Climate Change and Agriculture

Report of a Center for Rural Affairs Task Force

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Task Force on Climate Change and Agriculture Commission Statement

Under the sponsorship of the Center for Rural Affairs the Task Force on Climate Change and Agriculture was designed to review information on climate change and, if any, its relationship to agriculture. A diverse group of farmers and livestock producers from across the nation was invited to participate and be members of the Task Force and to study and analyze the best objective information that could be offered on the issue.

The interests of these farmers and ranchers could not be more important. Farmers and ranchers are subject to the vagaries of weather and climate like few others. Significant changes in temperature or precipitation can make a primary crop no longer feasible in a given area. Such shifts in growing patterns can render large investments in machinery and other agricultural inputs unrecoverable.

Land purchased at a given price under one set of circumstances is suddenly a bad investment if circumstances change. Perhaps most devastating to agriculture would be an increase in extreme weather events. Extreme weather – drought, floods, hail, tornadoes – are the bane of farmers and ranchers. It is in the best interests of farmers and ranchers to have a dependable climate.

Funding for the Task Force, its activities, and this report was made possible by the W. Alton Jones Foundation. We are grateful and appreciative of their interest and their support.

PURPOSES

- Review objective information about potential for climate change, its probable causes and likely effects, if any; any impact it might have on agriculture; and how agriculture might contribute to solutions.

- Review alternative private and public actions that are being proposed to mitigate any adverse effects.
- If possible based on the above, determine findings of fact, reach conclusions justified by those facts, and make recommendations that might be useful for farmers and agricultural organizations to consider.

MEMBERSHIP

By invitation only, members will include active farmers; retired farmers, especially those who serve or have served as leaders in diverse farm organizations; and others closely associated with production agriculture. Participants represent only themselves and are not expected to speak on behalf of any organization or interest group.

This task force is not "for show." The purpose here is to sort out the complexities of this issue among a group of responsible producers who are free to consider the evidence and various points of view about it without fear of the political consequences of doing so, and to offer such a group the opportunity to reach findings of fact, conclusions interpreting those facts, and recommendations about what people and governments should do, if anything, about those facts.

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INTRODUCTION

The goal of this group was to review objective information about the potential for climate change, its probable causes and likely effects on agriculture, and how agriculture might contribute to solutions. Based on the above information, we determined findings of fact, reached conclusions justified by those facts, and make these recommendations that might be useful for farmers, agricultural organizations, and policymakers to consider.

We approached this topic not as experts but rather informed citizens (farmers) to find prudent solutions to complex problems. No one on this task force has been asked to serve because he is an expert. To the contrary, we conducted a study process that makes sense to non-technical people like ourselves.

Although the issue of climate change is complicated and far-reaching, prudent actions available to policymakers now can affect change that is beneficial for the future.

The recommendations herein are my own and not those of any organization I am affiliated with, now or in the past.

Climate Change Task Force Members and Signatories:

Marty Strange (co-chair), Randolph, Vermont
William Northey (co-chair), Spirit Lake, Iowa
Roy Bardole, Rippey, Iowa
Bob Kjelland, Jamestown, North Dakota
Phillip McLain, Statesville, North Carolina
Richard Mercer, Kearney, Nebraska
Robert Warrick, Meadow Grove, Nebraska

IS CLIMATE CHANGING?

Yes, climate is changing. Climate is a dynamic phenomenon that is always changing. Warming and cooling periods are typical of the cycles of nature. The data we have reviewed appears to indicate that the world has been in a prolonged period of cooling (over 150,000 thousand years), and it should not surprise us if it is entering a period of warming.

However, both the speed and extent of the warming are too extreme to be dismissed as "normal," and their correlation to changes in atmospheric carbon are very close. We conclude that human activity is likely contributing to a warming rate that is almost certain to have significant impact on climate.

CAN AGRICULTURE ADAPT TO THE PROBLEM?

We do not believe that anyone can accurately predict the specific climate changes that particular regions of the world might experience. It seems likely that there will be variable outcomes, both positive and negative for production; new challenges for farmers in all areas; probably more variability within seasons and from year-to-year in many areas; and inherently in these conditions, more risk for the farmer, both with respect to production and with respect to market prices. Farmers, particularly those used to functioning in a market economy, will adapt.

Agriculture is, in many ways, the most consistently adaptive sector of the American economy. Farmers may change cropping and soil management practices where the direction of climate change is clear and consistent, and they may adopt many diversification strategies in areas where climate change is unclear and inconsistent.

They will change what they produce, how they farm, and perhaps how they manage risk. Some may change the extent to which they depend on farming for their sole source of income. Some, of course, will be unable to change enough to remain profitable. While agriculture is adaptable in the aggregate, individual farmers are very much vulnerable to climate change.

Even where change is feasible, there will be barriers to overcome. Farms are more heavily invested in fixed costs, especially technology and land, and the level of crop specialization mandated by many technologies is high. Also, market structures are, in some cases, integrated and rigid, with marketing patterns linked to production systems and investments in specified technology.

The investment in some of the marketing infrastructure itself might be a barrier to adaptation. The cost of private crop insurance will likely have to change as well to reflect greater weather variability. Some of these changes may be retarded by public policies that discourage diversification, seek to prop up certain crops in certain places based on historic production patterns, or base rewards on output rather than on best practices.

Nonetheless, farmers will adapt to climate change because there is no alternative. The markets and the government will ultimately have to accommodate themselves to these changes. The more flexible and adaptable markets and policies are, the less painful the adaptation will be for farmers.

U.S. AGRICULTURE'S CONTRIBUTION TO THE PROBLEM

Of course, U.S. agriculture contributes to the emissions of greenhouse gases into the atmosphere, as do all sectors of the economy and society. However, agriculture has made enormous progress in very important ways.

U.S. farmers have become substantially more energy efficient, reducing total energy consumption despite substantial increases in production largely by shifting to higher efficiency diesel tractors and by adopting conservation tillage. Moreover, the extent of soil tillage has been dramatically reduced in the past decade, sharply reducing erosion and

reducing carbon loss from the soil.

Fertilizer efficiency has been improved as well. Livestock feed efficiency gains have also reduced methane emissions from ruminants, helped produce more meat and milk from fewer animals with less grain, all reducing emissions per unit of food produced. These efforts have generally been accomplished for reasons not related specifically to concerns over global warming. They have been motivated by competition and profit, by environmental regulation related to soil erosion and water quality, and by personal concerns over soil quality and environmental health.

There are some areas where American agriculture has increased emissions, notably in the area of waste management and fertilizer use. The pork industry especially has shifted to water-based waste management systems that substantially increase methane emissions. Regardless of the form of nitrogen fertilizer used, the cropping system and management practices used are more important in determining the potential for nitrous oxide emissions.

Overall, agriculture has reduced emissions per unit of food produced because it has become a more efficient user of resources and because, often in agriculture, what is good for efficiency often happens also to be good for emission reductions.

WHAT CAN AGRICULTURE DO TO MITIGATE THE PROBLEM?

There is little doubt that agriculture can do more both to reduce emissions and to sequester carbon. Some of this will continue to be done for economic reasons, notwithstanding climate change policy or other environmental measures.

It is probably important that agriculture focus emission reduction efforts on the gases for which it is a relatively large contributor – methane and nitrous oxide – rather than on carbon dioxide, where it is a relatively small contributor and where its efforts to reduce emission have already achieved a lot. Voluntary efforts motivated by efficiency will do a great deal here. Better fertilizer management and more energy conservation are especially important.

Beyond voluntary efforts motivated by self-interest, some regulations have also been effective in these areas as well, mostly motivated by concern over water and air quality. Much more can be done, especially in the area of manure management and fertilizer management.

Also, there is the potential that use of farm biofuels could both reduce fossil fuel consumption and build soil carbon. This strategy would have the multiple benefit of contributing to rural development as well, especially if the scale of biofuels plants can be kept small.

However, agriculture has even more potential to provide offsets in the form of carbon sequestration in soil, and this would have independent value to farmers and society in the form of soil quality improvement. In this area, however, neither current environmental regulation (with the important exception of erosion control) nor current market forces are likely to provide the impetus for action. It is here that deliberate government action, either in the context of international agreements or otherwise, might make a difference in farmer practices.

In all of these attempts to encourage agricultural practices that mitigate greenhouse gas emissions, it is essential to apply a "whole farm" or systems approach. If farmers have learned one thing from practical experience, it is that all natural systems are connected.

Mitigation strategies that do not look at the whole of the interaction and feedback effects may produce unintended, perverse effects, or accomplish far less than they might accomplish for the good. For example, it is very important that any program to sequester carbon in agricultural soils take into account the effect that changing carbon levels has on nitrogen fertilizer efficiency, nitrogen sequestration, and nitrous oxide emissions.

We are keenly aware of the extent to which more soil research is crucial to the success of any sequestration policy. We need to know much more about the management systems involved in carbon sequestration and the complex

interactions that they produce. We also appreciate the need to be able to predict and measure the actual performance of these strategies as builders of carbon levels in soils, and the stability of the resulting increased carbon level.

THE NATIONAL INTEREST IN SOIL CARBON

It is irrefutable that emissions of greenhouse gases are accumulating in the atmosphere. It is also irrefutable that most scientists and many other well-informed people are concerned that this phenomenon will lead to significant climate changes, many of which will be adverse to many people and nations.

It is also clear that agriculture can play an important role in mitigating these damaging emissions, both by reducing its own emissions and by sequestering carbon. Given U.S. agriculture's current climate, the quality and volume of its soils, the competence of its farmers, the maturity of its science and technology, and the sophistication of its policy institutions, there is no national agricultural complex better suited to carbon sequestration than U.S. agriculture.

To the extent that some agricultural practices that mitigate climate change are also sources of improved economic efficiency and therefore profit – such as improved efficiency in ruminant livestock feeding practices – the market can be a positive force for constructive change. Better efforts to educate all producers will contribute to this change.

But it is also clear that the market alone will not move U.S. agriculture into its potential role as part of the solution to climate change. This move will not be fully made without some public policy changes.

Most important among these policy changes is a shift in emphasis in farm policy from one that focuses separately on commodity programs and conservation programs to one that unifies these separate concerns and focuses on how healthy and productive soil contributes to an economically healthy and stable farm economy.

These vital issues transcend merely political events like the recent collapse of negotiations over implementation of the Kyoto treaty. If implemented, the treaty would bind the public sector worldwide to specific policy goals with measured performance. The negotiations have brought out the worst in many who seek to blame or to force the greater part of sacrifice on others. But these failures may contain some hidden good. They may help us to see more clearly what is in the national interest of the United States.

Greenhouse gas emissions load the atmosphere with agents that affect the climate of every nation. Some nations will benefit from favorable climate changes, while many others will be adversely affected. These differing consequences will occur without respect to what any nation does either to exacerbate or to mitigate the problem.

But certain agricultural practices that reduce or offset emissions will produce multiple benefits that are realized only where those practices take place. It is in the national interest to build soil carbon, which has been reduced by as much as 50 percent or more through tillage in wide areas of the United States over the past 150 years.

The benefits of increasing soil carbon are well documented by soil scientists and agronomists. They include increasing soil fertility, improving the moisture-retaining capacity of the soil, improving nitrogen fertilizer use by crops, and making the soil more resilient to climatic stresses. The loss of substantial amounts of carbon from some of our nation's soils has reduced the quality and productivity of those soils, though that loss has been masked by technology.

In short, the larger environmental problem in the future may not be too much carbon in the atmosphere, but too little in the soil. Climate change is just one more good reason – perhaps a compelling one – to build soil carbon and improve soils. This means, however, that whether agriculture is the cheapest place to sequester carbon or not, it is in the national interest to sequester it there to advance our national agricultural capacity.

There are clearly long-term economic benefits in building soil organic matter. Some of those benefits will ultimately accrue to the owners of agricultural land, but most will accrue to the public through increased agricultural

productivity and reduced cost of pollution.

While there are both ample public and, in the long run, private benefits in building soil carbon, in the short run these benefits are not sufficient to reward actions by either farmers, or by landowners, in undertaking practices that build carbon at the expense of either production or profit. Public policies rewarding farmers for engaging in practices that build soil carbon at the expense of some economic reward may also help stabilize the farm economic situation and soften the nearly chronic roller coaster ride that U.S. agriculture has been on in the past decade.

AGRICULTURE'S ROLE IS LIMITED

The focus of our concern is on how public policy should address the role of agriculture in climate change. Before we turn to that question, we want to note that there is a measure of personal responsibility in this issue, just as there are in all others matters of consequence. Farmers obviously have some responsibility to conserve soil, for example.

But everyone has some personal responsibility in this matter, and that responsibility is often not so obvious. We live in a mass consumer society where the consequences of our personal behavior are often remote and uncertain. While agriculture can contribute to the solution to this problem, we do not believe that it can carry the weight of the atmospheric emissions created by unrestrained consumption of fossil fuels.

In a free market economy, consumers choose what to consume, and those choices reflect their values. Often, even in a free market, these choices are influenced by public policies. The public policies necessary to fully resolve the problems of climate change are beyond the scope of this paper. But we are aware that without changes in personal behavior, this problem cannot be resolved. Agriculture can contribute to the solution, but it cannot do it alone.

AGRICULTURE'S SPECIAL CONTRIBUTION

Still, what agriculture can do, it is important to do. It has a special role to play in the possible sequestering of carbon in soil. One of its principal tools for doing so is grass. With respect to carbon sequestration, planting grass compares favorably to planting trees in a number of important ways.

Unlike trees, grass places proportionally more of the carbon into its roots than into the aboveground stem of the plant. Once in the roots, carbon is relatively immobilized, and its pathway to the atmosphere is long and involved.

When carbon reduces to organic matter in soil, it is relatively stable, and even tillage, especially the minimal tillage used on more and more farms, releases it relatively slowly into the atmosphere. By contrast, tree tops that burn or decay above ground release carbon directly into the atmosphere in relatively short order.

Moreover, agriculture will sequester more carbon more quickly into soils that are poorly suited to tree growth, especially in semi-arid regions like the vast Great Plains. Trees, of course, will grow in places where grass will not, particularly on very poor soils. But these soils are often difficult to reach or to manage.

Finally, grass is especially important because making economic use of grass does not diminish its soil-sequestering function. Grazing may actually stimulate root growth. And even cropland, properly managed, can be productively farmed without a net loss of carbon to the atmosphere.

Agriculture's special contribution to the solution to this problem is that it makes productive use of a vast resource – land – that can constructively convert what is now a pollutant – atmospheric carbon – into an economic asset.

BUILDING QUALITY SOILS

We want to emphasize that the national interest here is in building quality soils in which carbon is not merely stashed, but in which it is stabilized as humus by living soil organisms that are part of a healthy, productive cycle of life. This process not only alters carbon from a relatively volatile condition in which it might be readily oxidized back into the atmosphere, but it strengthens its role as an agent of healthy plant production. Soil must be more than just a carbon dump.

Improved soil quality that enhances soil biota and soil organic matter quality is essential. A single focus on building soil carbon without consideration of improving soil quality may lead to the undesirable result of building carbon levels while actually reducing fertility, health, and profitability of the soil. Improving the soil quality by increasing soil biological dynamics is consistent with a policy of increasing soil carbon levels.

A better understanding of soil quality attributes and how they can be built can lead to a better understanding of carbon sequestration, as well. Aggressive research in these areas is important. We will never know enough about soils.

There should be a national policy to build quality soils through excellence in farming practices, and a national farm program that supports such a policy.

FARM POLICY

Farm policy should harmonize the economic and environmental benefits of building soil carbon. To do so, the routine practice of isolating conservation practices from production programs as if they were unrelated to one another needs to end. The farm program should support the integration of conservation and production practices in whole farm plans.

Land in production should be protected by conservation practices on that land and on adjacent land. Among the favored practices should be those that minimize or eliminate tillage, conserve moisture and fertilizer, reduce water runoff, shield soil from erosive winds, build and stabilize soil carbon, and minimize nutrient loss to the atmosphere by recycling nutrients through crops and livestock. Farm policy should include all land used to produce crops or livestock, and all farmers who do so.

This holistic approach to farm management and to farm policy has multiple benefits and will be welcome by most farmers because it is more flexible and less prescriptive than the regulatory approach that is characteristic of most farm programs. For each farm, there are many site-specific factors that limit, shape, and complicate management choices. The approach we are recommending expects of each farmer a careful analysis of these choices in a way that optimizes the economic and environmental performance of the farm.

For example, we expect that most such plans will mean a continuation in the well-established trend toward less tillage. But even in this, there will be tradeoffs that must be considered. On some farms, reducing tillage may lead to a substitution of herbicides for mechanical weed controls. There is no free lunch.

A whole farm plan that takes all factors into consideration and applies site-specific management principles to the selection of best farming practices is best. It will produce an infinite variety of management plans, however, not a uniform approach. We cannot emphasize enough that top management is essential to a viable whole farm plan that sequesters carbon without other adverse environmental effects and is also economically viable for the farmer.

As a matter of public policy, progress in the use of whole farm plans may be the basis for financial rewards. Public funds distributed to farmers under these programs should both support change among farmers whose practices do not now build soil carbon and sustain the excellence of those whose practices already do.

FERTILIZER MANAGEMENT

Overall, agriculture's potential contribution lies in its potential to better manage the nutrients and elements of soil that are essential to healthy plant growth. Almost all practices that improve the efficiency of fertilizer use will reduce emission rates of nitrous oxide and of carbon dioxide from fertilizer manufacture. The most beneficial practices include more and better soil analysis and more timely application of fertilizer.

In general, these practices are beneficial in their own right because they enhance the economic viability of agriculture. Market forces support better fertilizer management, especially in an era of low commodity prices and high energy costs. In such a setting, extensive educational efforts ought to be enough to produce behavior that reduces emissions. However, when the market forces are reversed, increased fertilizer use may be profitable, and that can lead to increased emissions, educational efforts notwithstanding.

CARBON SEQUESTRATION POLICY

Among the barriers to adoption of carbon sequestration policies are that it is difficult to measure changes in soil carbon except over a very long time and that there are many variables beyond the control of farmers that affect these changes. These realities make it difficult to base current rewards to farmers on actual changes in soil carbon. Improved measurement techniques can help lower these barriers, but will probably never completely eliminate them.

But these barriers are not good reasons to avoid a policy that moves carbon from the atmosphere into the soil. Until carbon can be reliably measured, it is sufficient to identify and reward practices that are proven by good science to build soil carbon. These practices may include balanced, long-term crop rotations that include deep rooted crops and perennials, no-till or reduced tillage, green manures, conversion of marginal crop land to grass, grass waterways, contour strips, filter strips, and other fundamental conservation practices.

While measuring the short-term direct impact of these practices on soil carbon levels may be difficult, there are other good indicators of soil carbon that are less difficult to measure over relatively short periods of five or ten years. These critical indicators of soil carbon include humus levels, water infiltration rates, and residual nitrogen levels.

These practices can, of course, be offset by other practices that diminish soil carbon levels, and the entire context in which these practices are employed has to be taken into consideration. That is why a whole farm plan is an essential part of this policy.

Rewarding these practices and measuring their effect by proxy indicators may not be a perfect system, but the most complex and difficult problems are rarely amenable to simple solutions. The national interest in building quality soils as well as the global interest in mitigating the damage from greenhouse gas emissions call on us to adopt a national policy that rewards farmers for practices that we know very well build soil carbon.

TRADING CARBON CREDIT

A policy of reducing carbon emissions presents many challenges, and reducing those emissions in the most cost-effective way is particularly important. A market in carbon credits may help address that need by putting a price on emissions in the form of payments to those who sequester carbon that offsets those emissions. Such a market incentive is viewed by some as the most efficient way to encourage both reduced emissions and increased sequestration, thereby reducing net emissions.

It seems reasonable that carbon emitters should be able to buy credits that offset their emissions when the technology is not available to directly reduce the pollution. Certainly, carbon credits should be traded to support research on new technology, on carbon sequestration, and on other aspects of climate change.

We do not believe that credits should substitute for adoption of new technology. Indeed, credits should not be viewed as the permanent solution to a problem that can only be resolved ultimately by new technologies and changes

in human behavior that are economically viable, socially responsible, and anchored in a better understanding of the science of climate change.

Public policies supporting carbon credit trading programs can employ a variety of financing mechanisms, including those that force the polluter, the taxpayer, or the consumer to pay. But by whatever design, these carbon credit trading programs should abide by uniform principles. Those principles may include the following:

- All practices that result in a carbon emission credit should produce verifiable and measurable carbon sequestration.
- Farmers who accept payment from carbon emitters seeking credits should not be separately compensated under public programs for the same practices.
- In the event that land use or farm management practices change subsequent to carbon sequestration under a credit trading program, measures are in place that either prevent the release of carbon into the atmosphere or recapture the sequestration payments.
- A credit program should be administered in a way that allows for broad voluntary participation by farmers and carbon emitters rather than a relatively narrow band of participation by a few large landowners in combination with a few large emitters.

These are daunting principles to fulfill in practice. We have serious doubts that they can be effectively accomplished at this time. We do not want to discourage the kind of research that would produce the scientific information necessary to meet the challenge of an effective carbon credit program.

But in the immediate future, we prefer prompt action by policymakers to adopt the farm policy changes we recommend above to increase carbon sequestration now, both for the national interest in soil health, and for global good in retarding greenhouse gas emissions that threaten to advance climate change.

Members of the Task Force and other participants are:

Marty Strange - Co-Chair, Randolph, Vermont
William Northey - Co-Chair, Spirit Lake, Iowa
Roy Bardole - Rippey, Iowa
Gregory Graff - Marienthal, Kansas
Bob Kjelland - Jamestown, North Dakota
Phillip McLain - Statesville, North Carolina
Richard Mercer - Kearney, Nebraska
William Richards - Circleville, Ohio
Donald Vilwock - Edwardsport, Indiana
Robert Warrick - Meadow Grove, Nebraska
Dennis Ojima - Natural Resource Ecology Lab, Colorado State University, Fort Collins, Colorado (advisor)
Martin Kleinschmit - Staff Coordinator, Center for Rural Affairs
Jon Bailey - Staff, Center for Rural Affairs

For additional information or copies of this report, please contact either:

Jon Bailey, Rural Research & Analysis Program Director
Center for Rural Affairs
Phone: 402/687.2100 E-mail: jonb@cfra.org

Martin Kleinschmit, Sustainable Agriculture Specialist

Center for Rural Affairs
PO Box 736
Hartington NE 68739-0736
Phone: 402/254.6893 E-mail: martink@cfra.org

Established in 1973, the Center for Rural Affairs is a private, non-profit organization working to strengthen small businesses, family farms and ranches, and rural communities through action oriented programs addressing social, economic, and environmental issues.