading 25 Years at The Land Institute, *including Marty Bender's summation of the Sunshine Farm project.*

I predict that at Prairie Festival 2026, a whole lineup of Land Institute staff members will be able to report, as Marty just did, on successfully completed decades-long projects, and that we all will be celebrating the confluence of our two main streams of research: agroecology and plant breeding, flowing together to form Natural Systems Agriculture.

We are already hauling water between those two streams, using our breeding populations of perennial grain-bearing plants in polyculture experiments, and using knowledge gained from those experiments in designing our breeding programs. But by the 50th Prairie Festival, our breeding programs will have developed perennial grasses, legumes and sunflowers with good grain yields, and we will know how to put them together to form a domestic prairie. Although breeding is only one tributary of our research, we now recognize that without a lot of breeding work, we will never see Natural Systems Agriculture producing food across the landscape.

But if we succeed, it will constitute a second origin of grain agriculture. In the first, 10,000 years ago, humans in southwestern Asia started saving and planting some of the seeds they gathered from annual grasses and legumes. They became not only the first farmers, but also the first plant breeders, and over millennia they and others around the world accomplished the amazing transformations that produced wheat, corn, rice, beans and many other species.

Why was it annual plants that they domesticated? Because they were abundant at that time, the end of the Pleistocene Ice Age, they had the biggest seed, and, being annuals, they lent themselves to cultivation and sowing — the very activities that began the process we call civilization.

Humans also selected some tree species — perennials, of course — to produce food. But they didn't select herbaceous perennials for seed production. To this day, we humans obtain the majority of our calories from the seeds of annual grasses, with much of the remainder coming from annual legumes and oilseeds.

If we are to usher in the age of perennial grain agriculture, we won't have 10,000 years available this time for breeding the requisite crops. But, luckily, much of the work has been done for us. We have techniques for merging the genomes of some perennial species with those of genetically similar annual grain crops, taking advantage of the efforts of Neolithic farmers, who selected mutant genes that paved the way for domestication: genes for seed retention, large-seededness, synchronous maturity, threshability, food quality, etc. We also can make use of the genetic improvements in productivity made by modern farmers and plant breeders. Our goal is to combine the grain-production traits of annual species with the perennial growth habit.

With the exception of a perennial grain sorghum breeding program, efforts at The Land Institute over the past 25 years have been directed toward the study and domestication of native prairie species. And we will continue to work on domesticating perennial species. However, where hybridization with annual species is possible, we will follow that route. I encourage you to take the self-guided tours described in the Prairie Festival booklet. The booklet will give you the details of our work on perennial crops: wheat, rye, intermediate wheatgrass, sorghum, sunflower, Illinois bundleflower and others. You will note in going through that booklet and the tours that our breeding work has not supplanted out studies of natural systems and agroecology. But the biggest expansion is occurring in the area of breeding.

In any discussion of breeding perennial grain crops, the question of biotechnology always comes up, usually within the first five minutes. To answer it, I'd like to use Wes' terminology and divide research tools into two groups: the descriptive and the prescriptive. Many genetic techniques have been developed during the past two decades that allow us to peer into cells with greater and greater resolution, so that we can determine the genetic constitution of a plant or population in which we are interested. These *descriptive* techniques, such as so-called chromosome painting and molecular markers — like mileposts along the plant's chromosomes — will be extremely useful as we work with crosses between different species.

Where biotech has gotten into trouble is in trying to become too *prescriptive*, most notoriously with the deployment of transgenic plants — so-called genetic engineering. If we are going to use nature as our standard in designing food production systems, we had better use nature as our example in breeding plants to grow in those systems. We cannot expect to breed varieties that function well as parts of an ecological mosaic by employing industrial methodology in the breeding program. Plants are not machines; we cannot envision an ideal plant in advance and then try to assemble it gene by gene. (Please have a look at my article in the summer *Land Report* for a more detailed argument against running a plant breeding program as a manufacturing process.) As an alternative, nature has refined the process of sexual reproduction, by

which whole genomes are recombined potentially in billions of new combinations. In nature as well as in a breeder's nursery, those new combinations are tested in the real world, in real ecosystems. In our research, we won't be telling the plants which genes and traits they need to survive and produce — they will tell us. Be assured: when it comes down to engineering vs. sex, The Land Institute chooses sex.

Twenty-five years ago this very month, just as The Land Institute was being born, I was beginning my graduate studies in plant breeding at Iowa State University. The Green Revolution was at its idealistic zenith. The genes in the cells of bacteria, plants and animals still belonged to those bacteria, plants and animals, and not to Monsanto. The majority of plant breeders at public institutions were sincerely attempting to work on the side of the small farmer.

Twenty years later, by the time I left my USDA wheat genetics job, few plant breeders still clung to the illusion that they could change the world for the better. The Green Revolution may have pumped up aggregate food production, but it also had helped widen the gap between rich and poor, and was unsustainable. Plant varieties and the genes within them had become commodities themselves, and not a means to a socially useful end. Corporations were stealing and patenting indigenous plant varieties and knowledge from Asia, Africa and Latin America. Research money was diverted largely into biotech products and processes, and agribusiness heavily influenced not only the research agendas of seed companies, but also those of state, federal and international institutions. Universities were in the business of selling germplasm, and many public plant breeders were working more or less on commission, releasing new varieties and earning a cut from every bag of seed of sold. Farmers were getting left in the dust, as always.

In 1996, I thought I was leaving plant breeding for good, but four years later, I saw an opportunity to participate in a new kind of agricultural research here at The Land Institute. It is a new kind of research because it assumes that agronomic, cultural and economic systems can and must change. A pollination being made today, even in an established annual crop species, may put a variety into a farmer's field only by the year 2015. Our task of breeding perennial grains will take somewhat longer. Given that time lag, I maintain that no plant breeder should step into the greenhouse or field nursery intending to breed varieties for today's conditions. We can't be sincere in hoping and working for a better world if we are doing research to prop up the old one. It is no longer enough for plant breeders to say, "We are working to help the farmer survive and maybe even prosper *today*." To do so is to help a million farmers overproduce so that five grain companies can grab their bushels at the lowest possible price. To do so is to select wheat varieties resistant to fungal diseases or corn hybrids resistant to rootworm, so that farmers can continue to plant the same species in monoculture on the same ground year after year. To do so is to select varieties tolerant to acid soils because farmers are forced to deplete their topsoil and apply acid-forming fertilizers. To do so is to select wheats resistant to leaf rust so that we can continue to grow a solid carpet of wheat from south Texas through the Canadian prairie. To do so is to breed Roundup-Ready soybeans because farmers are being pushed into that system whether they like it or not.

Here at The Land Institute, we are going to develop crops that will hold the soil in place, thrive in a diverse agroecosystem, and provide a good quality of life to people who grow them as well as to those who eat them. But mere plants can't do everything. Something must be given up. For example, these plants will not increase the share prices of agrochemical companies or help farmers become more productive wage workers or support animal factories. So, when people ask, "How long will it take you to breed perennial grains?" I tell them, "It's the job of you, and me, and all of us to demand and work for new priorities in agriculture and in society. By the time we have an economic system that benefits the land, the people and communities living on the land, and the people who eat what they grow — and lets agribusiness fend for itself — I assure you, by that time, we'll have the polycultures of perennial crops ready to go."

I sincerely believe that the profession of plant breeding needs Natural Systems Agriculture every bit as much as NSA needs plant breeding. NSA will let plant breeders make crosses and selections that can change the future, not just backfill against mistakes of the past and present. With The Land Institute and our handful of cooperators setting an example, I am confident that we will draw plant breeders, geneticists, ecologists, agronomists and folks from dozens of other disciplines from around the nation and world to this kind of work — and we need as many of them as possible if we're to meet our goals.

When you begin a plant breeding program, no matter how well planned, you cannot predict where it will lead. Imagine traveling back 8,000 years in a time machine, to Central America, with a big old ear of hybrid corn, and showing it to a person who had just decided to save and replant some seed from a wild grass called teosinte. She would certainly view you and the corn as alien species, and would never imagine that she herself was starting a process that would lead one day to the strange object you held in your hand, much less the corporate empires it supports. Likewise, we can't know precisely where our current research will lead — but we will have 8,000 more years of lessons and blunders to learn from.

I don't know how many of us will still be around for Prairie Festival 2026, but if you are one of those participants, sitting down to a tasty breakfast of perennial sorghum pancakes and sunflower/bundleflower patties, don't be surprised if there is plenty of chuckling around the table over how, back in 1976 and in 2001, we had had no idea the size of the revolution we were setting in motion.

Scott Bontz. The Prairie Festival supper served franks made from organic cattle raised by 1976 intern Nancy Voglesberg-Busch. At left is Land Institute farm manager John Mai. At right is general manager Ken Warren. At center is board member, rancher and frank cook Pete Ferrell, dressed to grill.

A Debate on the Science and Ethics of Genetic Engineering

Land Institute senior scientist Stan Cox debated the genetic engineering of food plants May 20 at the Unitarian Universalist Fellowship of Manhattan, Kan. His opponent was a friend and former co-worker at the U.S. Department of Agriculture, Dick Beeman. The two prepared a text for audience members to study. Here it is, edited for length.

Beeman: Welcome and opening statement

Our subject today is the genetic modification of food. Are genetically modified crops safe? Is genetic modification ethical? Is it even necessary? And what the heck is it, anyway?

The genetic modification of plants is the use of biotechnology to take a carefully chosen gene from any source – a virus, a bacterium, another plant, a fish, a mammal, even a human – and insert it permanently into the genome of a recipient plant to confer a useful trait that could not be conferred as quickly or, more likely, could not be conferred at all by conventional breeding. Such traits include resistance to herbicides so weeds can be selectively killed without hurting a crop, resistance to plant pathogens, resistance to insect pests, toxicity to insect pests, and enhanced nutritional properties. Examples of biotech foods are Flavr Savr tomatoes, golden rice, Starlink corn and Roundup-Ready soybeans.

Americans want perfect, unblemished, insect-free fruits and vegetables. This requires pesticides. But they also want natural, clean, risk-free, chemical-free fruits and vegetables, grown in environmentally balanced, diversified ecosystems — organic farming. They want high yields and an unlimited food supply, uniform and standardized, easily available, but this requires pesticides and crop monoculture. Biotechnology may provide solutions, but it may have downsides as well.

Beeman: Introduction

The most common transgenic crop is the soybean, followed by corn, cotton and canola. In 1999 transgenic varieties made up about half the U.S. soybean crop and about 25 percent of the U.S. corn crop. Engineered soybeans and canola tolerate Roundup herbicide. Engineered corn, cotton and potato produce the *Bt* toxin, which provides resistance to certain insects.

Here are answers to a few of the unfounded myths and fears of biotechnology opponents:

Myth: "Transgenic insecticidal crops are dangerous to the environment, human health and nontarget organisms." The most widely used transgene, *Bt*, produces the *Bt* toxin, a favorite among organic gardeners. It comes from a naturally occurring, insect-killing soil bacterium called *Bacillus thuringiensis*. It is mentioned favorably in Rachel Carson's famous 1962 book *Silent Spring*, which launched the modern environmental movement. She considered *Bt* an environmentally safe alternative to man-made chemicals.

Myth: "GM crops will disrupt the natural ecology." But how "natural" is our agronomic ecology? Only a handful of significant field crops grown in North America are native here: blueberry, Jerusalem artichoke, sunflower and squash. If you saw the tomato, broccoli, strawberry, potato, corn, wheat or most other crops as nature intended them, you would not recognize them. Traditional breeding completely disrupted the natural ecology long ago.

Fear: "Pests will develop resistance to GM crops." Probably true, but this is no reason to reject biotechnology. Insect pests have routinely developed resistance to insecticides and overcome the defenses of traditionally bred resistant plant varieties. Wild plants evolve natural insecticides, and insects evolve resistance to those natural insecticides.

Fear: "Transgenes will escape into weeds and wild relatives of crops." That could happen, but plants and animals have traded genes with viruses and bacteria for millions of years. Although no one knows the real risks of any endeavor, there is no plausible scenario that suggests danger from transgene escape. All genes transferred to GM crops are naturally occurring genes or slightly modified versions of those genes. Genetic mutation occurs naturally every second.

Myth: "GM crops are unnecessary." In truth, the potential benefits of GM crops are enormous – nutritionally enhanced food, disease- and insect-resistant plants, plant factories for production of medicines, even caffeine-free GM coffee! Some examples of promising GM crops already produced or under development are potatoes containing a high-quality protein gene normally expressed in amaranth seed, virus-resistant papayas and anticancer tomatoes high in flavonones.

Cox: Introduction

Genetic engineering is only one of many threats to our environment, health and economic well-being, but it receives a disproportionate amount of attention because of the great benefits it supposedly promises humanity. I believe transgenic technology is not needed to solve any of our problems, that it in fact will divert us from finding real solutions. It is "single-gene" technology, a mere extension of the "single-molecule" approach to humanity's problems. We have seen single molecules such as insecticides, herbicides, antibiotics and food additives fail as long-term solutions. They have failed because the problems of agriculture, human health and

the environment are too complex to be knocked out with a few molecules.

When transgenes have small effects, they give insignificant results. When they have dramatic effects, they are blunt instruments. Releasing synthetic chemicals or radioactive elements into the environment, while undesirable, has largely predictable results: There is a finite amount of the material, and its rates of movement and breakdown can be tracked. A gene is different. Genes cannot be confined, and their behavior when moved among species cannot be known in advance.

Techno-cheerleaders will say, "But it's worth the risk when humanity's survival is at stake." But will biotech be our savior? For 20 years we have been told that biotechnology would increase crop yields to feed a growing population, overcome pests and weeds — thereby decreasing the use of chemicals — and save the family farm. Let's ask, "What is the record after five or more years?" It isn't pretty.

Independent studies have shown that, compared with non-transgenic crops, transgenic crops have:

• Seen equal or greater use of herbicides and insecticides.

• Spurred the evolution of weeds resistant to herbicides and insects resistant to insecticides, just as happens when chemicals are sprayed or traditional resistance genes are used.

• Produced equal or – more often – lower grain yields.

• Produced equal or lower profit per acre for the farmer.

So what are transgenic organisms good for? They are ideal for enforcing corporate intellectual property rights, and, in fact, this is the *primary* reason so much money has been invested in biotechnology. Inserting one gene into a wheat plant's genome is equivalent to inserting one meter of pavement into Interstate 80 between New York and San Francisco. But on that one meter, a company can construct a toll booth that controls ownership of the entire highway.

Cox: Corporate control of agriculture

Vertical integration of the poultry industry is almost complete, with the farmer now serving simply as a wage hand, raising Tyson's chickens on Tyson's inputs and sending the finished product back to Tyson. Because grain-crop farmers can save their own seed, corporate America has often been frustrated in its attempts to fit grain agriculture into an industrial model. Transgenic crops like Roundup-Ready soybeans and *Bt* corn and cotton are the latest in a long series of attacks on farmers' independence.

Here are some excerpts from a contract that farmers sign when buying the seed of Monsanto's Roundup-Ready soybeans:

"Grower may use (the seed) ... for planting one and only one soybean crop."

"Grower may not save any of the seed produced from the purchased seed for ... planting."

"If the Grower uses any glyphosate-containing herbicide ... the herbicide will be Roundup branded herbicide or other Monsanto glyphosate-containing herbicide."

"Grower grants Monsanto ... the right to inspect and test all of Grower's fields planted with soybeans ... for the following three years."

"Grower shall pay ... a technology fee of $5.00 ... per unit (50 lbs.)."

What are the benefits to the farmer who signs this? Sixty percent of soybean acreage is now Roundup-Ready. In 1998, herbicide use was 30 percent higher on RR fields than on non-transgenic fields in Iowa and five other major soybean-producing states, and 10 percent higher in three others. Twenty million more pounds of herbicide active ingredient will be sprayed in 2001 because of RR. RR soybeans yielded 5 to 10 percent less than normal in research trials. Roundup sprayed on transgenic soybeans apparently depresses nitrogen fixation and lowers production of phenylalanine, which is involved in plant defense against pests or drought.

Iowa farmers planting corn-borer resistant *Bt* corn spend as much on insecticides as non-*Bt* farmers. Corn borer is only one pest that attacks the crop, and when farmers invest thousands of dollars extra in seed, they tend to protect that investment by spraying "just in case." And *Bt* genes have not stopped cotton farmers from applying huge amounts of pesticides, which have been needed for many years to protect that species.

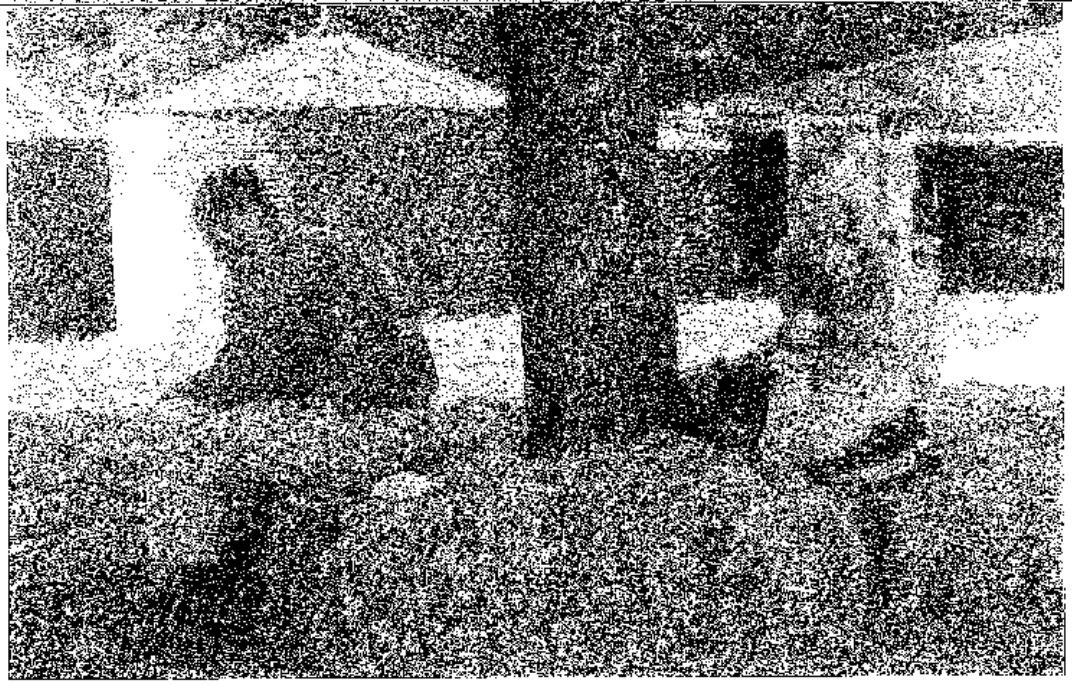
Beeman responds:

The current epidemic of biotechnophobia is largely faith-based. It also reflects a prejudice against corporations. It is not science-based. You can't judge the potential value of a commercial product based on the motives of the company that produced it. GM crops are perfectly compatible with a diversified agriculture. Many idealistic scientists are working on GM crops at universities, in government and nonprofit institutions, as well as in agribusiness.

Of course it's true that all those greedy agribusinesses that Stan worries about could use patents and license agreements to monopolize the sale and distribution of GM crops. This might in some cases delay or temporarily restrict the free dissemination of GM varieties to all who want or need them. But this need not always be so. Some genetically improved transgenic crops are donated to poor countries. Such varieties, if they have improved nutrition or virus resistance or insect resistance, could nudge many Third World farmers out of poverty.

Even greedy agribusinesses are sensitive to public opinion. Monsanto has recently given up all rights to GM virus-resistant sweet potato and is distributing the plant to developing countries. Stan might argue that this is a publicity stunt, but the poor farmers who receive this plant will benefit regardless of Monsanto's motives.

Much criticism has been aimed at agribusiness for developing "terminator" technology. This involves GM



crops that produce seeds that can be used as grain but will not germinate to produce a new crop. Farmers cannot save such seed and plant it the following year, but must buy new seed each season from the company. This is patent protection built right into the plant. By condemning terminator technology, the technophobes reject a potential solution to one of their worries: development of new noxious weeds. Terminator genes could prevent possible escape of transgenes into weeds or wild crop relatives. But if technophobes have their way, this innovation will never be used.

Beeman: Effects of GM on crop diversity and a balanced, ecological approach to farming and consumer nutrition

The argument: The greater the crop diversity, the less likely a pest or disease will sweep through fields and devastate a crop, since pests and diseases tend to adapt to particular crops and even particular varieties within a crop species. It's the same for human nutrition. A diverse diet promotes balanced nutrition. In other words, anti-biotech activists would say, "Don't improve the disease resistance or pest resistance of potatoes or rice through biotechnology. Instead, plant a diversity of crops so you won't lose everything to a particular disease or pest outbreak. Don't improve the nutritional value of potatoes or rice through biotechnology. Rather, encourage a more varied diet."

Many – including Stan, I expect – even oppose golden rice, which has been genetically modified to provide vitamin A precursors (beta-carotene and other pre-vitamin A nutrients which are rapidly metabolized into vitamin A in the human body). I maintain that golden rice is a fine example of the benefits of GM food. Rice is the most important grain on earth. Unlike wheat, maize, cassava or beans, the rice grain is devoid of vitamin A, and the genes needed to produce it cannot be introduced by conventional breeding and selection. Two hundred and fifty million children under age 5 suffer from vitamin A deficiency. Each year, almost half a million children become partly or totally blind from the deficiency, and many die, according to the World Health Organization.

Many of these people depend on rice. In 1999 Swiss scientist Ingo Potrykus and his colleagues from the Swiss Federal Institute of Technology and the International Rice Research Institute in the Philippines succeeded in creating transgenic "golden rice," the first time vitamin A precursors have been expressed in rice grains. How have the ecobabblers responded? That "GM crops are dangerous, unnatural and immoral … let the children die of vitamin A deficiency. At least their diet will be as nature intended." Or they say, "Let them eat carrots." The problem is these people don't have carrots.

Cox responds:

We have so many insect, disease and weed problems in crops because single species, varieties and hybrids are sown over vast acreages, often without rotation. Quick fixes like *Bt*-toxin genes make it more attractive – even essential – for farmers to sow monocultures and ignore ecologically sound management, exacerbating other problems while never addressing the basic causes. Genetic engineering is not just a benign alternative to innovative new agricultural practices that really can enrich the landscape and sustain people on the land and in the cities.

Dick offers a vivid example to illustrate my point: golden rice. The big problem faced by Asia's poor is not vitamin A deficiency; it's a lack of food, especially

Above: Scott Bontz. Some took in Prairie Festival talks from outside the Big Barn. George Potts, left, and Ed Judd.

nutritious food. Conversion of vast acreages to cash-crop agriculture, which drives farmers off the land and shrinks the number of cultivated crops, results in an impoverished diet for those who cannot afford to buy green and yellow vegetables or have no land on which to grow them. Many of these people cannot even get enough starch, protein or oil – generally provided by rice and legumes. Nothing short of social and economic transformation will fix this problem.

Suppose we do "fix" their beta-carotene deficiency with golden rice. We will feel better, but *they* will still face the problem of getting enough rice of any kind to feed their families. They will still be deficient in other vitamins because of the lack of vegetables. And they likely will still be vitamin A deficient: Beta-carotene absorption is dependent on sufficient fats and oils in the diet, and vitamin A metabolism is disrupted by protein deficiency.

Brown rice, which is rice with the bran and germ still attached, does contain beta-carotene as well as more oil and protein than white rice. But brown rice is universally shunned by Asians. No one suggests we tell Asians, "Hey, eat your brown rice, it's good for you." That would be paternalistic. But telling them to eat yellow rice is just paternalism of a different color.

Fifty-eight percent of the rice fields in India are sown to hundreds of different locally preferred varieties. Will any corporation or nonprofit research center transfer the beta-carotene gene into all of those varieties – a huge undertaking promising no profit – or will they say, "You grow our generic yellow rice or else go blind"?

Cox: Environmental and consumer safety

Here are some of the environmental and health consequences of GM crops and food so far:

• The press has widely reported that Starlink engineered corn containing potential allergens has ended up in taco shells. But did you know the gene coding the allergen has already spread to non-engineered corn via cross-pollination?

• Experiments have demonstrated that movement of engineered genes from crops to related weeds can occur easily in sorghum, radish, sunflower, rice, canola and pearl millet.

• You will hear that even if genes do spread, it's no problem. Even though they are supposed to create super crops or animals, alien genes paradoxically will, we are told, always weaken any nontarget species they get into. But then explain this: Australian scientists trying to sterilize mice by inserting an interleukin-4 gene accidentally created a mousepox virus so virulent that it wiped out all their mice, which had been vaccinated against it!

• Roundup-resistant canola is now evolving into a potentially devastating weed, with resistance to three different herbicides: Roundup, Liberty and Pursuit.

• Pollen from engineered corn has been shown to kill monarch butterflies. In addition, caterpillars feeding on engineered *Bt* corn have been shown to be toxic to the beneficial insects that normally help to control the caterpillars.

• Technophilic soothsayers claim that alien DNA, RNA and protein introduced into food will be destroyed in our digestive tracts. But bacteria in the guts of cattle managed to take up and incorporate alien DNA from cattle feed before it could be broken down by the cow's highly efficient gut. A canola gene was found in bacteria in the guts of bees in Germany. And what about Mad Cow disease? It doesn't involve GM food (so far), but the ability of little molecules called prions to pass through the food chain from sheep to cattle to humans and cause fatal brain infections in all three species should be a stern warning.

• Finally, if there really isn't any danger, what are companies like Monsanto trying to hide? A Nagoya University analysis of Monsanto's application for licensing of Roundup-Ready soybeans in Japan concluded:

1. Information disclosure was nominal.
2. There was incomplete analysis of the introduced protein.
3. Feeding experiments were insufficient.
4. "Wrong" data were neglected.
5. Interpretation of data was misguided.
6. "Monsanto, in their rush to verify safety, patchworked the results and analyses that are full of voids like a puzzle and asserted safety with manipulation of results."

Beeman responds:

One unfounded myth about agricultural technology is that "man-made pesticides are more dangerous than naturally occurring insecticides." The modern version of this myth is that "man-made gene combinations are more dangerous than natural gene combinations." Let's consider this claim. Glyphosate is the chemical that is sold under the name Roundup, among others. It is very safe compared with other pesticides. According to a study done at New York Medical College in 2000, glyphosate is "nonmutagenic, noncarcinogenic, nonteratogenic, has no effect on fertility or reproductive tissues or functions, either in chronic or subchronic multigenerational studies, and has no effect on endocrine modulation. ... It is concluded that under present and expected conditions of use, Roundup herbicide does not pose a health risk to humans."

Plants, including crop species, are full of natural toxins. Crucifers (mustards and cabbages) contain allyl isothiocyanate, goitrin and thiocyanate, which can cause goiter. Many plants contain pyrrolizidine alkaloids that can cause cirrhosis of the liver. Potatoes contain toxic solanines and chaconines.

Another GM food myth: "Transgenes harm nontarget species." Cornell entomologist John Losey exploited technophobia and hoodwinked an otherwise respectable scientific journal, *Nature*, by publishing in it a paper entitled "Transgenic pollen harms monarchs."

Losey in essence force-fed monarch larvae *Bt* pollen

in a no-choice test and, predictably, a few died. His irresponsible conclusion, eagerly exploited by Greenpeace, was that harmless butterflies are threatened by noxious transgenic corn. It's unlikely that a single monarch has had so much as a tummy ache from any transgenic crop outside Losey's laboratory. In fact, there is hardly any milkweed (the monarch's favored plant) in cornfields, and torrents of pollen do not rain down from corn plants onto nearby weeds. Losey's claims have been completely discredited by several recent field studies of pollen fallout in or near transgenic cornfields.

The monarch scare is part of a campaign against genetically engineered pest resistance in crops that ignores an obvious point: In regard to the safety of nontarget species, GM is vastly preferable to the alternative of blanket, indiscriminate aerial spraying of pesticides, which will definitely kill any monarch in the vicinity.

Another myth — actually a true statement but irrelevant to any health concern: "GM crops are potentially allergenic." The reality: Some proteins are allergens, including some found naturally in milk, peanuts and other common foods. It's impossible to predict which proteins will be allergenic. Every plant has thousands of proteins, and a few are allergenic to some people. In spite of claims, there is no evidence that any transgenic crop protein is allergenic. In fact, genetic modification of crops could actually be used to *eliminate* allergens naturally present in peanuts and other crops.

Beeman: Moral and ethical concerns

Now that we can snip any gene out of any species and paste it into another, the concept of species boundaries begins to disappear. There is little reason to worry more about moving genes between unrelated species than between related species. Much of the opposition to GM stems from a religious belief about the sanctity of species. This belief is a close cousin to the notion that species are "immutable." A species is actually a temporary state in the long process of evolution. Thus the argument really is about the pace of change. Yes, species do evolve, one into another, but on a geological or at least a very long time scale. So isn't it dangerous, say GM opponents, to create artificially a new species or new combinations of genes in an instant?

My answer: It is much more conservative to introduce a single, known gene through biotechnology than to introduce a whole set of unknown genes by conventional breeding, e.g., by crossing two species to make a hybrid. There is no scientific rationale for predicting dangerous consequence simply because the donor and recipient are unrelated species. We know a lot about the genes being transferred, and we have now acquired considerable experience with transgenes. No one has ever observed a dangerous interaction between foreign transgenes and native genes, and there is no theoretical basis on which to predict one. The worst-case scenario might be that a plant will be unviable because of some incompatibility with a transgene.

Cox responds:

As a plant breeder, I have often done unspeakable things to plants. Although I believe that much of plant biotechnology is *unethical* – for the many reasons I've just discussed – I don't have any basic *moral* objection to genetic manipulation of plants. Having said that, I respect the view of many people that moving genes among species that cannot mate sexually is like playing God and is morally wrong. Out of respect for those people, detailed labeling of GM food is absolutely necessary, just as we label kosher food or organic food.

Sentient beings – animals – are a different story. For many millennia, our ancestors killed and ate animals or used them as beasts of burden but, as a rule, did not torture them. The cruelty already widespread in corporate hog farms, feedlots, slaughterhouses and laboratories should be stopped; it should not be worsened by transforming animals into mere food or drug production units through genetic engineering.

And, finally, what about genetic engineering of humans? Almost everyone thinks that's immoral. But the longer our exposure to bogus studies purporting to show that human health problems are mostly genetic, and the more inured we become to those transgenes creeping closer and closer up the evolutionary tree toward us, the harder it will be to resist. Fortunately, gene therapy – that is, altering the genetic functions of individual humans but not their offspring – is turning out to be a flop, so we may have some extra time for morality to prevail.

Beeman's conclusion:

Stan and his technophobic buddies have disparaged the crudeness of the "single-gene" approach, as if these first successes with food biotech will be the last. But the single-gene approach is only the beginning. How would we have viewed the Wright brothers' achievements if we had judged them by the standards of modern aviation? In the case of golden rice, we have already inserted three genes, complementing and completing an existing, incomplete pathway toward vitamin A. The technology to introduce even more complex traits and to fine-tune them is almost upon us.

Technophobes fear runaway transgenes and "genetic pollution" – the possibility that crop transgenes can invade related weeds and nontarget species. Transgenes delivered either via biolistics (the gene gun) or *Agrobacterium*-mediated gene splicing in plants are completely stable and indistinguishable from native genes once inserted. This means that a transgene is no more likely to invade a weed than are any of the tens of thousands of genes already present naturally in the host plant. I concede that transfer of herbicide resistance from crops to related weeds should be a concern. Canola can hybridize with related wild mustards, and sorghum can hybridize with related weeds like Johnsongrass and shattercane. But even if genetically engineered herbicide resistance did transfer to these weeds, the worst-case scenario is that the herbicide might become ineffective.

That should please the back-to-nature crowd, because it will reduce dependence on chemical inputs. Most crops are not grown in proximity to related weeds, so this danger is minimal.

GM foods should be analyzed on a case-by-case basis, not subjected to blanket judgments. My analysis tells me that in almost every case, GM is a good and hopeful thing. I agree with Stan that we should get "back to nature": Let's not thwart the natural expression of human scientific curiosity and ingenuity. We can be cautious while recognizing that "zero risk" is neither possible nor desirable.

Cox's conclusion:
Surprisingly, Dick and I may end up agreeing on some points. I am sure he would agree, for example, that traditional, non-transgene plant and animal breeding programs should be encouraged, considering the food-production problems that lie ahead. Unfortunately, as the *New York Times* reported recently, plant breeding is moving fast from the public to the corporate realm, and corporations are moving most of their resources from breeding into biotech, because that's what they can patent. Breeding programs at universities and the USDA are being gutted. Says Dr. Margaret Mellon of the Union of Concerned Scientists: "I am worried that we are getting off the proven thoroughbred too quickly to get onto a highly decorated donkey."

Sadly, a ban on genetic engineering is unlikely. But people have a right to avoid planting, raising, buying or eating GM food. Believe me, if labeling is required, the widespread public aversion to genetic engineering will ensure that plenty of non-GM food is available. Dick and I may disagree on which details should go on a label; but he tells me that he has no objection to labeling.

More important, we need an immediate ban on the patenting of genes or DNA sequences. Genes do not come close to fitting the criteria in U.S. law covering patentable inventions. Let corporations prosper on the process patents that cover their gene-transfer methods, and not on claimed ownership of molecules that existed long before the first Neolithic farmer planted his first seed.

Even if gene patents are not outlawed, the corporate and venture capital on which biotech has survived for two decades will soon dry up – just as the dot-com money did. Genetic engineering cannot begin to deliver on its promises. It has followed the classic trajectory of all the bandwagons that have come and gone in the history of plant and animal breeding. Its patent potential has helped it endure a bit longer than most fads but its days are numbered. The sad thing is that before this bandwagon rumbles off into the sunset, it will have dealt serious blows to science, to the environment and to our food supply.

What Is Science?

George Orwell

In last week's *Tribune,* there was an interesting letter from Mr. J. Stewart Cook, in which he suggested that the best way of avoiding the danger of a "scientific hierarchy" would be to see to it that every member of the general public was, as far as possible, scientifically educated. At the same time, scientists should be brought out of their isolation and encouraged to take a greater part in politics and administration.

As a general statement, I think most of us would agree with this, but I notice that, as usual, Mr. Cook does not define science, and merely implies in passing that it means certain exact sciences whose experiments can be made under laboratory conditions. Thus, adult education tends "to neglect scientific studies in favor of literary, economic and social subjects," economics and sociology not being regarded as branches of science, apparently. This point is of great importance. For the word science is at present used in at least two meanings, and the whole question of scientific education is obscured by the current tendency to dodge from one meaning to the other.

Science is generally taken as meaning either (a) the exact sciences, such as chemistry, physics, etc., or (b) a method of thought which obtains verifiable results by reasoning logically from observed fact.

If you ask any scientist, or indeed almost any educated person, "What is science?" you are likely to get an answer approximating to (b). In everyday life, however, both in speaking and in writing, when people say "science" they mean (a). Science means something that happens in a laboratory: the very word calls up a picture of graphs, test tubes, balances, Bunsen burners, microscopes. A biologist, an astronomer, perhaps a psychologist or a mathematician, is described as a "man of science": no one would think of applying this term to a statesman, a poet, a journalist or even a philosopher. And those who tell us that the young must be scientifically educated mean, almost invariably, that they should be taught more about radioactivity, or the stars, or the physiology of their own bodies, rather than that they should be taught to think more exactly.

This confusion of meaning, which is partly deliberate, has in it a great danger. Implied in the demand for more scientific education is the claim that if one has been scientifically trained one's approach to *all* subjects will be more intelligent than if one had had no such training. A scientist's political opinions, it is assumed, his opinions on sociological questions, on morals, on philosophy, perhaps even on the arts, will be more valuable than those of a layman. The world, in

other words, would be a better place if the scientists were in control of it. But a "scientist," as we have just seen, means in practice a specialist in one of the exact sciences. It follows that a chemist or a physicist, as such, is politically more intelligent than a poet or a lawyer, as such. And, in fact, there are already millions of people who do believe this.

But is it really true that a "scientist," in this narrower sense, is any likelier than other people to approach non-scientific problems in an objective way? There is not much reason for thinking so. Take one simple test — the ability to withstand nationalism. It is often loosely said that "Science is international," but in practice the scientific workers of all countries line up behind their own governments with fewer scruples than are felt by the writers and the artists. The German scientific community, as a whole, made no resistance to Hitler. Hitler may have ruined the long-term prospects of German science, but there were still plenty of gifted men to do the necessary research on such things as synthetic oil, jet planes, rocket projectiles and the atomic bomb. Without them the German war machine could never have been built up.

On the other hand, what happened to German literature when the Nazis came to power? I believe no exhaustive lists have been published, but I imagine that the number of German scientists — Jews apart — who voluntarily exiled themselves or were persecuted by the regime was much smaller than the number of writers and journalists. More sinister than this, a number of German scientists swallowed the monstrosity of "racial science." You can find some of the statements to which they set their names in Professor Brady's *The Spirit and Structure of German Fascism.*

But, in slightly different forms, it is the same picture everywhere. In England, a larger proportion of our leading scientists accept the structure of capitalist society, as can be seen from the comparative freedom with which they are given knighthoods, baronetcies and even peerages. Since Tennyson, no English writer worth reading — one might, perhaps, make an exception of Sir Max Beerbohm — has been given a title. And those English scientists who do not simply accept the *status quo* are frequently Communists, which means that, however intellectually scrupulous they may be in their own line of work, they are ready to be uncritical and even dishonest on certain subjects. The fact is that a mere training in one or more of the exact sciences, even combined with very high gifts, is no guarantee of a humane or skeptical outlook. The physicists of half a dozen great nations, all feverishly and secretly working away at the atomic bomb, are a demonstration of this.

But does all this mean that the general public should *not* be more scientifically educated? On the contrary! All it means is that scientific education for the masses will do little good, and probably a lot of harm, if it simply boils down to more physics, more chemistry, more biology, etc. to the detriment of literature and history. Its probable effect on the average human being would be to narrow the range of his thoughts and make him more than ever contemptuous of such knowledge as he did not possess; and his political reactions would probably be somewhat less intelligent than those of an illiterate peasant who retained a few historical memories and a fairly sound aesthetic sense.

Clearly, scientific education ought to mean the implanting of a rational, skeptical, experimental habit of mind. It ought to mean acquiring a *method* — a method that can be used on any problem that one meets — and not simply piling up a lot of facts. Put it in those words, and the apologist of scientific education will usually agree. Press him further, ask him to particularize, and somehow it always turns out that scientific education means more attention to the exact sciences, in other words — more *facts.* The idea that science means a way of looking at the world, and not simply a body of knowledge, is in practice strongly resisted. I think sheer professional jealousy is part of the reason for this. For if science is simply a method or an attitude, so that anyone whose thought-processes are sufficiently rational can in some sense be described as a scientist — what then becomes of the enormous prestige now enjoyed by the chemist, the physicist, etc. and his claim to be somehow wiser than the rest of us?

A hundred years ago, Charles Kingsley described science as "making nasty smells in a laboratory." A year or two ago a young industrial chemist informed me, smugly, that he "could not see what was the use of poetry." So the pendulum swings to and fro, but it does not seem to me that one attitude is any better than the other. At the moment, science is on the up-grade, and so we hear, quite rightly, the claim that the masses should be scientifically educated: we do not hear, as we ought, the counter-claim that the scientists themselves would benefit by a little education. Just before writing this, I saw in an American magazine the statement that a number of British and American physicists refused from the start to do research on the atomic bomb, well knowing what use would be made of it. Here you have a group of sane men in the middle of a world of lunatics. And though no names were published, I think it would be a safe guess that all of them were people with some kind of general cultural background, some acquaintance with history or literature or the arts — in short, people whose interests were not, in the current sense of the word, purely scientific.

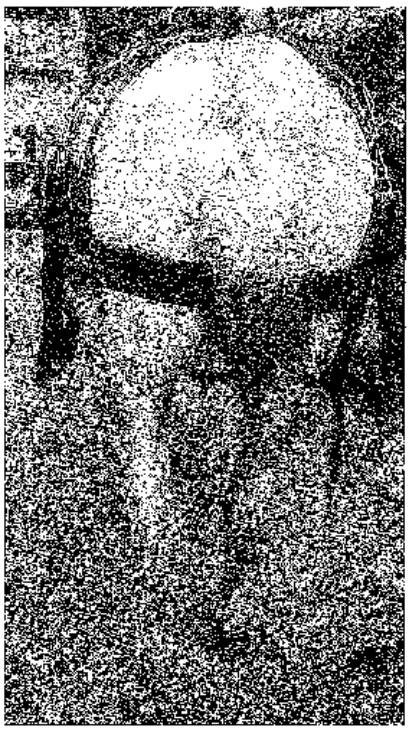
Tribune, 26 October 1945

The Horse Before the Cart

Tradition and Design History

Author unknown

The U.S. standard railroad gauge — the width between the two rails — is 4 feet 8½ inches. That's an odd number. Why was that gauge used? Because that's the way they built railroads in England, and the U.S. railroads were built by English expatriates.



Why did the English build them like that? Because the first rail lines were built by the same people who built the pre-railroad tramways, and that's the gauge they used.

Why did *they* use that gauge then? Because the people who built the tramways used the same jigs and tools they used for building wagons, which used that wheel spacing.

Okay! Why did the wagons have that particular odd wheel spacing? Well, if they tried to use any other spacing, the wagon wheels would break on some of the old, long distance roads in England, because that's the spacing of the wheel ruts.

So who built those old rutted roads? The first long distance roads in continental Europe and England were built by imperial Rome for its legions. The roads have been used ever since. And the ruts in the roads? The initial ruts, which everyone else had to match for fear of destroying their wagon wheels, were first formed by Roman war chariots. Since the chariots were made for or by Rome, they were all alike in the matter of wheel spacing. The United States standard railroad gauge of 4 feet 8½ inches derives from the original specification for a Roman war chariot.

Specifications and bureaucracies live forever. So the next time you're handed a specification and wonder what horse's a-- came up with it, you may be exactly right, because the Roman wagons were made just wide enough to accommodate the back ends of two horses. Thus, we have the answer to the original question.

There's an interesting extension to this story. When we see a space shuttle sitting on its launch pad, there are two big booster rockets attached to the sides of the main fuel tank. These are solid-fuel rocket motors, made by Thiokol in Utah. The engineers who designed the boosters might have preferred to make them a bit fatter, but the motors had to be shipped by train to launch in Florida, and on the way they must pass through mountain tunnels. Engineers build the tunnels not much wider than need be for trains, whose width is limited by that of the track.

So, a major design feature of the world's most advanced transportation system was determined over two thousand years ago by the widest part of a horse.

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Helen Ridder: festival food preparation
Miner and Valetta Seymour: apple juice for festival
Alice Sutton: festival children's activities

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