ENVIRONMENTAL ENTREPRENEURS

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The Business of Food

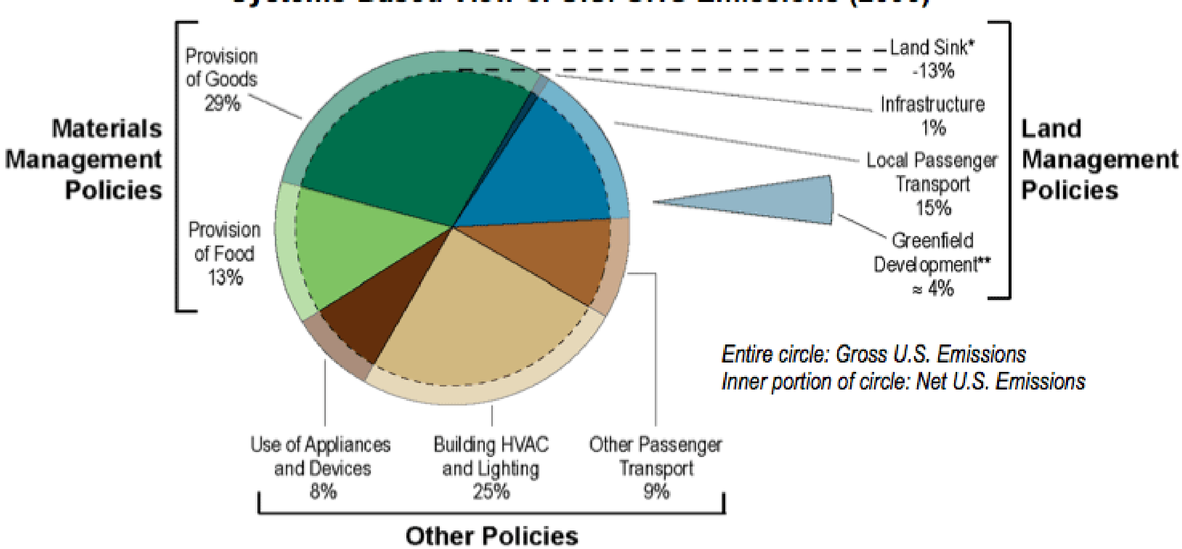
What will U.S. food systems need to be in 2050 to achieve the 80% reduction in greenhouse gases (GHG) called for in the proposed Federal climate bill? How will land-use be managed to deal with the competing land needs for (1) food and fiber, (2) forests, natural carbon sequestration and habitat, (3) biofuels, and (4) human habitat? How will global food systems feed an estimated 9.2 billion people in 2050 while working to substantially reduce GHG emissions from agricultural practices?

In this article we begin to frame the issues that surround the way the United States grows, delivers and consumes food. The issue is larger than just reducing emissions from agriculture, since the number of calories people consume plus the source of those calories (i.e. meat versus grains) has a major impact on human health as well as GHG emissions. A federal climate bill will result in major new agriculture policies. We look at agriculture policy options and the impact of changing consumer demand.

Climate Impacts of Food Production

The U.S. Environmental Protection Agency (EPA) estimates that GHG emissions related to the production and distribution of food constituted about 13% of annual U.S. GHG emissions in 2006, including emissions from the electric power, transportation, industrial and agricultural sectors associated with growing, processing, transporting and disposing of food.[1] This estimate is likely conservative, as it only takes into account domestically produced food and not food that arrives from international commerce.

Figure ES-1
Systems-Based View of U.S. GHG Emissions (2006)



System view of U.S. GHG emissions showing food system at 18% of total emissions

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Emissions attributed to the agricultural sector alone account for roughly 7% of U.S. annual GHG emissions.[2] There are three types of GHG emissions from farming:

1. Carbon dioxide (CO_2) emissions from fossil energy inputs like electricity, diesel fuel, motor gasoline and natural gas
2. Methane (CH_4) from livestock and the decay of organic matter
3. Nitrous oxide[3] (N_2O) that comes from land-applied fertilizers and livestock manure management

N_2O and CH_4 are particularly problematic because they are 300 and 22 times (respectively) more potent as greenhouse gases[4] than CO_2.

On-farm emissions come from four sources:

1. Land conversion (one-time impact) - When, for example, forested land is converted to farmland, the stored carbon is released, creating a one-time carbon emission. In addition, the loss of tree cover reduces the future capacity to absorb and sequester CO_2.
2. Livestock emissions - Emissions from livestock include (a) methane from enteric fermentation (i.e. cow burps), (b) methane from manure, and (c) GHG emissions associated with feed production.
3. Nitrogen fertilizer synthesis and its application to land - The current production of synthetic fertilizer requires intensive energy inputs. In addition, a fraction of the nitrogen applied to soil is converted to N_2O through natural processes.
4. Direct and indirect farm energy use - Farms use electricity and transportation fuels. In addition, there are indirect energy uses - for example, the energy needed to deliver irrigation water to the farm.

Farms can also reduce their direct GHG emissions through greater energy efficiency, improved management of livestock manure and fossil energy inputs, and a shift towards more renewable energy sources, as well as play a role in sequestering carbon through improved management of soils and surrounding pastures and forests. Examples include:

- Promoting soil health on the farm to sequester carbon, reduce nutrient inputs, retain water and increase productivity.
- Increasing nitrogen use efficiency and reducing nitrogen inputs by growing legumes in rotation with other crops.
- Increasing on-farm energy efficiency through reduced tillage, water use efficiency and other measures.
- Anaerobically digesting manure to capture the methane and use it for power.
- Manufacturing fertilizer from gasification of waste biomass instead of fossil energy.

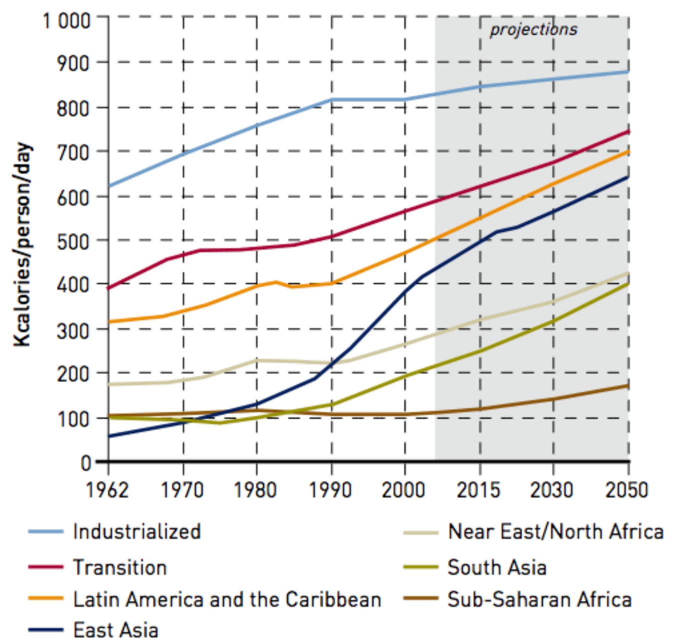
Food waste

While food waste occurs outside the farm, it could be used to reduce GHG emissions in the food system. For example, the U.S. EPA estimates that composting 100% of food waste would save 20 million metric tons of CO_2 equivalent (CO_2e) per year.[5] The United Nations Environment Program optimistically estimates[6] that if we used agricultural residues and other food waste as livestock feed, rather than fattening animals on cereals, we could rescue enough food to sustain an extra 3 billion people.

The Role of Consumers

Both the total calories consumed and the choice of food can cause large shifts in agriculture production and thus GHG emissions. A 2006 report, "Livestock's Long Shadow," by the Food and Agriculture Organization (FAO) of the United Nations, estimates that globally, "the livestock sector generates more greenhouse gas emissions as measured in CO2 equivalent – 18 percent – than transport," when taking into account emissions from associated deforestation. At the same time, the percentage of meat in the worldwide diet is rising significantly as incomes go up.[7]

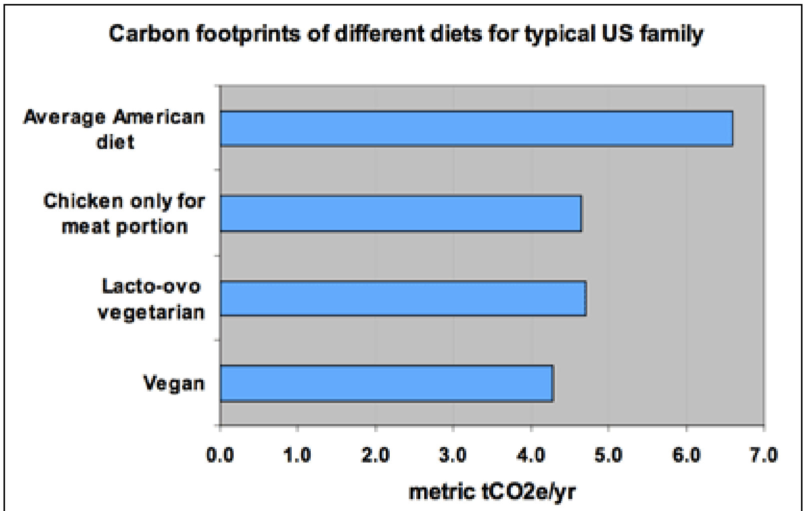
The chart at right shows that in the last 40 years, calories per day per person from meat and dairy in the industrialized countries have increased from about 600 to over 800 kilocalories. In the last 20 years, meat and dairy consumption in East Asia has doubled from 200 to over 400 kilocalories. The FAO estimates that one third of all cultivated grains are currently used as animal feed.



Note: For past, three-year averages centered on the indicated year. Livestock products include meats, eggs, milk and dairy products (excluding butter).
Source: FAO (2006a) and FAO (2006b).

Past and projected world-wide food consumption of livestock products.

Grains currently supply 50% of human calories. As demand for grains continues to shift to meat production, it will become increasingly difficult to feed the world. If increases in demand for meat and dairy in the developing world continue at current rates, grains grown for animals will increase from one-third of all cultivated grains today to one-half by 2050.



Source: Chris Jones, UC Berkeley Institute of the Environment

Estimates by CoolCalifornia.org show the impact of meat on the typical U.S. diet. The average U.S. family diet results in GHG emissions of about 6.6 tons CO2e per year. Simple changes in meat consumption can have significant impacts on GHG emissions. For example, switching to chicken only for the meat portion would reduce the GHG impact of the family diet to about 4.6 CO2e.

Impacts on Consumer Health

Our goal in presenting this information is not to argue for the elimination of meat but rather to illustrate that a change in diet has a significant effect in GHG emissions. According to *Food Matters*, the total calories in the average American diet have increased by 25% per person since 1970.[8] The accompanying increase in obesity has had significant and costly health consequences. Diseases including heart disease, diabetes, hypertension and certain cancers can be significantly reduced through changes in diet. Eating the proper amount to prevent obesity would mean a healthier population as well as less farm GHG emissions.

The Global Picture

There are currently 6.7 billion people in the world of which over one billion are already malnourished. Current estimates predict that the world's population will reach 9.2 billion by 2050[9] – the year by which industrialized nations will need to cut their GHG emissions 70-80% below 2000 levels if we are to stabilize the concentration of CO_2e in the atmosphere at, or below, the target level of 450 parts per million identified by scientists and avoid the worst impacts of global warming.[10]

At the same time, climate change itself is likely to put severe pressures on agricultural output,[11] as heat waves, more frequent droughts and intense storms wreak havoc on farm productivity. (See article on global food production concerns: http://www.nytimes.com/2009/10/22/world/22food.html).

Modern food production has historically focused on growing supply through the use of fossil fuel and fossil fuel based fertilizers. However, as fossil energy becomes more costly and the need to reduce global GHG emissions becomes more urgent, there will be an increasing need for alternative approaches to agriculture.

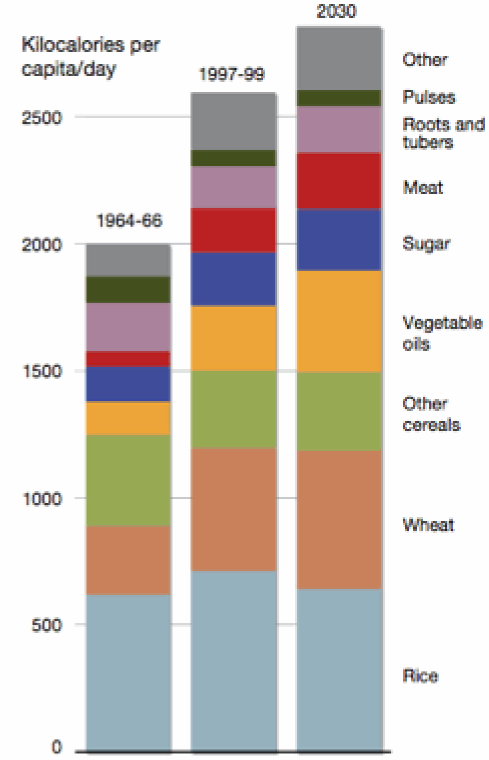


Figure 6: Changes in historic and projected composition of human diet and the nutritional value. (Source: FAO, 2008; FAOSTAT, 2009).

Changes in human diet and nutritional value.

Policy Options

Policy options should address three goals simultaneously: (1) reduce the environmental impacts of our food production system, including GHG emissions and other pollutants; (2) shift American food consumption towards a healthier diet that reduces demands on scarce agricultural resources and our health-care system; and (3) provide a framework for handling competing global demands for land use including food production, the production of biomass feedstocks for biofuels and bioelectricity, preservation of wild lands, and enhanced carbon sequestration in soils and forests.

The suite of policy options includes consumer-facing informational campaigns that seek to influence consumer demand, direct regulation, such as performance standards for industries like agriculture and biofuels, as well as economic incentives to shift on-farm practices.

For example, the energy sector uses the "Energy Star" certification and label to help consumers select more energy-efficient appliances, performance standards to enforce maximum amounts of pollution per kilowatt-hour of electricity produced and incentives to encourage the deployment of renewable energy. What should the equivalent policies be for food systems?

NRDC is already working with food industry leaders to develop the "Stewardship Index for Specialty Crops," a multi-stakeholder initiative to develop a system for measuring sustainable performance throughout the specialty crop supply chain.[12] The project seeks to offer a suite of outcomes-based metrics to enable operators at any point along the supply chain to benchmark, compare and communicate their own performance.

Changing consumer demand

Governments are beginning to experiment with information campaigns to influence consumer food choices. For example, California has the Cool California campaign (coolcalifornia.org) and Sweden now labels all food products with their carbon emissions.[13] This year, NRDC launched the "Growing Green Awards," which recognize and promote innovation in food thought leadership, business leadership and food producer leadership.[14] The first awards were given in May of 2009 and a call for nominations has been issued for the 2010 awards.

Performance standards

Some farms and animal production facilities are subject to air and water quality performance standards. NRDC is advocating for the inclusion of new source performance standards for large uncapped stationary sources of methane emissions in federal climate and energy legislation, including large confined animal feedlot operations.

Financial incentives

Most farm policy is implemented through economic incentives – primarily through the federal Farm Bill that is reauthorized every five years. As Michael Pollan points out in *The Omnivore's Dilemma* and *In Defense of Food*, U.S. policy has distorted the market and incentivized cheap calories.

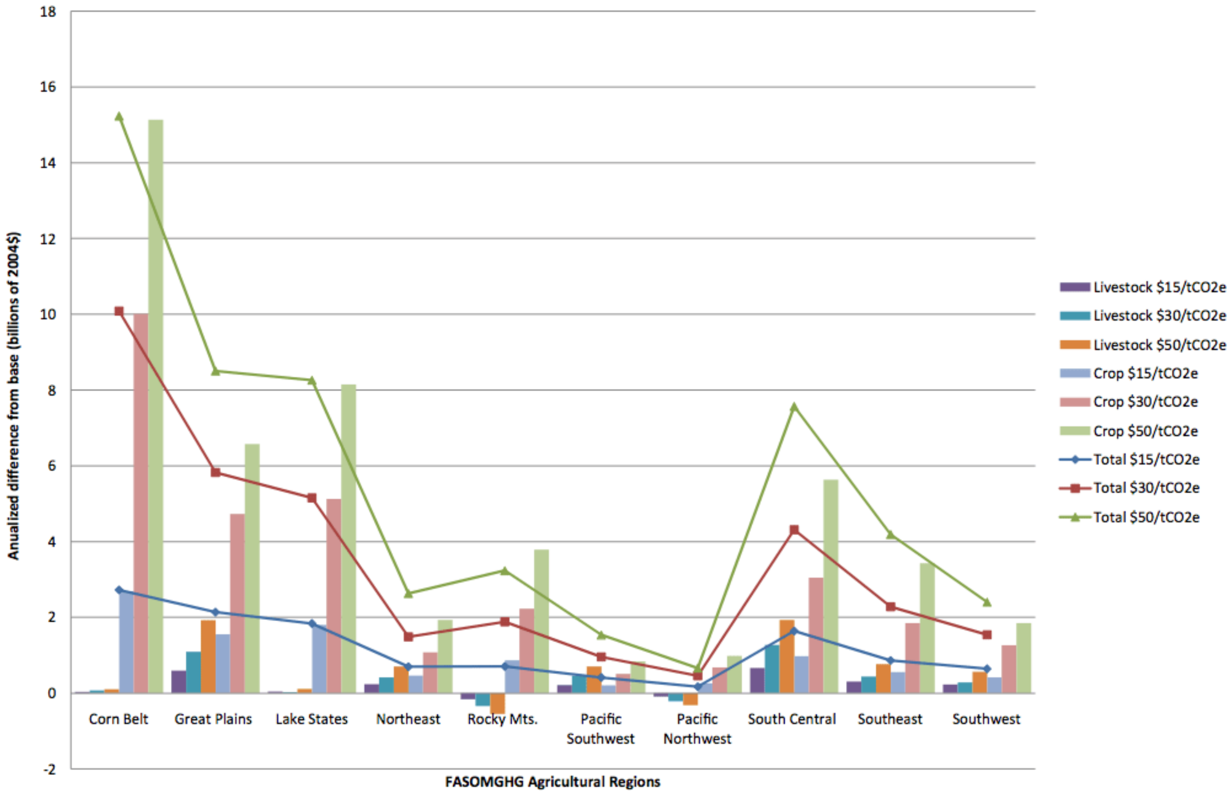
A federal climate bill will also affect food production through an increase in the cost of fossil fuels and an incentive program to encourage farm practices that reduce GHG emissions and increase carbon sequestration in soils and forests. A key question is whether a federal climate bill will help or harm farmers.

According to both the U.S. Department of Agriculture's "Preliminary Analysis"[15] and the U.S. EPA,[16] farming will see a net increase in income as a result of the House climate bill (H.R. 2454). Indications to date are that the Senate climate bill will provide similar, or possibly more favorable, benefits to farms. None of the analyses include the costs of climate change on farming if we do nothing.
A Duke University/A&M University paper[17] estimates the economic costs and benefits to agriculture from the Energy Independence and Security Act of 2007, which substantially increased the volume of biofuels required under the 2005 Renewable Fuels Standard (RFS) and the American Clean Energy and Security Act (H.R. 2454), which amongst other provisions establishes a Renewable Energy Standard (RES) and a declining cap on GHG emissions, based on region and crop type. In general, the following items are considered:

1. Increased costs for fossil fuels, fertilizer and other fossil energy-intensive farm inputs that result from a cap on GHG emissions
2. Direct revenues from increased demand for biofuels and bioelectricity feedstocks
3. Additional revenues from direct payments for "offsets" (i.e. additional, verifiable and permanent reductions in GHG emissions or enhanced carbon sequestration that occur outside the cap)
4. Indirect revenues from higher commodity prices and land rents
5. Cost savings from changes in production practices

Additionally, though the report does not directly estimate new revenues to farmers from expanded markets in wind and solar energy, increased demand for renewable electricity in general will generate substantial incentives for farms to lease some of their land for either wind or solar power – providing a potentially large new source of farm income.

The figure below shows the overall positive benefits from three different prices of carbon ($15, $30 and $50 per ton of CO2 equivalent).



Annualized effect of H.R. 2454 for different regions and different prices of carbon

Though the results of the Nicholas Institute analysis show widely varying income effects depending on the type of crop and region in question, even under the low carbon price scenario ($15/ton), all regions show some increase in farm income, with direct new revenues from the sale of carbon offsets and biomass feedstocks, and indirect benefits from higher commodity prices and land rents offsetting increases in on-farm fossil input costs that result from the cap.

Financial incentives versus carbon offsets

A key question for the country is not whether we should assist farms and the overall food system in reducing their emissions but whether that assistance should take the form of carbon offsets or direct payments for best practices. The EPA estimates that there could be up to 1 billion tons of farm and forest offsets, so the measurement, monitoring and verification of offsets is critical to the over all success of a cap and trade program.

Because offsets allow capped firms to increase their pollution levels, rigorous quality standards must ensure that offsets provide environmental benefits equal to reducing a ton of pollution from a smokestack or tailpipe. To be an offset, the reduction must be verifiable, permanent and additional.

Some examples of farm and forest offsets that have been proposed include:

- Diversion of land to forests and grasslands
- Ceasing the use of histosols (i.e. a soil composed primarily of organic material)
- Modifying existing forest management to increase carbon sequestration
- Reducing methane emissions from livestock, manure handling and rice cultivation
- Sequestering carbon through improved soil management
- Reducing nitrous oxide from fertilizer and manure/livestock

All of these practices have benefits and should be encouraged as appropriate – but it is not always simple to determine whether they are also *additional* reductions of GHG emissions. The actual GHG benefit of many practices is often difficult to measure or model with confidence. If a farm starts a practice after the climate bill is passed, are they entitled to claim an offset? What about a farm that was already using the practice? These questions directly affect the integrity of the overall emissions cap, since if the reduction would have happened without the payment, it cannot be considered "additional." By contrast, an incentive payment for best farm practices risks possibly paying for non-additional actions, but protects the integrity of the cap.

Permanence is equally difficult. If the farm is sold next year and the new farmer plows the field releasing the stored carbon, how do we detect this and who is responsible for the carbon emission if it was part of an offset? For how many years must the carbon be stored?

Futhermore, when land is disturbed and put into any new usage, stored carbon is released. If more U.S. land is put into biofuels production and, as a result, more land must be cleared elsewhere for agricultural production, the result is emissions leakage. These indirect emissions must be accounted for if we are to meet our emissions reductions goals. Currently climate policies in California and the Federal Renewable Fuels Standard (RFS) have provisions to account for emissions associated with indirect land use change (ILUC). Though the American Clean Energy and Security Act, passed by the U.S. House of Representatives in June, lacks similar protections, the debate over ILUC continues in the U.S. Senate. (For a detailed analysis of offset and biomass definitions, see tables 4 through 6 of ETAAC Overview of Pending Federal Legislation.[18])

Finally, as a more general matter, any policy that allows facilities to continue unabated emissions while purchasing offset reductions elsewhere may result in disproportionate impacts to surrounding communities.

Summary

Emerging climate policy gives us a unique chance to improve our food systems and diets, resulting in healthier citizens and a healthier planet. This will depend on changing consumer demand and creating an incentive system that rewards lower-impact farm practices while protecting the integrity of the carbon cap.

Notes

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[4] See wikipedia.org entry on "Global warming potential": http://en.wikipedia.org/wiki/Global_warming_potential
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