



Climate and Agriculture

CANCÚN 2010

A Farm Bill for a Cooler Climate

As a society, we face few issues as complicated and contentious as climate change. We are already feeling the effects of a warming planet, suffering through an increase in the frequency and intensity of floods, heat waves, droughts and other weather extremes. But despite calls from scientists, activists and citizens around the globe for action on climate change mitigation, national and international efforts to mandate greenhouse gas (GHG)–emissions reductions have repeatedly stalled. World leaders failed to reach a binding agreement on climate mitigation in Copenhagen in December 2009, and the U.S. Senate failed to bring a climate bill to a vote in 2010.

While comprehensive climate legislation is a necessity that we must continue to push for, these and other failures to pass sweeping climate agreements or to legislate GHG reductions suggest a need for actions in other arenas; both legislative as well as on the ground. Similar to U.N. Secretary General Ban-Ki Moon, who recommended in August 2010 that nations take small steps in different fields to work toward a wider consensus instead of awaiting a full-fledged international accord, there are opportunities outside the arena of climate legislation for progress on global warming mitigation.¹ We feel one of the best and most pressing opportunities is in agriculture.²

Agriculture offers a two-fold benefit for the climate: as a place to reduce direct emissions and as a carbon sink. Many farmers have already adopted more climate-friendly agriculture practices, stimulated in part by programs in the 2008 Farm Bill. And with agriculture's vulnerability to climate change increasingly felt, there are additional reasons to emphasize climate considerations in farm policy. So while getting a climate bill passed will require a gargantuan effort and not a little luck, many of

the tools we need to bring about immediate GHG reductions in agriculture already exist in the Farm Bill and, with minimal changes, could help move us towards our overall climate goals.

The Farm Bill

Ever since President Franklin Roosevelt's New Deal programs of the 1930s, the federal government has taken an active role in shaping American agriculture. Every five to seven years, a new federal Farm Bill emerges to evaluate and reauthorize not only agricultural policy, but also areas such as nutrition, trade, rural development and energy policies. The last bill was passed in 2008. The next is expected in 2012 or 2013, and the multi-year process to create it is already underway. The last Farm Bill contained nothing specific to climate—no climate title, no discrete programs—but the policies within have had a tremendous impact on the climate, for better and for worse.

The Food, Conservation, and Energy Act of 2008 (the "2008 Farm Bill") consists of 15 titles that govern everything from commodities payments to conservation programs, to agricultural trade and aid, food stamps, rural development and energy. Embedded within each title is a set of programs and provisions, many of which are mandatory outlays, meaning that they require no additional authorization for funding. This, along with the overall breadth and depth of the Farm Bill, makes it an incredibly powerful, and incredibly contentious, piece of legislation. The passage of the Farm Bill always attracts a diverse set of interest groups who lobby hard to shape it to their advantage, from agribusiness companies looking to preserve access to cheap commodities, to hunger groups trying

to influence the food stamp program. The Farm Bill has not yet, however, become a rallying point for those focused on climate change. That may soon change.

Agriculture and the climate

Agriculture walks a precarious line when it comes to climate: depending on how it is practiced, farming can help or hurt the climate. As the real-time impacts of climate change increase, agriculture (and our food supply) will be right in the line of fire when it comes to negative effects.

Agriculture has always been a source of some direct emissions—methane from ruminant animals is a primary example—but changes in how animals are raised and fed, in the use of synthetic fertilizers and other chemicals, and in land-use patterns, have increased agriculture's burden on the climate. Currently, direct emissions attributed to global agriculture make up about 13.5 percent of all GHG emissions, and about 6 percent of U.S. emissions.³ In the U.S., the majority of agriculture-related GHG emissions fall under the category of "Agricultural Soil Management," according to the Environmental Protection Agency (EPA). This category includes the use of synthetic and natural fertilizers, production of nitrogen-fixing crops, cultivation of high organic content

soils, and the application of livestock manure to croplands and pasture, all of which produce nitrous oxide, a GHG that persists far longer than carbon dioxide in the environment.⁴ The second largest contributor is enteric fermentation (i.e., the methane produced by ruminant animals), followed by manure management, which includes methane and nitrous oxide released from manure storage.

Agriculture of any sort—industrial, organic, etc.—produces GHG emissions, but a great deal of agriculture's current contribution to climate-warming pollution comes from management choices associated with industrial agriculture. Two examples are the increased use of synthetic fertilizers—the keystone of intensive corn production—which has caused a rise in nitrous oxide emissions, and concentrated, intensive livestock production, which creates pools of methane-emitting manure.

There are other ways of farming, however, that are better for the climate. Sustainable agriculture systems can enhance productivity while also reducing GHG emissions and sequestering carbon. Organic agriculture not only reduces emissions by prohibiting fossil fuel-derived chemicals and fertilizers, but studies have also shown that organic systems can sequester more carbon than conventional and no-till systems.⁵ Perennial crop incorporation, a central component of many sustainable agriculture systems, whether for animal fodder or as a feedstock for renewable energy, can also lower fertilizer and pesticide requirements, reduce tillage and sequester carbon. According to the EPA, converting annual cropland to grassland can significantly increase the sequestration rate of carbon in soil.⁶ Adding cover crops and increasing the diversity of crop rotations also decreases the need for fertilizer and pesticide additions, thereby directly reducing GHG emissions. And to reduce methane, one of the most significant GHG sources from agriculture, sustainable systems have clear advantages over conventional agriculture. Cattle raised on high-quality pasture have lower methane

FARM BILL TITLES

Title I. Commodity Programs

Title II. Conservation

Title III. Trade

Title IV. Nutrition

Title V. Credit

Title VI. Rural Development

Title VII. Research

Title VIII. Forestry

Title IX. Energy

Title X. Horticulture and Organic Agriculture

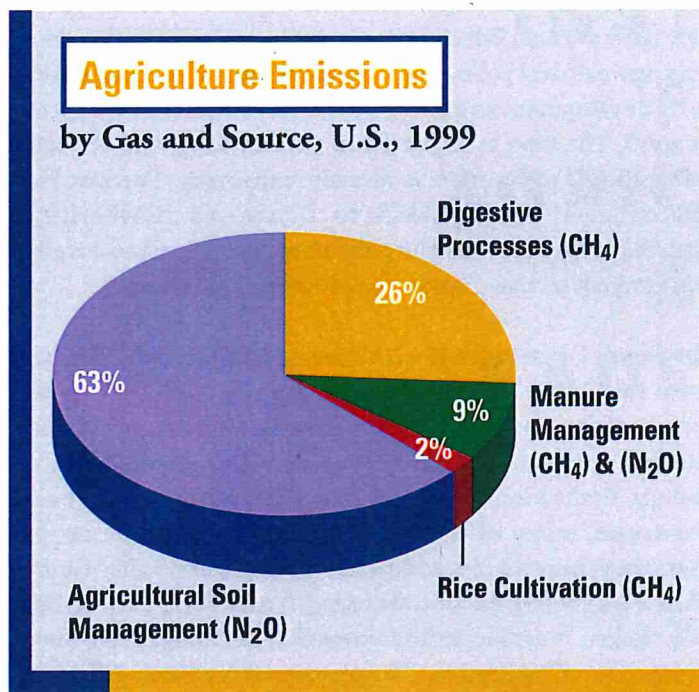
Title XI. Livestock

Title XII. Crop Insurance and Disaster Assistance Programs

Title XIII. Commodity Futures

Title XIV. Miscellaneous

Title XV. Trade and Tax Provisions



Source: U.S. EPA. *Inventory of Greenhouse Gas Emissions and Sinks: 1990-1999*.

Image from Pew Center on Global Climate, *Agriculture's Role In Addressing Climate Change*, October 2001, <http://www.pewclimate.org/publications/brief/agricultures-role-addressing-climate-change> (accessed November, 2010).

emissions than cattle raised on mature grass alone.⁷ Manure management matters as well. Studies have shown that manure stored in lagoons or other cache systems emits more methane than composted manure.⁸

Unlike piecemeal or technologically focused solutions like no-till farming or methane digesters, which are frequently promoted as the best way to make agriculture climate-friendly, sustainable agriculture systems offer a multitude of other environmental benefits including improved water, soil and air quality, increased wildlife habitat and a decrease in harmful pesticides.⁹ And, by improving the soil and reducing the need for irrigation and synthetic inputs, sustainable agriculture increases farmers' ability to handle the risks posed by a warming climate.

Sustainable agriculture offers climate benefits on two levels: a reduction in direct emissions and an increase in carbon sequestration. Agriculture's potential in sequestering carbon is still being researched and debated, but it could be very significant. An optimistic estimate states that, depending on the system, agriculture could sequester up to 25 to 40 percent of carbon from fossil fuel emissions annually.¹⁰ That sequestration, coupled with direct emissions reductions from improved farming practices, positions agriculture as an undeniably important focus for combating climate change. But despite such potential, agriculture's role in addressing climate change has not been included in farm policy to date. With the upcoming Farm Bill, that should change.

Climate and the Farm Bill

The Farm Bill contains programs that help farmers both reduce current GHG emissions through efficiency measures and renewable energy development, as well as increase on-farm carbon sequestration potential. Many, though not all, of these programs are detailed below. It is also important to note that several well-designed Farm Bill programs help farms address not only climate mitigation, but also climate adaptation, a goal of ever-increasing importance as we all begin to feel the effects of climate change. The Conservation Stewardship Program, for example, provides support for farmers to diversify and perennialize their working lands, both practices being good strategies to help cope with droughts, floods and other changing weather patterns. Programs that address on-farm practices in this holistic way will prove most beneficial to farmers, as well as to those of us who depend on farms for food, fiber and fuel, which is to say, all of us.

THE CONSERVATION STEWARDSHIP PROGRAM (TITLE II):

The Conservation Stewardship Program (CSP) is a voluntary, nationwide conservation program for working lands. Unlike set-asides and other programs that encourage farmers to take

land out of production, CSP rewards farmers and ranchers for maintaining high levels of environmental stewardship on land with active production. And unlike cost-share programs that only help farmers *beginning* to make transitions, CSP rewards both farmers trying new practices as well as farmers who have already committed to sustainable practices. The CSP, which was modified and expanded in the 2008 Farm Bill, is a wide-ranging, comprehensive program designed to "conserve and enhance soil, water, air, and related natural resources."¹¹ However, GHG reductions and carbon sequestration are not currently discrete priorities for the program.

To enroll in CSP, farmers must first apply and then, if accepted, enter into a five-year, renewable contract period, during which they receive payments (an average of \$18/acre, up to \$200,000 over a five-year contract) based on "conservation performance point" scores (these points are calculated by weighing a practice's impact on the program's stated goals and/or conservation priorities for a particular region). These payments are not connected to sales of what they harvest. In other words, the government is rewarding farmers for *how* they grow their crops, not *what* crops they grow.

CSP can encourage climate-friendly agriculture in several ways. Conservation practices that earn "points" (and thus increase farmers' eligibility and payment level) include tree planting (on farm borders or windbreaks, sequestering carbon), crop rotations (reduces emissions), cover crops (reduces emissions and sequesters carbon), continuous organic no-till (reduces emissions and sequesters carbon), transition to organic (reduces emissions and sequesters carbon), prescribed grazing (reduces emissions and sequesters carbon), and improved manure management (reduces emissions). And farmers aren't rewarded only for the status quo. The program awards more points for improvements over time, so farmers are encouraged to increase practices that sequester carbon or reduce emissions. The USDA also has the ability to prioritize conservation areas based on regional differences, thus increasing that agency's leverage to increase climate mitigation through farming. An example of this potential could be the prioritization of carbon sequestration in areas well suited to pasture lands, which, when well-managed, can serve as tremendous carbon sinks. One of CSP's advantages, however, is its diffusion nationally: Farmers of all types, in most every region, are able to participate and in turn have the incentive to increase carbon-friendly practices.

Each year 12.8 million acres of crop, pasture, range and forest lands will be enrolled. CSP enrollment currently stands at around 25.6 million acres and is set to reach over 60 million acres by the end of 2012. This would represent almost 20 percent of U.S. crop acreage.

The Conservation Stewardship Program is one of the best tools we currently have to improve agriculture's impact on the climate. The program's effectiveness could be increased by expanding its focus on climate-friendly systems and practices—specifically on those that improve and increase soil quality and soil organic matter—as well as those that minimize overall GHG emissions. Carbon sequestration and GHG emissions reductions must be made clear priorities for the program. The next Farm Bill must also increase funding for CSP. Although 60 million acres is very significant, at that rate only a fraction of farmers are able to participate. For CSP to have a large impact on climate mitigation, the program will have to be expanded so that, eventually, *all* U.S. farms are eligible to receive funding and are thus incentivized to make climate-friendly changes to their systems. Such a public investment would provide high returns not only in meeting our GHG goals, but also in addressing other areas of high environmental concern, such as water quality, soil erosion, habitat, etc.

CONSERVATION RESERVE PROGRAM (TITLE II):

The Conservation Reserve Program (CRP) pays farmers to set aside highly erodible or otherwise environmentally sensitive cropland and plant it with perennial vegetative cover that the farmer may not harvest.¹² As such, the CRP constitutes one of the nation's largest federally funded carbon sinks.

Applicants to the CRP are ranked relative to one another, and then chosen based on how well they would address CRP priorities: wildlife habitat, water quality benefits, on-farm benefits from reduced erosion, air quality benefits and cost. Farmers enroll for 10- or 15-year contracts, with penalties for early program withdrawal. About 31 million acres are currently enrolled in CRP, and farmers receive an average of \$51.52/acre.

CRP's climate benefits could be improved. Often, when crop prices rise, farmers decide to convert expiring CRP land back into row crops, thereby negating much of the land's accrued climate benefits. It is ultimately a farmer's decision how to manage his or her land, however. Particularly sensitive lands should be targeted for ongoing protection from row-cropping through incentives for creating permanent easements, thus ensuring that the carbon sink is permanent. This problem highlights the wisdom of working lands programs such as the CSP, as farmers are not forced to choose between a crop (or grazeable pasture) and a conservation payment (and the climate-friendly benefits of conservation-minded practices).

ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (TITLE II):

The Environmental Quality Incentives Program (EQIP) gives farmers financial assistance to develop conservation plans and implement conservation programs. The funded practices are based on identified natural resource concerns and local conditions, and have ranged from support for manure lagoons

to construction of managed grazing systems. Climate-wise, EQIP is designed to help promote energy conservation and in turn to reduce GHG emissions through energy audits, efficiency measures and by establishing renewable energy systems. Congress has authorized \$1.1 million in funding for 2010, transferred to farmers as a cost-share of up to 75 percent.

While much of EQIP funding to date has been targeted towards livestock systems and infrastructure (of which the climate benefits are unclear), the 2008 Farm Bill improved EQIP's climate and energy conservation capacity by developing an organic provision that authorizes the use of funds for organic production and for farmers transitioning to organic production. The 2012 Farm Bill should expand this emphasis on organic production, and practices that are currently authorized for funding should be reviewed in light of an emphasis on climate mitigation and reduced emissions.

RURAL ENERGY FOR AMERICA PROGRAM (TITLE IX):

The Rural Energy for America Program (REAP) is designed to reduce GHG emissions by providing grants for energy audits, purchasing renewable energy systems and making energy efficiency improvements. Both farmers as well as rural small business owners are eligible. Grants can fund 25 percent of project costs and range from \$1,500 to \$500,000. Directed toward the right projects, REAP offers a very important source of funding and support to farmers and rural business owners—who generally use and pay more for energy than urban counterparts—seeking to reduce energy consumption. Congress should ensure that these grants don't inadvertently support high GHG-emitting agricultural practices by targeting them to weatherization and other energy efficiency measures, low-carbon renewable energy projects such as wind turbines, solar power and on-farm bioenergy production.

BIOMASS CROP ASSISTANCE PROGRAM (TITLE IX):

The Biomass Crop Assistance Program (BCAP) was created in the 2008 Farm Bill to help farmers get over the chicken-egg problem of perennial biomass production: biorefineries' hesitation to using biomass without a reliable feedstock market. The program's original language proposed financial assistance for farmers and woodland owners close to biorefineries that wanted to establish biomass crops. Payments would also help with biomass harvest, collection, transportation and storage. Perennial biomass provides two-fold climate benefits: it is low-input, thus reducing GHG emissions over annual crop production, and the deep-rooted plants can help sequester carbon.

This program offered a great shot at increasing the number of perennials on the landscape, but went grossly awry in its public roll-out in 2009-10. The vast majority of funding to date has gone to already-existing biomass suppliers, instead

of jump-starting the development of new perennial biomass production and markets, which would have led to an increase in climate-friendly agriculture.

With the release of the final rule for BCAP, the crop establishment portion of the program is now being introduced and can provide real support for production of perennial crops for bioenergy markets. However, the major focus of the program is still on existing biomass marketing and handling support, which will need to be revised in the upcoming Farm Bill to ensure that BCAP is a positive, and not negative, component of our rural climate efforts.

RURAL DEVELOPMENT TITLE (TITLE VI): The Rural Development Title is home to many programs that could help reduce greenhouse gas emissions, while also improving rural community and farmer resilience to a changing climate. Some of the primary areas of focus for Rural Development are on rural housing and infrastructure (electricity, water, communications). A Rural Development Title that emphasized climate considerations as part of its overall goals could help rural housing and businesses be more energy efficient in their construction and ongoing operations. Inclusion of climate goals in the electricity and telecommunications sectors could help emphasize and support the production and transmission of more rural renewable energy production goals (including small-scale and on-site wind and solar) as well as increased broadband access in rural communities, allowing for more telecommuting options. This could reduce emissions associated with transportation and office operation, while potentially increasing job opportunities for rural citizens. Rural Development also includes the Value-Added Producer Grants program and the Local and Regional Food Enterprise Guaranteed Loans program, both of which can help jump-start a more diverse agricultural landscape. Support for smaller scale production, as well as regional and local food production and sale, are important to the development of more climate-friendly agriculture.

RESEARCH AND EXTENSION (TITLE VII): Title VII addresses several USDA research and extension programs and initiatives, including the National Institute of Food and Agriculture (NIFA), the Agriculture and Food Research Initiative, the Organic Agriculture Research and Extension Initiative, and the Agricultural Bioenergy Feedstock and Energy Efficiency Research and Extension Initiative. These research and extension programs are enormously important in advancing the development and implementation of climate-friendly agriculture. The USDA's Agriculture Research Service has created a "Global Change Strategic Vision" aimed at targeting research toward climate change adaptation and mitigation. The next Farm Bill should expand this emphasis throughout the USDA research and extension programs, and provide

increased support for sustainable agriculture research, both within the Sustainable Agriculture Research and Education (SARE) program (administered by NIFA) as well as throughout other research and extension programs. The USDA should also provide funding for studies that examine the climate-related outcomes of different agriculture systems, including modeling of the climate benefits from programs like CSP. This would improve our ability to set goals for GHG reductions in agriculture, and might encourage increased support for sustainable agriculture systems.

Focus on the Farm Bill

In the absence of comprehensive climate legislation, the Farm Bill presents a substantial opportunity to codify climate-savings measures. But the number and scale of programs within the Farm Bill that can have a positive impact on the climate demonstrate that the Farm Bill deserves climate attention for its own merits. In fact, programs like CSP should play an important role in the design of climate legislation.

The cap-and-trade bills that were presented in Congress in 2009 and 2010 assigned agriculture a large, but narrow, role as a primary source of carbon offsets. Under those climate bills, GHG emitters would be able to avoid actual emissions reductions by purchasing carbon offsets. Most of these offsets would come from agriculture and forestry (although not necessarily in the U.S.), through a quantification of on-farm practices such as no-till systems, planting trees and using cover crops, to name a few.

ALLOWABLE AGRICULTURE AND FORESTRY OFFSETS IN THE 2009 HOUSE OF REPRESENTATIVES CLIMATE BILL:

Altered tillage practices, winter cover cropping, continuous cropping, slow and controlled-release fertilizer and stabilized nitrogen fertilizer use, reduced methane emissions from rice cultivation, carbon emissions reductions on organic farms, emissions reductions from animal management, pasture-based livestock practices, resource-conserving crop rotations of at least three years, practices that will increase the sequestration of carbon in soils on cropland, hayfields, native and planted grazing land, grassland, or rangeland, biogas capture and combustion, waste aeration, improved manure management or application to agricultural land, afforestation, adaptation of plant traits or new technologies that increase sequestration by forests, reduced deforestation and urban tree planting.¹³

While some of the practices that would have qualified as offsets could have clear benefits for the climate, it is important to consider them in the context of carbon trading more broadly. Carbon markets—which include offsets—treat agriculture as a mere mechanism for banking carbon. But agricultural systems are multifunctional. They protect the climate, biodiversity, soil, water and air and provide food, fiber and fuel. If we value agriculture's multifunctionality, then carbon markets may not

be the right mechanism to achieve these varied goals, as by definition they only incentivize climate goals of reduced emissions and increased sequestration. Offset activities that make farms better and more adaptive, like organic agriculture or managed rotational grazing, would likely cost more than tree plantings, for example, making the market that drives offset activities unlikely to encourage many of the kinds of agricultural practices that have both climate benefits and provide food and feed crops. Add that to the difficulty of verifying and quantifying emissions reductions on complex systems like farms, and you have a complicated mechanism that might do little to improve agriculture or the climate. An example of the difficulty of counting on carbon markets to reduce emissions is the recent announcement of the closure of the Chicago Climate Exchange (CCX), a voluntary U.S. emissions trading market. After a high share price of \$7.35 per metric ton of CO₂ in 2008, prices quickly dwindled to around \$0.05 per ton.¹⁴ It is easy to imagine that farmers who participated in the CCE will view future agriculture-offset schemes skeptically.

For those reasons, we believe that increased funding and support for farm bill programs such as CSP is a much better way to improve agriculture's impact on the climate while preserving the other benefits of agriculture. They provide farmers with stable, predictable supports that effectively encourage transitions to more climate-friendly agriculture. And, as future climate legislation is developed, we think farm policy and climate policy could marry well together.

Financing good farming

Climate mitigation efforts in many areas will lead to cost savings. In agriculture, transitions toward sustainable and organic systems will mean a decrease in costs for synthetic fertilizers, pesticides and other fossil fuel-based inputs. But any serious commitment to climate mitigation will require substantial monetary support. Because an investment in climate-friendly agriculture is also an investment in the health and longevity of our food system, and in the vitality of our rural areas, we feel that it is money very wisely spent, especially if it eliminates the need for costly, yet generally less effective, pollution mitigation efforts. Of course, federal dollars do not grow on trees, and funding an expansion of programs such as CSP will require identifying new sources of money. While there are a variety of proposals out there, below are two potential areas of funding:

- 1. MARRYING CLIMATE LEGISLATION AND THE FARM BILL.** Some funding derived from carbon emission permit auctioning (for major GHG emitters) or from other mechanisms that put a price on carbon and generate revenue could go toward increasing the scope and scale of climate-friendly

farm programs. This money would go to farmers through existing programs administered by the U.S. Department of Agriculture, and would be an investment in a food system that we all depend on.

2. RESHUFFLING FARM BILL ALLOCATIONS.

Determining the best allocation of supplemental payments to farmers is a highly contentious issue. Many farmers depend on government subsidies to ride out market volatility and low prices. Direct payments, one form of commodity subsidies in the Farm Bill, are allocated to farmers based on how much land they own and their production history ("base acreage"). These payments are not associated with farm prices, do nothing to encourage sustainable practices and are problematic because they promote farmland concentration. Currently, the USDA distributes about \$5 billion annually in direct payments. Directing this money to farmers through climate-targeted conservation programs could vastly increase the number of enrolled acres and in turn result in substantial climate benefits. Distributing the \$5 billion across all our agriculture acreage (about 300 million acres) would give each farmer a little over \$16/acre—more than double the highest market price for carbon credits on the now-defunct Chicago Climate Exchange. Or, CSP acreage could be more than doubled (to about 139 million acres) and farmers given payments twice as large (\$36/acre). Talk about incentives for good agriculture. However it were divided, the money would be spread more widely among different types of farmers, and would directly promote climate-friendly agriculture practices. The risk mitigation that sustainable practices provide could also mesh well with cost savings from crop insurance modifications.

Rural matters

Focusing on agriculture and rural areas to address climate change is important both practically and politically. Farms present tremendous opportunities for real reductions in carbon emissions. These on-the-ground emissions reductions are needed immediately, and a focus on climate in the Farm Bill—which is a major determinant in what U.S. farmers do—can help to push these changes to the forefront. Supporting farmers' transitions to climate friendly practices through the Farm Bill would also reduce on-farm costs and increase energy independence through decreased reliance on fossil fuel-based inputs; outcomes that would be celebrated regardless of one's feelings about climate change.

But engaging rural America in the climate debate is important politically as well. Much of the opposition to passing climate legislation has come from rural areas. That's partly because rural residents have well-founded concerns about increases in energy costs as rural Americans spend a significantly higher proportion of their income on energy than do urban Americans. But perhaps even more important, many rural residents and agriculture producers did not feel that their concerns and perspectives on climate policy were taken into account by the environmental groups pushing for the legislation. For action to reduce carbon emissions to be successful, whether it is at a political or practical level, the needs of rural Americans have to be listened to and addressed.

Outline for a climate-friendly Farm Bill

1. Acknowledge agriculture's role—good and bad—in climate change
2. Codify climate as a primary focus for the USDA
3. Increase CSP funding, and expand that program's focus on climate-friendly agricultural practices
4. Create permanent protection measures to keep highly erodible land in CRP
5. Expand EQIP and REAP to help reduce on-farm GHG emissions, but make sure grants are awarded to low-carbon projects and expand funding for the EQIP Organic Provision
6. Get BCAP back on track to meet its original legislative intent to spur the production of new kinds of dedicated bioenergy crops
7. In place of offsets for agriculture, marry holistic programs like CSP to comprehensive climate legislation
8. Shift federal farm dollars out of direct payments and toward climate-focused conservation programs

References

1. MacFarquhar, Neil, "U.N. Chief Recommends Small Steps on Climate," *New York Times*, August 9, 2010, <http://www.nytimes.com/2010/08/10/science/earth/10nations.html> (accessed November 9, 2010).
2. See iatp.org/climate for an extensive list of documents on this subject by IATP and others.
3. U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2008*, (Washington, DC: April 15, 2010).
4. Ibid.
5. LaSalle, Tim J. and Paul Hepperly, *Regenerative Organic Farming: A Solution to Global Warming*, Rodale Institute, 2008. Available at: http://www.rodaleinstitute.org/files/Rodale_Research_Paper-07_30_08.pdf.

6. U.S. Environmental Protection Agency, *Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture* (Washington, D.C.: November 2005). Available at: http://www.epa.gov/sequestration/greenhouse_gas.html

7. Ominski, K.H., D.A. Boadi, K.M. Wittenberg, D.L. Fulawka and J.A. Basarab, "Estimates of Enteric Methane Emissions from Cattle in Canada Using the IPCC Tier-2 Methodology," 2001, *Can J. Anim Sci.* 87: 459–460.

8. Pattey, E., M.R. Trzcinski, and R.L. Desjardins, "Quantifying the reduction of greenhouse gas emissions as a result of composting dairy and beef cattle manure," 2005, *Nutrient Cycling in Agroecosystems* 72: 173–187.

9. Boody, G., Vondracek, B., Andow, D.A., Krinke, M., Westra, J., Zimmerman, J., and P. Welle, "Multifunctional Agriculture in the United States," 2005, *Bioscience* 55:1, 27–38.

10. Sara J. Scherr and Sajal Sthapit, *Mitigating Climate Change Through Food and Land Use*, (Washington DC: Worldwatch Institute, 2007).

11. United States Department of Agriculture, Conservation Stewardship Program Final Rule, (Washington, DC: June 3, 2010) http://www.nrcs.usda.gov/programs/new_csp/special_pdfs/2010-12699.pdf.

12. Farm Service Agency, "Conservation Reserve Program," USDA, <http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp>.

13. Bill Summary and Status, 110th Congress (2007–2008), S.AMDT.4949, The Library of Congress, <http://thomas.loc.gov/cgi-bin/bdquery/z?d110:SP4949>.

14. Chicago Climate Exchange, "CCX Carbon Financial Instrument (CFI) Contracts Daily Report, December 12, 2003–November 16, 2010," CCX, <http://www.chicago-climatex.com/market/data/summary.jsf>.

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