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Climate Change and Rural Communities in the US

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Acronyms

ACES	America Clean Energy and Security Act
CCTP	Climate Change Technology Program (US)
CBO	Congressional Budget Office (US)
EPA	Environmental Protection Agency (US)
FCCC	Framework Convention on Climate Change (UN)
GAO	Government Accountability Office (US)
IPCC	Intergovernmental Panel on Climate Change (UN and World Meteorological Association)
LEED	Leadership in Energy and Environmental Design
NSF	National Science Foundation (US)
RGGI	Regional Greenhouse Gas Initiative
USDA	US Department of Agriculture

Introduction

Rural communities in the US have an important stake in the climate change debate. First, climate change effects already have direct impacts on our rural populations and economies. Second, climate change legislation and policies currently under consideration in the US will have serious repercussions for rural livelihoods and prosperity. Third, rural residents and the landscapes that they manage have the potential to make important economic and conservation contributions to climate change mitigation and adaptation efforts in the US.

What is climate change?

The definition of climate change used by the UN Intergovernmental Panel on Climate Change (IPCC) is "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (IPCC glossary). Most of these changes are attributed to the increasing amount of carbon dioxide and other greenhouse gases that trap heat in Earth's atmosphere (see box at right). Humans have significantly contributed to the naturally occurring "greenhouse effect" of our atmosphere by emitting greenhouse gases from our cars, power plants, and many of our agricultural and industrial practices (Environmental Protection Agency [EPA] website). The UN's IPCC has reached a consensus that human activities have caused "most of the observed increase in global average temperatures since the mid-20th century" (2007). While climate change, or global warming, has been a contested idea in the scientific and public realms, international scientific organizations agree on the basic facts:

- Our Earth's temperature is rising,
- At least part of that change is due to human activities, and
- The impacts of climate change are already affecting human and ecological systems.

Documented physical effects of climate change include warming temperatures, melting ice and rising sea levels, and changes in hydrological systems around the globe. The IPCC reports that "the average surface temperature of the earth has increased during the twentieth century by about 0.6° ± 0.2°C" (National Science Foundation [NSF] Exploratorium). Precipitation has increased significantly in some areas of the world such as the eastern US, but has declined in the Sahel, the Mediterranean, southern Africa and parts of southern Asia (IPCC 2007). In fact, the effects of climate change may be more serious than many scientists predicted. The Pew Center on Global Climate Change reports, "recent scientific work demonstrates that changes in the climate system are occurring… earlier and faster than expected" (Ebi and Meehl 2007).

Human systems are dependent on their environments, and changes to those environments directly affect human health, society, and prosperity. Many climate change predictions foresee an increase in the number and severity of

What are greenhouse gases?

Greenhouse gases trap heat in the Earth's atmosphere, which "keeps the planet's average temperature at a hospitable 15°C [59°F]" (NSF Exploratorium website). Some greenhouse gases are introduced into the atmosphere through natural processes. For example, water vapor is considered a natural greenhouse gas.

Some greenhouse gases are created by human activities. The EPA explains how these gases are emitted:

"Carbon dioxide enters the atmosphere through the burning of fossil fuels, solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement).

"Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

"Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

"Fluorinated Gases… are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes." (EPA "Emissions" website)

Oxygen and nitrogen make up more than 95% of our atmosphere, and they are not greenhouse gases (NSF Exploratorium website).

extreme weather conditions such as hurricanes and wildfires, which can economically and physically devastate our communities. Where warmer temperatures reduce snowpack or precipitation in mountainous or arid regions of the US, residents' health will suffer (Congressional Budget Office [CBO] 2009). Increasing heat waves in the Midwest cause higher mortality rates and heat-related illness among vulnerable populations such as the very young and the old (Ebi and Meehl 2007). Local economies that depend on forest products, fisheries, or agricultural production are closely tied to the health and productivity of their environment and its climate (CBO 2009).

While it is confirmed that human and ecological systems around the world have already begun to feel the impact of climate change, the severity of the changes and their long-term effects are difficult to measure or predict. The continued sources of contention about climate change are related to future predictions. Due to the difficulties of climate change measurement, scientists differ in their forecasts about how much and at what rate temperatures will continue to change, and how those changes will affect global systems in the future (NSF Exploratorium). However, governments around the world are increasingly committed to taking at least some action to mitigate and adapt to climate change effects among their populations. The public debate today centers around the appropriate economic and political response to the issue.

Climate change in rural communities

Climate change has already directly impacted our rural populations and economies. The economic, health, and community impacts described below are likely to increase in scope and scale over the coming years.

In many places, the rural economy is closely tied to its natural environment. Rural workers and communities are the stewards of most American forests, watersheds, rangelands, agricultural land, and fisheries. Each of these environments has already been affected by climate change, with both positive and negative results for rural economies. For example, scientists say warmer winters may be one reason pine-boring beetles have spread to new forest habitats in the American West, killing more than seven million acres of forest (Johnson 2009). Some logging companies in western forests have profited from using the dead trees in their operations, but public officials have also had to close roads and recreation areas due to dangers related to forest fires and falling trees (Cliff 2008). Scientists and policymakers predict that agricultural economies may also both benefit and suffer from climate changes, depending on their location. Some areas in the US will experience increased plant growth due to increasing levels of carbon dioxide in the atmosphere (GAO 2009). However, changes in precipitation patterns will mean more droughts, floods, and other water-related problems such as extreme storms (National Oceanic and Atmospheric Administration 2009) that will adversely affect some rural populations and agricultural economies.

Another concern for rural communities is the "climate gap," recognized as climate-vulnerable populations because they are less economically or physically adaptable to climate changes. Rural populations are made up of a high percentage of these groups, especially seniors, the poor, and those that depend on climate-sensitive employment. A recent report on the climate gap says "the climate crisis may dramatically reduce or shift job opportunities in sectors such as agriculture and tourism, which predominantly employ low-income Americans and people of color" (Morello Frosch, Pastor, Sadd, and Shonkoff 2009, p. 5). These economic sectors are a major part of many rural economies. In addition, the poor in rural areas spend more of their income on basic necessities such as energy for travel and food. Both climate change *and* its policy solutions are predicted to increase the cost of those necessities.

Finally, climate change will adversely impact the health of senior citizens and the poor. For example, in the US, these groups suffer more injuries and death from heat waves because they are less likely to own air conditioners, and from extreme weather events such as Hurricane Katrina because they are less likely to own cars to escape (ibid). The climate gap will continue to widen in rural and inner city communities without appropriate measures to help these communities adapt to climate change effects.

Lastly, it is important to recognize that rural areas contribute significantly to climate change, and thus they must be a significant part of the effort to address it. For example, agricultural emissions alone are responsible for over 6% of all annual U.S. greenhouse gas emissions (EPA 2005). In addition, rural residents and businesses use more energy to travel due to longer distances and less public transportation. Finally, the EPA notes that "mitigation potential is likely to have a regional, uneven distribution. The South-Central, Corn Belt, and Southeast regions possess the largest competitive potential to generate [greenhouse gas] mitigation, while the Rockies, Southwest, and Pacific Coast regions generate the least mitigation" (EPA 2005b). Thus, some rural areas can have more impact on climate change mitigation and therefore it is especially important that those places take action.

Policy responses to climate change

Climate change policies are generally divided into two categories: mitigation and adaptation (see box at right). Overall, mitigation and adaptation strategies require an integrated approach in many sectors. Examples of mitigation and adaptation tools include:

- **Policy tools**: cap and trade systems to limit greenhouse gas emissions, renewable portfolio standards, carbon markets, incentives for investment in clean energy technology (such as tax breaks)
- **Renewable energy technologies**: wind, solar, biofuels, solid and aquatic biomass, biogas, geothermal
- **Research**: Renewable energy technology research and development; climate change research
- **Energy conservation efforts**: LEED certification in construction, retrofitting old buildings, vehicle fuel economy standards
- **Conservation for carbon sequestration** of forests, wetlands, rangelands; erosion prevention; fire management practices
- **Agricultural practices** for reduced emissions, adjusting livestock feed to reduce methane, increasing methane capture and/or production at livestock operations, using no- or low-till farming practices, nitrogen fertilizer reduction, erosion protection, farming with perennials and rotational grazing of livestock for carbon sequestration

Mitigation and adaptation

Mitigation policies attempt to reduce climate change impacts by reducing greenhouse gas emissions or removing those gases from the atmosphere through carbon sequestration techniques (Karl, Melillo, and Peterson 2009).

Adaptation measures attempt to improve people's ability to cope with harmful climate change impacts or take advantage of beneficial ones (ibid). Adaptation strategies are often identified as individual or community choices such as:

+"a farmer switching to growing a different crop variety better suited to warmer or drier conditions;

+a company relocating key business centers away from coastal areas vulnerable to sea-level rise and hurricanes;

+a community altering its zoning and building codes to place fewer structures in harm's way and making buildings less vulnerable to damage from floods, fires, and other extreme events" (ibid, p. 11).

US climate change policies

Today, the majority of federal US policies to mitigate and adapt to climate change impacts are voluntary. However, more extensive mandatory regulations and policies are currently under consideration. A climate bill called the America Clean Energy and Security Act (ACES) was passed in the House of Representatives on June 25, 2009. In its current form, the bill seeks to reduce US greenhouse gas emissions by 17% by 2020 and 83% by 2050 through a cap and trade program (see inset on next page). The bill also would require utilities to produce 15% of their power from renewable sources by 2021 (Rascoe 2009). The bill has been postponed for consideration in the Senate until September, but ACES is an example of the US government's increasing commitment to climate change mitigation.

Examples of voluntary mitigation efforts at the federal level include the EPA's many partnership programs aimed at developing new technologies, improving energy efficiency, and reducing greenhouse gas emissions among states, consumers, and corporations (EPA Climate Change Policy website). Other federal agencies—including the Department of Energy, Department of Transportation, and Department of Agriculture (USDA)—offer their own voluntary partnership programs with similar goals. The federal government also offers tax credits as incentives to consumers purchasing energy efficient goods.

What is a cap and trade policy?

Cap and trade schemes are one policy method to mitigate the amount of greenhouse gases that a nation, region, or industry produces.

The policy sets a limit ("cap") on the allowable amount of greenhouse gases – usually carbon dioxide – to be emitted by a specified group. Then the members of that group can buy and sell ("trade") permits to emit up to the allowable levels. Over time, the allowances are reduced, and affected industries are encouraged through the increased price of carbon emissions to use conservation or alternative sources of energy.

The government's current mandatory regulations include the Energy Policy Act of 2005 that requires certain energy efficiency standards in new federal buildings and some residential structures (FacilitiesNet 2007). Some federal agencies such as the USDA/Forest Service have developed strategic frameworks for responding to climate change.

Other important federal-level measures include climate-related research efforts. The Climate Change Science Program and the Climate Change Technology Program (CCTP) are multi-agency efforts tasked with conducting and disseminating climate change research in the US. An example of the CCTP project in action is the recently reinstated FutureGen clean coal pilot project in Mattoon, Illinois (Mercer and Suhr 2009). Several agencies such as the National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration manage programs to help policymakers at all government and business levels make climate-related decisions (GAO 2009).

State and regional policies

US states and regions have developed and enacted their own climate change policies. Some states have set up climate change commissions, action plans, greenhouse gas reporting systems, and emissions targets or regulations (Pew Center for Global Climate Change website). In an ongoing battle with federal regulators, California won the right on June 30, 2009, to enforce its own standards for controlling greenhouse gas emissions from cars and light trucks (Barringer 2009). Thirteen other states and the District of Columbia have voluntarily adopted the stricter California standards.

Regional initiatives to address climate change include the Midwest Greenhouse Gas Reduction Accord, the Western Climate Initiative, and the Regional Greenhouse Gas Initiative (RGGI). Ten states participate in RGGI, the "the first mandatory, market-based effort in the United States to reduce greenhouse gas emissions" (RGGI website). Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont have committed to reduce by 10% the carbon dioxide emissions from their power sector by 2018.

US participation in international policies

The US has historically been a reluctant participant in global climate change policy. In 2001, the US withdrew from the 1997 Kyoto Protocol on Climate Change, one of the first international efforts to curb greenhouse gas emissions by specific targets among industrialized countries (UN FCCC website). The US cited concerns about the Kyoto Protocol's possible negative effects on the US economy, and eventually rejected the treaty because developing nations such as China and India were not asked to lower their emissions (Kirby 2001, BBC News 2005). Most other industrialized nations ratified the treaty, which expires in 2012.

The US administration under Barack Obama is expected to participate more fully in global climate change regulations. The upcoming UN Framework Convention on Climate Change (UNFCCC) in Copenhagen, Denmark, in December may result in a new international climate treaty as a successor to Kyoto (Bülow 2009). In a precursor to the Copenhagen convention, Obama has led climate talks at the Group of Eight Summit in L'Aquila, Italy. So far, the nine developing nations invited to the climate talks

on July 9 have refused to commit to specific targets to cut greenhouse gases (Baker 2009). Nonetheless, the American government is showing unprecedented willingness to participate in a global climate change initiative.

Policy impacts on rural communities

Climate change legislation and policies currently under consideration in the US will have serious repercussions for rural livelihoods and prosperity. The America Clean Energy and Security Act (ACES) "could lead to profound changes in many sectors of the economy, including electric power generation, agriculture, manufacturing, and construction" (Broder 2009), which make up important parts of the rural economy. Critics warn the bill will penalize areas that rely on coal for electricity, and many rural areas fall into this category. ACES proposes a cap and trade system for carbon emissions that will increase energy costs for coal-dependant areas. Where rural communities rely on manufacturing economies, some critics of ACES fear that rising energy costs might move industrial jobs overseas (Laasby 2009). Agriculture advocates worry about the increasing costs of fertilizers and fossil fuels.

In February of 2009, the US Secretary of Transportation proposed a "vehicle miles traveled" tax to charge motorists for each mile driven rather than by fuel consumed. The idea was quickly and publically abandoned by the Obama administration, but some transportation experts continue to support the tax as "a sound policy to reverse the highway budget shortfall without endangering environmental incentives or creating excessive logistical difficulties" (Weiner 2009). Critics of the mileage tax proposal say that it will be unfair to rural states where residents must drive longer distances for necessities. In addition, it would tax drivers using electric, hybrid, biofuels, and other low-carbon emitting vehicles at the same rate as gas-guzzlers.

However, many of the currently proposed climate change policies may provide rural communities with new avenues for economic competitiveness. The next section will review potential opportunities for rural areas to benefit from climate change mitigation and adaptation efforts.

Opportunities for rural communities

Rural residents and the landscapes that they manage have the potential to make important economic and conservation contributions to climate change mitigation and adaptation efforts in the US. Rural communities have incentives to act because they contribute to climate change, and because many of the mitigation activities have potential economic benefits. The potential economic opportunities for rural communities include participation in the "green jobs" economy—especially in environmental entrepreneurship and renewable energy production—as well as in natural resource management techniques that are important climate change mitigation strategies.

Renewable energy production

Rural communities can capitalize on the current political push for renewable energy production. Many mitigation policies such as cap and trade and renewable portfolio standards will likely increase the cost of fossil fuels and make investment in renewable energy more cost-effective. Rural areas are the logical home for investment in renewable energy technologies such as wind and solar farms or biofuel and biogas production.

A recent report by the Natural Resources Defense Council analyzes the economic development potential of renewable resources for rural Missouri, for example. Like many rural states, coal is the main source of electricity in Missouri, "almost all of it shipped from distant Wyoming" (Cohen 2009, p. iv), The report estimates that "if energy consumption continues to grow at the current rate, imports of fossil fuels into Missouri—and outflow of Missourian's energy dollars—will triple by the middle of the century" (ibid). However, the state could create jobs, reduce its reliance on fossil fuels, and even export energy to other states with the proper investment in renewable energy production in wind, biofuels (cellulosic ethanol from crop waste and nonfood plants), solid biomass (crop waste burned in existing coal plants), and biogas (methane from decomposing manure) (Cohen 2009). Other states such as Massachusetts have conducted similar reports on their potential for wind and other renewable power production.

Carbon sequestration

Carbon sequestration is another important climate change mitigation strategy. Sequestration is the capture and storage of carbon dioxide by natural absorption into microorganisms in the soil or plants, or by injection into underground reservoirs (National Energy Technology Laboratory website). Rural communities and residents already manage many of the landscapes where carbon sequestration will be most effective. Agricultural and forest land managers in particular will have many opportunities to support carbon sequestration efforts. For example, such agricultural practices as "no-till" or "low-till" farming can reduce carbon emissions from the soil. Appropriate forest management techniques can make major contributions to mitigation efforts. According to the EPA, over 90% of carbon sequestration in the US currently occurs on forest lands, and it offsets 12% of our greenhouse gas emissions from all sectors of the economy annually (EPA 2005). With wider implementation and more research into new and appropriate sequestration techniques, rural communities can lead the effort in forest stewardship.

However, for rural people and communities to benefit from enacting these techniques, our national and international policies must build and maintain markets for carbon sequestration. Carbon markets must provide appropriate incentives and returns on investment for landscape management techniques in climate change mitigation. The current ACES bill in Congress "would allow businesses to meet their emissions reduction targets through agricultural offsets" (Power 2009), including paying farmers to

reduce emissions. This is the kind of policy necessary to build the carbon trading markets that could benefit rural landowners.

Green jobs

According to the White House, green jobs "provide products and services that use renewable energy resources, reduce pollution, and conserve energy and natural resources" (Biden 2009). The renewable energy production and landscape management strategies described above are potential "green" employers for rural communities. The WorldWatch Institute reports that "renewables tend to be a more labor-intensive energy source than the still-dominant fossil fuels, which rely heavily on expensive pieces of production equipment. A transition toward renewables thus promises job gains" (Renner 2009). Renewable energy is often produced in rural communities, requiring local workers.

Green jobs are diverse, and some advocates say they are less likely to be outsourced than traditional blue-collar positions. "Green-collar" jobs related to energy efficiency need the full range of low- to highly-skilled workers. Examples of green jobs include construction positions to retrofit commercial and residential buildings for energy efficiency, jobs in mass transit, and manufacturing employment to build low-emissions automobiles. Many of these jobs cannot be outsourced, and many rural residents already possess the skills necessary to participate in this sector.

In addition, the green economy offers opportunities for environmental entrepreneurs. These green entrepreneurs may develop their own businesses related to expanding the renewable power grid, landscape management techniques, or emerging carbon-trading markets. Rural entrepreneurs with connections to the land and understanding of the strategies needed in climate change mitigation may have an advantage in many of these areas. Rural environmental entrepreneurship offers the added bonus of creating locally based investments, which may help ensure that the wealth generated from local natural resources will stay in rural communities.

Opportunities for rural-urban collaboration

Both rural and urban residents have felt the impacts of climate change, and they can share a commitment to reduce greenhouse gas emissions to their mutual benefit. The discussion of the climate gap above is directly relevant to rural communities, but inner city populations often suffer from the same problems. Investment in adaptation to climate change impacts should be shared among these vulnerable populations, and lessons can be learned from the experience of both urban and rural communities.

Urban and suburban communities rely on the ecosystem services that rural areas provide. Examples of ecosystem services include clean drinking water, natural recreation space, and waste management. Where metro residents recognize the important environmental stewardship contributions made by rural communities, investment in rural areas can be perceived as regional investment. Current research into value chain strategies and regional-level planning may provide avenues for improving the urban-rural relationship and addressing their interdependent needs.

One emerging area for urban-rural collaboration is the "foodshed", based on the idea of a watershed in a region. When urban and suburban residents value locally grown foodstuffs, the surrounding rural area often benefits economically from small-scale farming efforts and environmentally from reducing the carbon footprint of a region's food. Where urban areas invest in their region's agricultural resource base, they also mutually benefit from the protected green space around the metro area. The Foodshed

Alliance in northwest New Jersey, for example, lists among its many goals the promotion of "a robust farm economy… through local efforts and regional collaborations" (Foodshedalliance.org). The Alliance hopes to encourage environmentally friendly farming practices, and to "advance agriculture as a way of preserving our rural landscapes and hindering their destruction by the spread of sprawl" (ibid). Hence, the foodshed is used to promote economic, environmental, and collaborative efforts for conservation and quality of life.

Conclusion

Rural communities can and must participate in the current climate change debate in the US. Rural landscapes and economies will inevitably be impacted by climate change effects and the mitigation policies chosen by our states, nation, and global institutions. Without a voice in the debate, rural interests and contributions will not be heard, and climate change legislation may have seriously negative repercussions for rural prosperity. Instead, rural advocates have the potential to make important economic and conservation contributions to climate change mitigation and adaptation efforts in the US.

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