POTENTIAL IMPACTS OF CAP-AND-TRADE POLICY ON U.S. AGRICULTURAL PRODUCERS

Prepared For

National Association of Wheat Growers
&
American Farmland Trust

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Disclaimer

Abbreviations and Units

Abbreviations

EPA = Environmental Protection Agency
USDA = U.S. Department of Agriculture
NASS = National Agricultural Statistics Service
EISA = Energy Independence and Security Act
ARRA = American Recovery and Reinvestment Act
RFS2 = Renewable Fuels Standard 2
DOE = Department of Energy
CRP = Conservation Reserve Program
EIA = Energy Information Administration
CCX = Chicago Climate Exchange
RES = Renewable Electricity Standard
GHG = Greenhouse Gas
CO_2 = Carbon Dioxide
ACESA = American Clean Energy and Security Act = H.R.2454
ILUC = Indirect Land Use Changes
CTIC = Conservation Technology Information Center
COP = Cost of Production
SR = Sequestration rate
CO_2e = Carbon Dioxide Equivalent
Bu = Bushel
Lbs = Pounds
Ac = Acre
Ha = Hectare
Tonne = Metric tonne
Mt = Metric tonne
Bgy = Billion gallons per year

Units

Bushel of Corn = 56 lbs
Bushel of Soybeans = 60 lbs
Bushel of Wheat = 60 lbs
One pound = 2.2046 kilograms
Metric ton = 2,204.6 lbs
Short ton = 2,000 lbs
Metric ton = 1.2204 short tons
Acre = 0.4046873 hectares
Hectare = 2.471044 acres
CO_2 = 3.667 units of carbon (C)
$mtCO_2/ac/yr$ = Metric tons of carbon dioxide per acre per year

I. Executive Summary

Cap-and-trade legislation has the potential to be a transformational force to U.S. agriculture. There are many unknowns surrounding the future design of cap-and-trade policy and projecting the resulting implications over the next 40 years is challenging at best. What is clear; however, is that stakeholders of the agriculture sector need to be engaged to shape the final legislation – if there is one. Whether cap-and-trade is viewed as "good" or "bad", designing the policy in such a way as to best favor agriculture and improve the potential outcomes for farmers and rural America can put agriculture in a favorable position if a cap-and-trade policy is indeed enacted. If structured properly, cap-and-trade has the potential to provide significant long-term benefits to a large segment of farmers; however, there are also plausible policy design outcomes that could be harmful. Lack of engagement could leave Agriculture in a weaker position. There is also the risk that if no climate change legislation is passed, there could be direct regulation by the Environmental Protection Agency (EPA) – a scenario that would harm agriculture and agricultural producers more than cap-and-trade.

This analysis shows that with properly structured policy, cap-and-trade could be a net benefit to agriculture and to wheat farmers. There will be production cost increases resulting from higher energy prices which will be incurred by all farmers, although thought to be relatively modest. Yet, there will also be an opportunity for farmers to gain despite these cost increases by participating in carbon offsetting activities such as no-till, improved fertilizer management and cover crops. In addition to a variety of on-farm offsetting activities offered to crop and livestock farmers, offsets will be provided for switching from conventional crop production to perennial crop or forest production; as such, an additional crop becomes available to farmers – "carbon". This new crop may provide revenues that exceed current cropping revenues, providing additional income for agricultural producers. These land usage shifts will have regional impacts, with marginal – not prime – land switching first. If the policy is structured properly, gains are expected to exceed costs within the agricultural sector as a whole.

In spite of the potential opportunities that cap-and-trade presents for farmers that are able and eligible to receive carbon credit payments for a carbon offsetting activity, there will be other farmers that will not be able to participate in carbon offsetting practices for a multitude of reasons. Whether or not cap-and-trade will benefit a particular producer will largely be determined by whether or not that farmer can adopt a carbon offsetting activity and at what cost – what is the cost of adopting the offsetting practice relative to potential carbon credit revenues?

In addition to offset credits, there will also be opportunities for some farmers to gain additional revenues from increased production of renewable energy. Increasing costs within the petroleum fuel industry via cap-and-trade will make renewable energy relatively more competitive. In addition to, the Renewable Electricity Standard (component within the House passed cap-and-trade legislation) increases the demand for renewable energy feedstocks, which will provide an additional revenue opportunity for some farmers.

The potential benefit of GHG emission reductions via cap-and-trade for agriculture is contrasted with a direct EPA regulated scenario. Achieving equal emission reductions via direct EPA regulation will result in greater energy price increases, there will not be any offsetting revenue opportunities, and some agricultural producers will be subject to direct costs of compliance; hence, greater cost impact to Agriculture. Agricultural is not capped within the cap-and-trade system, but under an EPA regulated scenario some producers will be subject to emission regulations. Under the cap-and-trade system these producers will be impacted by rising energy prices, but under EPA regulation, they will be impacted by higher energy prices and the direct costs of compliance.

Many of the "potential" opportunities/benefits of cap-and-trade to U.S. agricultural producers can be limited or not available if the farm sector is not actively engaged in the writing of cap-and-trade legislation. There is a high degree of uncertainty about which exact carbon offset activities will qualify, the quantity of offsets that will be provided for a given activity, what producers will be eligible to receive these offsets, and the length of time that farmers can continue to receive these offsets. Through engagement in the legislative process, the agriculture sector can and should be involved in helping to shape the policy in such a way that these areas of uncertainty are directed in the favor of agriculture.

A few specific examples of key policy points agriculture can work on include: (i) carbon allowances distributed to the fertilizer industry are critical in keeping the cost impacts down – it is important that these allowances are maintained and that language in the legislation ensures that this benefit is passed on to the farmer; (ii) maximizing the number of carbon offsetting opportunities available; (iii) ensuring that continued enrollment in these offset programs is available for as long as is justifiable; and (iv) involvement in establishing methodologies used to calculate sequestration rates for various carbon offsetting activities.

If one thing is clear, it is that the "potential" opportunities are critical to determining whether or not cap-and-trade will benefit or harm U.S. agriculture.

A. General Overview of Cap-and-Trade Legislation

The American Clean Energy and Security Act (H.R. 2454) was passed by the House of Representatives on June 26, 2009 to establish a cap-and-trade program that is designed to reduce greenhouse gas (GHG) emissions 17% below 2005 levels by 2020 and 83% below 2005 levels by 2050. H.R. 2454 includes a market-based approach which would establish an absolute cap on the emissions and would allow trading of emissions permits (allowances). It would also allow capped entities to purchase offset credits to offset their allowance obligations. H.R.2454 includes a separate offsets program for agriculture and forestry practices. USDA will determine which agriculture and forestry practices will be eligible to generate offset credits. Farmers and ranchers will be able to earn offsets for their practices and in turn, be able to sell the credits to refiners, utilities, or other firms subject to the cap on GHG emissions. In addition, H.R.2454 specifically excludes "agriculture and forestry sectors" from being subject to the GHG emissions cap.

In September, 2009, Sens. John Kerry (D-MA) and Barbara Boxer (D-CA) introduced The Clean Energy Jobs and American Power Act (S. 1733) on September 30, 2009. This bill drew heavily from the climate provisions of the American Clean Energy and Security Act (H.R.2454). Although the House and Senate bills are similar, some of the major initial differences were (changes are ongoing):

- The Senate bill specifies a greater initial reduction in greenhouse gases - 20% below 2005 levels by 2020.
- The Senate bill does not define clear roles for EPA and USDA to implement and administer the offsets program.
- The Senate bill favors domestic offsets over international offsets.
- The Senate bill retains EPA's authority to regulate GHGs that emit less than 25,000 tons under the provisions of the Clean Air Act (CAA), while the House bill precludes the EPA from regulating under the CAA until 2020.

In November 2009, Sens. Debbie Stabenow and Max Baucus submitted S. 2729, the Clean Energy Partnership Act of 2009. This legislation builds upon many agricultural elements of the final House bill (HR 2454). All of the agricultural elements of the House bill discussed above are retained but the bill seeks to provide even greater clarity with respect to the role of agriculture. For example, the bill provides a larger and more permissive list of carbon offset project types. The bill also has various technical aspects that make it potentially more functional/useful to engage in carbon markets. Even more significantly, the bill recognizes that not all farmers and ranchers will be able to benefit from carbon offset credits (e.g. some may be too small to profitably enter into the carbon market). The bill thus creates a Carbon Conservation Program, which seeks to assist these producers to develop projects to reduce or sequester carbon that may not qualify for carbon offset credits. These projects would be funded through allocating allowances to USDA that would be used to capitalize these projects.

As of the writing of this report, Sens. John Kerry, Lindsey Graham, and Joe Lieberman are attempting to create support for a bipartisan bill that can pass the Senate. This Senate bill is believed to combine aspects of the House passed bill with provisions that are generally considered more favorable to industry. These provisions likely include a hard price collar on emissions permits to better control costs, preemption of EPA climate regulations under the Clean Air Act and preemption of state climate initiatives that have already become law to ensure uniformity of regulation, and slower phase-in times and perhaps alternative regulatory approaches for certain industry sectors that may have more difficultly adapting to GHG regulation. However since the plan has not been released, many of the differences with the House bill are unknown.

Alternative to Climate Change Legislation

There is also the *risk* that if no climate change legislation is passed, there could be direct regulation by the EPA. On December 7 2007, the EPA announced its determination that GHGs "threaten the public health and welfare of the American people." This finding directs the EPA to regulate GHGs. In March 2010, EPA announced that they will begin regulating stationary sources emitting GHGs. During the next 3-5 years, the EPA will begin regulating the largest emitters of GHGs through a phased in approach. In addition, EPA has already announced a rule to begin regulating various mobile sources with regard to GHGs.

However, both the EPA Administrator and President Obama have publicly stated that they support a legislative solution to the problem of climate change and Congress' efforts to pass comprehensive climate legislation rather than EPA regulating GHGs. Some sources indicate the EPA endangerment finding will pressure Congress to pass climate change legislation. On the other hand, a growing number of lawmakers signal the votes may not be there for the Senate to pass climate change legislation when that chamber attempts to vote on the matter. The major reason cited by both opponents and proponents is that the EPA endangerment findings gives EPA "ownership" of the climate change issue and lawmakers will not have to take this issue into the 2010 elections.

B. Energy Price Impacts – Summary of Comparative Analysis of Studies

Informa compared the results of eight different studies which focused on projecting the carbon price and energy price impacts of H.R.2454. The results from these studies varied significantly, ranging from a carbon price in 2030 of \$13.92/mtCO_2e (2007\$), estimated by MIT, to \$190.52/mtCO_2e (2007\$), estimated within EIA's highest price scenario. These carbon price estimates in turn, directly impact projected energy prices.

The wide variation in carbon and energy price projections across these studies can be attributed largely to the variation in their assumptions. Key assumptions driving the variation across these price estimates include:

- **Reference Case (no cap-and-trade) Assumptions** - Studies utilizing reference scenarios with lower emission forecasts will inherently have lower allowance/energy price estimates than if they had utilized a reference scenario with higher emission forecasts, as there is less abatement needed to reach a particular emissions cap.

- **Energy-Efficiency Assumptions** – Studies assuming greater prospective energy efficiency inherently have lower energy demand projections. Thus, allowance/energy price estimates are relatively lower, as a portion of emission reduction requirements are able to be met by reduced energy production.

    - For example: The EIA projects 2020 reference level energy consumption to be 104.7 quadrillion Btu; they project to be reduced to 101.6 under the basic cap-and-trade scenario. In contrast, the EPA projects 2020 reference level energy consumption to be 99.9 quadrillion Btu (lower than even the reduced demand scenario projected by EIA), and they project consumption to decline to 92.9 under their basic cap-and-trade scenario.

- **Alternative Energy and CCS Technologies** - Studies assuming lower alternative energy technology cost projections (e.g., nuclear, wind, cellulosic ethanol) have relatively lower allowance/energy price estimates as more of the overall energy demand is able to be met by these alternative energy sources, thereby reducing the demand for traditional fossil fuels. This enables a portion of emission reduction requirements to be met by reduced carbon intensive energy production. Assuming lower carbon capture and sequestration (CCS) costs also result in lower allowance/energy price estimates.

- **Offset Availability** – The greater the assumption regarding offset availability, the lower the estimated allowance/energy price. The quantity and timeframe of offset availability and utilization assumptions across studies have been found through sensitivity analyses to have a significant impact on projected allowance prices.

- **Interest Rates and Allowance Banking Assumption** – Varying the assumption regarding the interest rate required to incentivize firms to bank allowances for future compliance impacts the estimated allowance price path.

- **Version of H.R. 2454** - Different studies used various versions of H.R.2454 in their analyses. For example, the Brookings Institute utilized an earlier discussion draft which had more stringent emissions caps than the bill that was ultimately passed.

In the end, Informa chose to adopt the EIA basic scenario to use as its base scenario when analyzing the implications of increasing carbon and energy prices under H.R.2454 provisions on the agricultural sector. However, sensitivity analysis was frequently conducted on this energy price assumption using the highest of all examined cases – the EIA's No International/Limited scenario and EPA's basic scenario (one of the lower price projections and a commonly cited price projection in current cap-and-trade discussions). However, it should be noted that while the high scenario may be plausible in the short-to-medium term, it becomes highly unlikely in the long term.

Table 1: Base, High, and Low Scenario Carbon and Energy Price Impacts

Cap and Trade Energy Price Impact (relative to reference case)									
	2020			2030			2035		
(nominal$)	Low	Base	High	Low	Base	High	Low	Base	High
Carbon Price ($/mtCO2e)	**$ 22.29**	**$ 40.75**	**$123.56**	**$ 45.69**	**$104.94**	**$328.37**	**64.98**	**167.16**	**528.74**
Diesel (cents/gallon)	20.59	32.57	110.65	42.32	78.31	299.55	54.60	93.10	356.10
Natural Gas ($/thous ft.^{3})	0.99	1.47	7.66	1.89	3.81	19.35	2.33	4.53	23.00

*EIA's reference case, basic case and high price scenarios are extended from 2030 to 2035 based on the average growth rate of the previous three years.
**Nominal dollars for the low price case, which is based on EPA's basic case, are derived using EIA's inflation forecast. EPA only reports their forecasts in real dollars.
Sources: EIA (high and base), EPA (low)

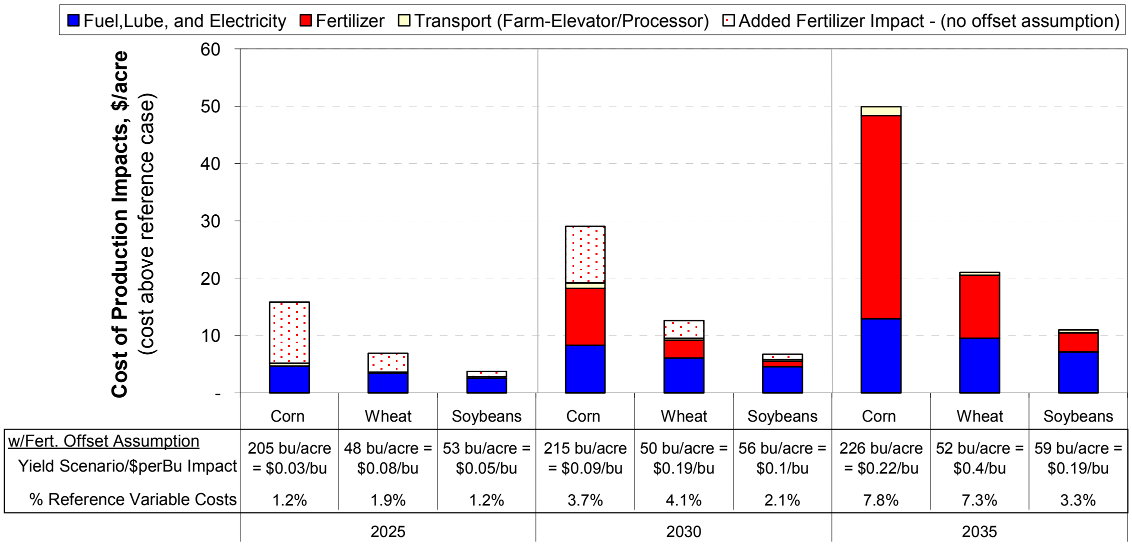
C. Cost of Production Impacts to Production Agriculture

There will be production cost implications resulting from increased energy prices that will stem from cap-and-trade which will be incurred by all farmers, although thought to be relatively modest. For each of the primary crops produced within the U.S. (e.g., corn, soybeans and wheat), Informa evaluated the impacts of potential cap-and-trade legislation on production costs, as well as any additional fuel costs associated with transporting the raw material from the farm to the elevator or first stage processor. Informa utilized its costs of production model to forecast production costs under the reference energy prices provided by the EIA in their *Annual Energy Outlook 2009* (April 2009). These forecasts are then compared with cost projections resulting from the alternative energy price scenarios discussed above: EIA basic (base), EPA basic (low), and EIA No International/Limited (high). .

General Implications

- Production cost impacts are minimal in the short-term; up until 2025.
  - Fertilizer allowances are important to keep costs down.
  - Sensitivity analysis to the assumption that fertilizer allowances are provided at sufficient quantities to offset rising energy costs and that this benefit is passed on to farmers is conducted – the implications of removing these allowances are illustrated by the dotted red bars in Figure 1.
- Even in later years (after 2025), costs are relatively modest – 7% increase above reference case variable costs for wheat production. Similar conclusions are found for corn and soybeans, with soybean impact being even less.
- Corn is impacted the most relative to soybeans and wheat, and soybeans are impacted the least. This is primarily due to higher fertilizer usage by corn.
- On a regional basis (see Figure 3 for regional definitions):
  - In the short-term, cost of production impacts are higher in the Prairie Gateway than in other regions, as this region uses relatively more energy due to their irrigation costs. However, past 2025 when the fertilizer allowances are phased out, this region is not impacted as much as other regions because it uses less fertilizer.
  - The Northern Great Plains benefits in the out years of the forecast as fertilizer costs begin to take full effect, as historical ERS data shows that fertilizer costs in this region are typically less than other regions.

Figure 1: Basic Scenario U.S. Production Cost Impacts (Corn, Soybeans and Wheat)



*Does not include fuel efficiency increases beyond that assumed in the reference case.
**Dotted red bar represents an alternative scenario, illustrating the additional costs that would be estimated if there were no fertilizer allowances and/or a case where the benefit of these allowances is not passed on to the farmer.
Sources: Informa Economics, EIA and ERS

Corn

- Under the base scenario, the impact of cap-and-trade on corn production costs in the short-term is expected to be minimal. By 2020, the impact is estimated to be $3.81/acre above reference case costs, accounting for only 1% of total variable costs. This assumes that the allowances provided to Trade-Vulnerable Industries between 2012-2025 are of sufficient quantity for fertilizer manufacturers to offset rising natural gas costs and that this benefit is passed on to the farmer.
  - If allowances are not of sufficient quantity to offset rising natural gas costs and/or this benefit is not passed on to the farmer, production cost impacts could be substantially higher. By 2020, the impact without the fertilizer allowance benefit is estimated to be $11.46/acre above reference case costs.
- As the fertilizer allowances are phased out from 2025 to 2035, the production cost impact increases substantially. By 2035, the impact is expected to be nearly $50/acre above reference costs. This increase represents 7.8% of total 2035 reference variable costs.

Soybeans

- Under the base scenario, the per acre impacts of cap-and-trade on soybean production costs in the short-term are less than corn. However, impacts are similar when compared as a percentage of variable costs.
  - Per acre, fuel and fertilizer costs are less for soybeans than for corn.

  - Fuel costs accounts for 14-15% of total variable costs for both corn and soybeans. However, fertilizer costs account for a much smaller percentage of soybean costs than corn.
- By 2020, the impact of cap-and-trade on soybean production costs is estimated to be $2.02/acre above reference case costs, accounting for only 1% of total variable costs.
- As the fertilizer allowances are phased out from 2025 to 2035, this impact increases, but because soybeans are not as fertilizer intensive as corn, particularly nitrogenous fertilizers, this impact is significantly less than what was previously presented for corn.
- By 2035, the impact is expected to be nearly $11/acre above reference costs. This increase represents 3.3% of total 2035 reference variable costs.
- The assumption that the allowances provided to Trade-Vulnerable Industries prior to 2025 are of sufficient quantity to offset rising natural gas costs and that this benefit is passed on to the farmer is of less significance relative to the corn analysis.

Wheat

- Under the base scenario, the per acre impacts of cap-and-trade on wheat production costs in the short-term are less than corn but more than soybeans.
  - However, as a percentage of variable costs, cap-and-trade impacts on wheat production costs are greater in the short-run, as fuel costs account for a larger share of variable wheat costs than the other crops.
  - In the out years of the forecast, as fertilizer cost impacts grow, the cost impact for corn becomes greater than for wheat on a percentage basis.
- By 2020, it is estimated that wheat production costs will be $2.67/acre above reference case costs, accounting for 1.6% of total variable costs.
- As the fertilizer allowances are phased out from 2025 to 2035, this impact increases, expanding to nearly $21/acre by 2035. This increase represents 7.3% of total 2035 reference variable costs.

D. Carbon Offset Credit Opportunities

H.R.2454 establishes offsets credits as an additional method to comply with the requirement to hold an emissions allowance for each metric tonne (mt) of greenhouse gas (GHG) emissions. Instead of purchasing an emissions allowance, regulated entities can purchase an offset credit that represents reductions or increased sequestration of GHGs. Through the sale of offset credits, the agriculture sector has the opportunity to not only mitigate the increased cost of production but also generate additional income through carbon credits. Farmers, in a way, will have the option to “produce carbon” in addition to their crops.

H.R.2454 includes an “Initial List” as an example of agricultural and forestry offset credit practices that avoid or reduce GHG emissions; this list includes practices under three broad categories.

- Agricultural, grassland, and rangeland sequestration and management practices (e.g., no-till conversion, fertilizer management).
- Changes in carbon stocks attributed to land use change and forestry activities (e.g., afforestation of cropland and pasture, conversion from cropland to perennials).
- Manure management and disposal (e.g., biogas capture and combustion, waste aeration).

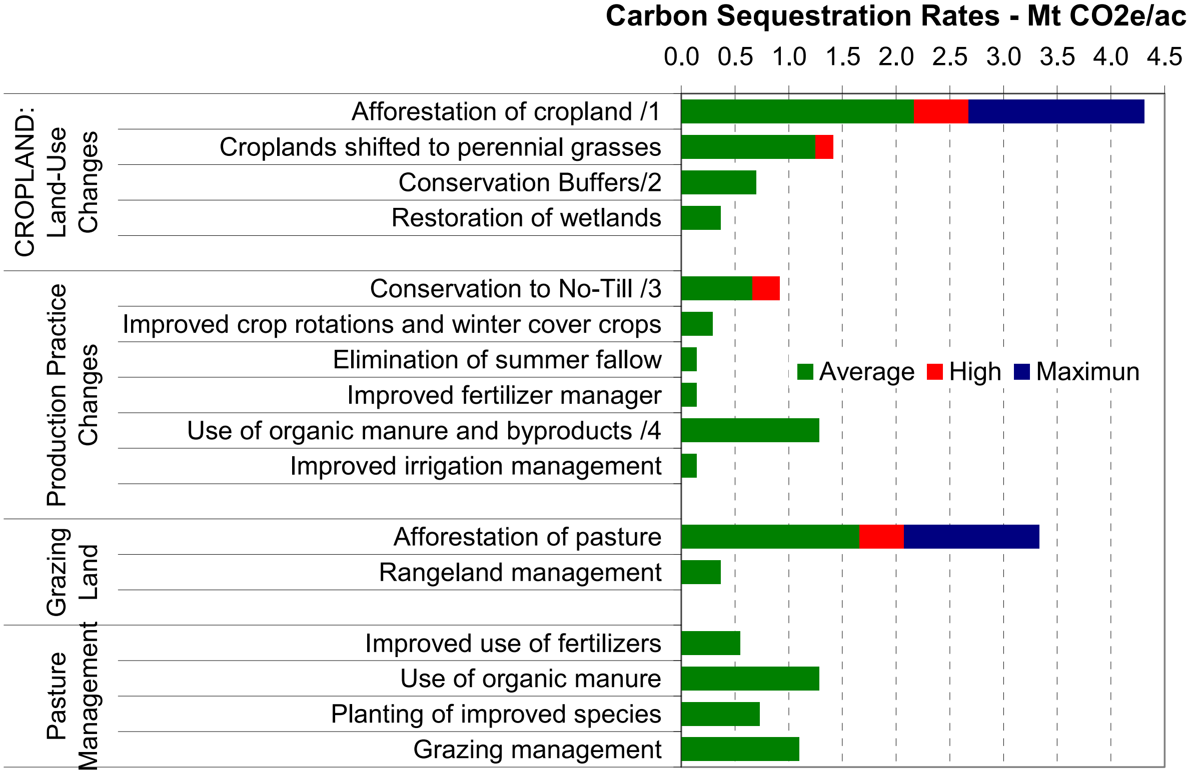
However, H.R.2454 only lists offset practices as examples; this creates a high degree of uncertainty regarding the options that will actually be available to farmers.

Figure 2 provides a perspective of the potential offset credit opportunities. In this illustration, the carbon sequestration rate (in carbon dioxide equivalent units) for land and potential production management offset credit practices is provided. The offset credit would be equivalent to the sequestration rate times the prevailing carbon price in a given year. For example, the offset credit for adopting no-till practice in 2025 would be $35 per acre (i.e., 0.53 mtCO_2e/ac/yr * $66/mt$CO_2$e).

Afforestation of cropland and pasture sequesters significantly greater amounts of carbon than other offset activities. For example, the no-till credit reaches $35/ac (in nominal terms) by 2025 while the credit for afforestation reaches $100/ac by 2025; this amount is close to 3 times larger than the offset credit for no-till and other production practices. One of the resulting implications is the incentive to convert cropland/pastureland into forests. More is discussed on this topic in section I.G. However, if farmers can stack carbon credits from various production management practices (currently not explicit in H.R. 2454), then the potential offset credits that could be generated from traditional crop production and farmer adoption rates will increase, reducing the incentive to shift cropland acres to forests. For example, if farmers were allowed to stack carbon credits, a farmer who adopts no-till, uses cover crops and improves fertilizer management could receive a carbon payment of $58/acre by 2025 (nominal terms), an increase of $23/acre over a scenario where the farmer is only able to receive the no-till credit.

In addition to receiving a carbon payment, farmers that adopt certain carbon offsetting projects may receive additional benefits stemming from improving water quality or other environmental services.

Figure 2: Carbon Sequestration Rates (SR) by Practice



Source: USDA, CCX, DOE, Informa Economics

A critical point regarding the establishment and measurement of carbon sequestration rates under the cap-and-trade system is that many factors affect the actual rate in which carbon sequestration (or loss) occurs within a particular acre of land for a particular practice (e.g., fertilizer management). Some of these factors include the following.

- Climate (temperature and precipitation)
- Crop rotation
- Soil disturbance (tillage intensity)
- Soil texture
- Drainage
- Nutrient management
- Manure application
- Soil type,
- Crop produced
- Tree species
- Regional climate
- Topography
- Management practice
- Time

H.R. 2454 indicates that a uniform method to account for carbon sequestration would be preferred (e.g., cropland in the Midwest having a single carbon sequestration factor), but it also leaves open the possibility for USDA to set sequestration rates ("SR") specific to a region/county or potentially to a crop. Based on existing research by the USDA, the EPA and the Chicago Climate Exchange (CCX), the methodology used will likely be driven by regional or county level soil type characteristics. However, the methodology used to calculate carbon SRs is not exact and the final methodology used by EPA/USDA to calculate these rates will have a significant impact on the carbon credits obtained by farmers and ranchers. While the base SR set by the final legislation/rule making process will certainly have a strong science component, the uncertainty and complexity surrounding SRs suggests that this rate can be influenced by groups that are in favor of higher or lower rates for agriculture and forestry. The fact that details of the methodology and estimates of the SRs will likely be done after legislation is passed, adds another layer of uncertainty about the scale of the potential offset credits available to farmers.

A lack of consistency among carbon SR estimates and the complexity of calculating actual SRs for a particular "carbon producer" or farm would indicate that:

- There will be room for error and/or interpretation when EPA and USDA set a rate for soil sequestration and/or other activities;
- A standardized methodology will be needed to manage the cap-and-trade program;
- This standardized methodology could be broader, such as the one implemented by CCX, or more specific, by county level and by crop;
- Stakeholders of the agricultural sector need to be engaged to ensure that the methodology used to calculate SRs is favorable.

Informa's assessment suggests that there is significantly greater uncertainty and risk regarding the potential carbon offset activities and credits to farmers than there is surrounding the energy cost impacts from H.R.2454.

1. Conversion from Conventional to Continuous No-Till

According to the Conservation Technology Information Center (CTIC), rotational tillage, which no-till is used in part of the crop rotation; represented 24% of U.S. cropland in 2004. Rotational no-till soybeans account for almost 40% of U.S. acreage. Due to soil erosion problems, the regions that employ no-till technology to the greatest extent are Eastern Uplands and Southern Seaboard. Under H.R. 2454, the offset credit for no-till will require a no-till period of up to five-years (i.e., continuous no-till); this five-year period is consistent with the benchmark period used by CCX, However, currently not all farmers are not willing to forgo tillage for a five year period due to the limitations of no-till. In 2004, continuous no-till accounted for approximately 6% of U.S. cropland.

This differentiation between rotational and continuous no-till is key when addressing concerns of additionality. There have been various concerns expressed within cap-and-trade discussions regarding whether or not no-till would provide an added carbon sequestration beyond "business as usual" and the number of farmers that would be eligible to receive carbon credit from no-till practices, particularly if they have already been practicing no-till. However, practicing rotational no-till does not sequester the same carbon as continuous no-till and only a small portion of current production is under continuous no-till.

On average, across all crops, the offset credit for adopting no-till is estimated to be $89 per acre by 2035. However, assuming the adoption of a SR methodology similar to the

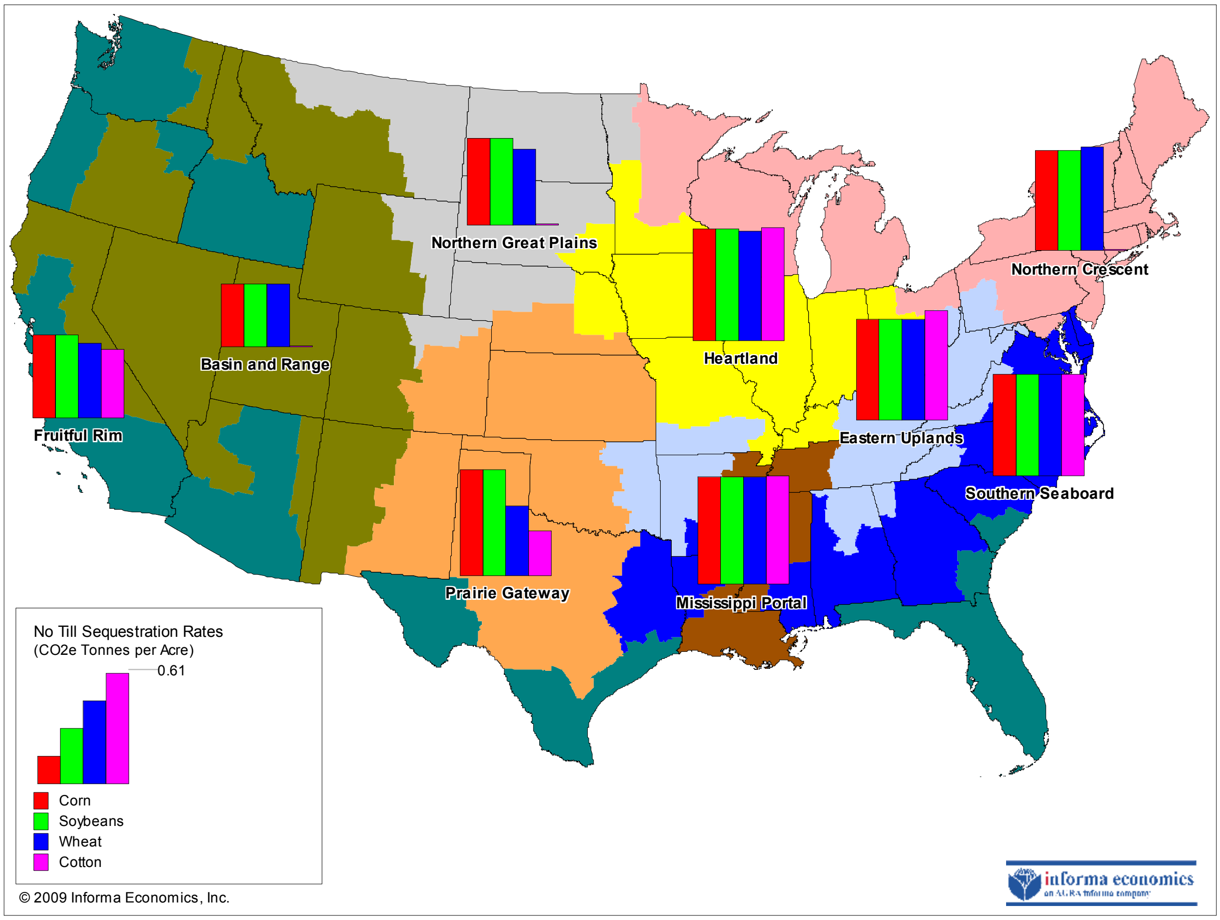
CCX where the SR is based on regional soil types, the average estimated offset credit for wheat is estimated to be lower ($72/acre) based on where the crop is grown (see Figure 3).

- In general, farmers in the Northern Great Plains and the Prairie Gateway will receive a lower no-till offset carbon credit and would be at a relative competitive disadvantage. However, net crop incomes and land prices in these two regions tend to be lower than elsewhere.

- Wheat farmers on average will get lower no-till carbon credits; however, the SR for wheat could increase relative to the regional average if the methodology to estimate SRs is specific to wheat.

- The spread among regional SRs and its consequent impact on potential carbon offset credit revenues can have a structural impact on crop production.

Figure 3: Average No-Till Carbon Sequestration Rate by Region and Major Crop



The ability of the farmer to adopt continuous no-till profitably will determine if the farmer is able to take advantage of this carbon credit opportunity to offset the increased energy costs.

- The ability of the farmer to adopt continuous no-till practices will be heavily impacted by the definition of continuous no-till. Cap-and-Trade legislation needs a definition of no-till that allows farmers the flexibility to take advantage of new no-till technologies.

- The no-till farmer should not be punished for "Acts of God" that largely only harm farmers practicing no-till. In H.R.2454, the secretary of USDA can lower the penalty of breaking a continuous offset credit contract if USDA deems it to be a catastrophic event. Due to the local nature and timing of agriculture, non-catastrophic events, such as an unusually cold, wet spring, could harm a no-till farmer and not harm a conventional farmer.

- Continuous no-till corn has the greatest barriers to overcome in terms of economics and agronomics. Continuous no-till soybeans have the easiest path to adoption.

- Southern areas, such as the Southern Seaboard, Mississippi Portal and Eastern Uplands have the least resistance adopting continuous no-till practices. The Northern Crescent and Northern Great Plains have the largest barriers to overcome to adopt continuous no-till practices.

- These regional and crop adoption barrier differences are largely driven by the fact that the ground needs to be warm for corn to germinate well, this often requires the land to be turned over in northern areas so that the sun can warm the soil. Soybean germination is less sensitive to soil temperature. Furthermore, more time and precision is required for no-till relative to conventional till, and the shorter planting window is time limiting.

2. Additional Carbon Offsetting Opportunities

There are numerous carbon offsetting opportunities in addition to no-till. A list of potential "other" carbon offsetting revenue opportunities is presented in Figure 2, a few of which are described below.

Cover Crops

By 2035, the estimated carbon payment from the use of cover crops is $39/acre.

Cover crops are often planted in late summer or fall, after harvest, to provide soil cover during the winter months. Cover crops reduce wind and water erosion; in the case of a legume crop, fix nitrogen in the soil; improve soil quality; and help to suppress weeds and reduce insect and disease problems. However, these benefits are weighed against the costs of establishing the cover crop (e.g. seed and planting). Currently, economic assessments often compare the most quantifiable benefits of fertilizer and herbicide reduction against these establishment costs. For certain farmers that do not currently find cover crops to be economically efficient, the addition of a carbon payment could justify its adoption.

Elimination of Summer Fallow

By 2035, the estimated carbon payment from eliminating summer fallow is $20/acre.

Summer fallow systems are often used in winter wheat production to store water in the soil prior to seeding. However, by leaving the soil open to the elements, this practice typically results in wind and water erosion. In addition to erosion benefits, planting a cover crop during the summer (i.e., eliminating summer fallow) can also help to reduce weed, pest and disease pressures and in the case of a legume crop, can help fix nitrogen in the soil. According to the 2007 Census, approximately 15.7 million acres or 1.7% of all cropland was in summer fallow.

Improved Fertilizer Management

By 2035, the estimated carbon payment from improved fertilizer management is approximately $20/acre.

There are several practices which can be included in the discussion of improved fertilizer management practices, with the end goal being to increase efficiency, including

- Timing of fertilizer application.
- The method of fertilizer application
- The type of fertilizer applied, including the use of advanced fertilizers
- Optimum placement of fertilizer applications
- Use of nitrogen-fixing cover crops

E. Net Revenue Impacts

Net revenue impacts are examined by region and crop by weighing projected production cost impacts versus the potential carbon offset credit revenue opportunities.

Much of the current net revenue impact discussions surrounding the potential cap-and-trade legislation have focused on two extreme net impact scenarios: (1) the production cost impacts of H.R.2454 assuming no carbon offsetting revenue and (2) the net benefit which includes an offset revenue which is calculated by taking the carbon price multiplied by the sequestration rate of a practice, assuming 100% adoption of offsetting practice and no adoption costs.

Informa focuses on calculating the net revenue impacts when considering no-till as a potential offset revenue opportunity. No-till is one of the more researched carbon offsetting opportunities and more data is available on the costs and benefits associated with this practice than other carbon offsetting activities. It is also one of the more common, as many farmers have at least some moderate degree of understanding of the practice.

In contrast to previous analyses, the cost/risk associated with adopting no-till is taken into account. These costs/risks are assessed by region to formulate and adoption rate which is used to weigh the net benefit of no-till adopters against the cost incurred by those that do not adopt no-till (the weighted net benefit is illustrated within the following net impact diagrams by the dotted green line). The cost/risk of no-till adoption, equipment investment as well as fuel savings are included in the calculation of net no-till adopter revenue.

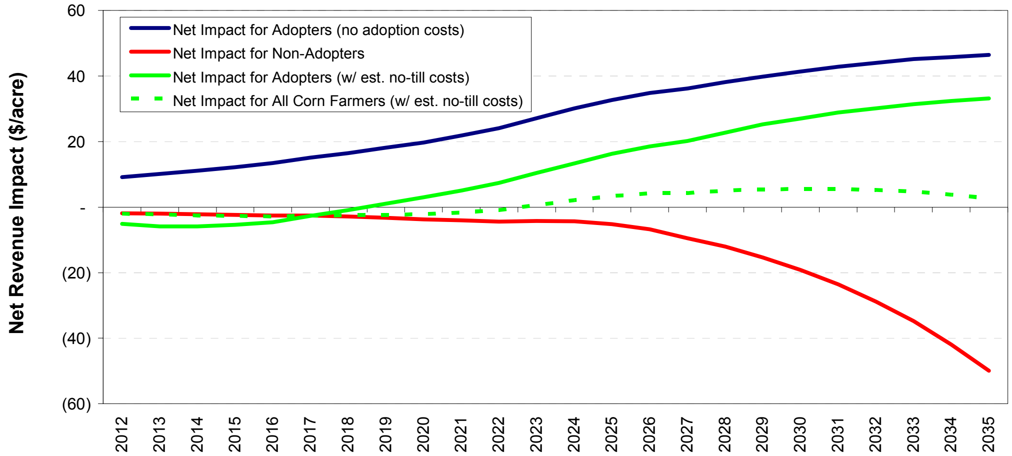
Informa finds the net impact to be positive when considering only no-till, however, this benefit would be augmented even further when including other carbon offsetting activities. The potential revenue from these alternative activities is included in Table 2 (adoption costs are not calculated for the “other” opportunities – net revenue is not calculated).

The more activities that qualify as carbon offsetting projects the better-off U.S. agriculture will be, and allowing farmers to stack carbon credits would further increase revenue opportunities.

1. Corn

- The net impact of cap-and-trade on the corn industry is relatively modest. While there is potential for losses for farmers who cannot adopt a carbon offsetting activity; up to around $50/acre by 2035, relative to the reference case, there is also a potential benefit of up to $46/acre for no-till adopters (assuming no costs associated with gaining this no-till carbon credit).
- Under the base scenario assumptions regarding no-till costs and adoption rates, Informa estimates that on average, U.S. corn farmers will neither gain nor lose substantially from cap-and-trade (under H.R.2454 provisions).
- Sensitivity analysis is conducted on various assumptions within the report. The key drivers determining whether there is more gain or more loss than estimated will be: (1) the carbon SR and (2) the industry’s ability to adopt carbon revenue generating activities, such as no-till, with the least amount of cost.
- However, there are key regional differences. The Northern Crescent and the Northern Great Plains will be at a distinct disadvantage, as there are greater barriers and costs associated with no-till corn adoption in these northern regions.

Figure 4: U.S. Corn: Base Scenario Net Impacts (no-till carbon credits only)

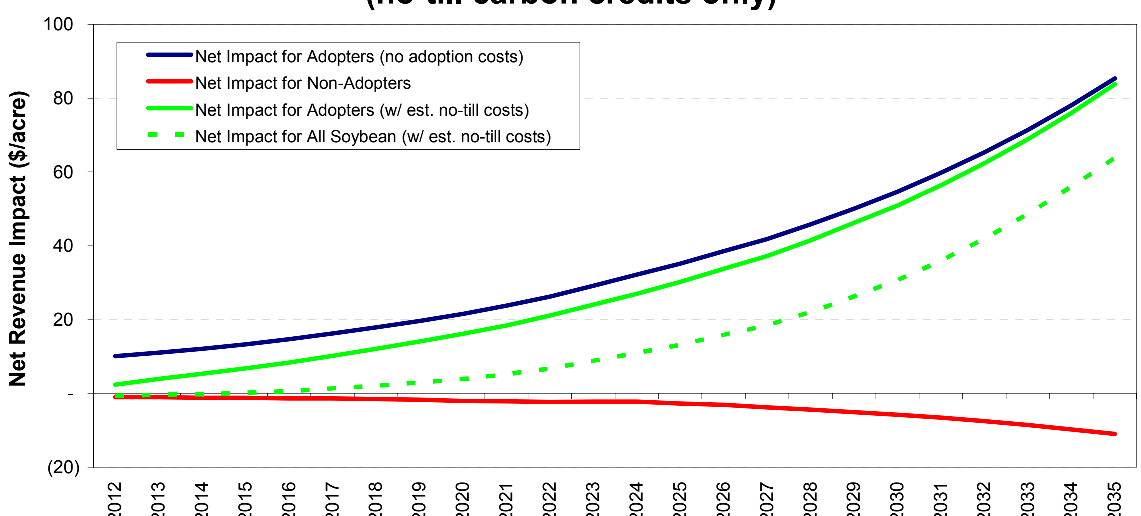


Source: Informa Economics analysis; EIA basic energy scenario

2. *Soybeans*

- Soybeans have a smaller potential loss and larger potential gain, as the production cost impacts are projected to be lower for soybeans than for corn, and the costs associated with adopting no-till also are lower.
- Under base scenario assumptions, it is estimated that on average, U.S. soybean producers will benefit by approximately $60/acre from cap-and-trade by 2035.
- Regional net impact differences for soybeans will primarily be driven by the relative carbon sequestration rates.

Figure 5: U.S. Soybeans: Base Scenario Net Impacts (no-till carbon credits only)



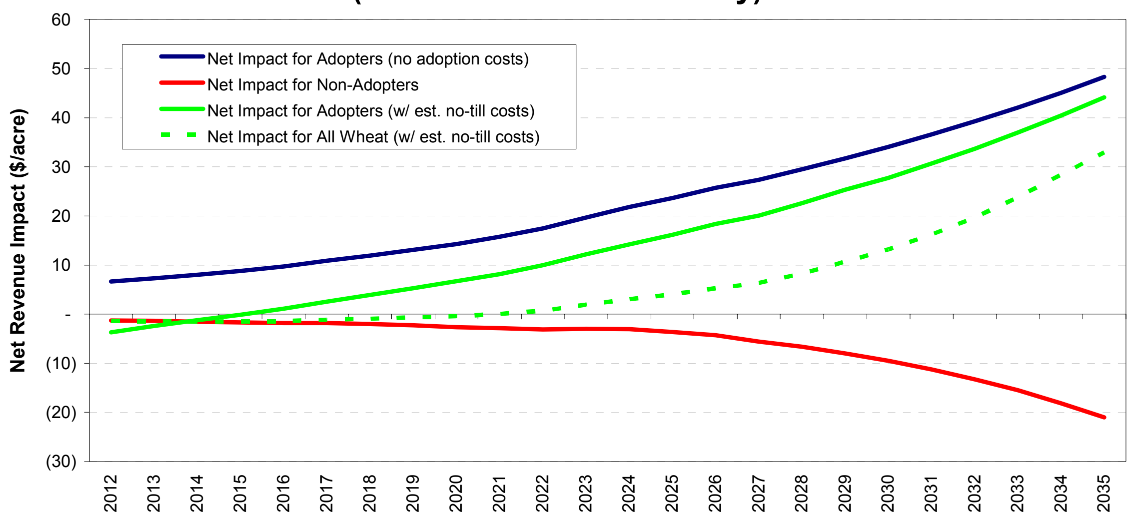
Source: Informa Economics analysis; EIA basic energy scenario

3. Wheat

- Wheat has a smaller potential loss and larger potential gain than corn, but a higher potential loss and a lower potential gain than soybeans.
- Under base scenario assumptions, it is estimated that on average, U.S. wheat producers will benefit by approximately $30/acre from cap-and-trade by 2035.
- As with soybeans, the key driver behind regional net impacts for wheat will be determined primarily by the relative carbon sequestration rates.

Figure 6: U.S. Wheat: Base Scenario Net Impacts

(no-till carbon credits only)



Source: Informa Economics analysis; EIA basic energy scenario

4. Additional Carbon Offsetting Revenue Opportunities – Impact on Net Revenue

- Table 2 illustrates potential revenue opportunities in addition to no-till; these opportunities were initially presented in section I.D.
  - These carbon payments only represent the revenue side and do not include any costs associated with these activities. Both the revenues and the costs need to be taken into consideration when accessing the net impact on a per farmer basis.

- These other opportunities may help reduce the costs of cap-and-trade for farmers who are unable to adopt no-till.
  - For example, if no-till is not a profitable option, but a farmer could improve fertilizer management practices, the carbon payment could be $20/acre.

- If allowed to stack carbon credits (not explicitly stated in H.R.2454), revenue opportunities would be expanded.
  - For example, a wheat farmer adopting no-till and improving fertilizer management could recieve a carbon revenue payment of $92/acre by 2035.

- This is calculated using an average no-till payment for wheat of $72/acre not the U.S. corn, soybean and wheat average shown in Table 2.

Table 2: Carbon Offset Revenue Opportunities

Practice	Sequestration Rate	2012	2015	2020	2025	2030	2035
	Mt CO2e/ac	*Carbon Credit - $/Acre **					
Afforestation of cropland /1	1.90	25	38	62	100	160	255
Croplands shifted to perennial grasses	1.25	19	25	41	66	105	167
Conservation Buffers/2	0.70	11	14	23	37	59	93
Restoration of wetlands	0.37	6	7	12	19	31	49
Conservation to No-Till /3	0.66	10	13	22	35	56	89
Improved crop rotations and winter cover crops	0.29	4	6	10	15	25	39
Elimination of summer fallow	0.15	2	3	5	8	12	20
Improved fertilizer manager	0.15	2	3	5	8	12	20
Use of organic manure and byproducts /4	1.28	20	26	42	67	108	172
Improved irrigation management	0.15	2	3	5	8	12	20
Afforestation of pasture	1.48	23	30	48	78	125	198
Rangeland management	0.37	6	7	12	19	31	49
Improved use of fertilizers	0.55	8	11	18	29	46	74
Use of organic manure	1.28	20	26	42	67	108	172
Planting of improved species	0.73	11	15	24	39	62	98
Grazing management	1.10	17	22	36	58	92	147
Carbon Price (nominal$/CO2e)		19	25	41	66	105	167

* Sequestration rates are discounted by 20% to reflect potential reversals.
Source: USDA, CXX, DOE, IEA, Informa Economics.

5. Renewable Electricity Standard

- There will also be opportunities for some farmers to gain additional revenues from increased production of renewable energy.
  - Increasing costs within the petroleum fuel market via cap-and-trade will make renewable energy relatively more competitive.
  - In addition, the Renewable Electricity Standard (a provision in H.R.2454) increases the demand for renewable energy feedstocks.
  - Opportunities for increased energy crop production will be particularly prevalent in the Southeast and the Prairie Gateway where land rents are typically lower and long growing seasons lead to relatively high (relative to northern regions) biomass yields.

- The renewable electricity standard (RES) requires states to produce six percent of total electricity from renewable sources by 2012 and this percentage would increase to 20 percent by 2020.
  - However, given that many states already have an RES, the added demand from a federal standard enacted via cap-and-trade is partially mitigated.
  - It is estimated by the EIA that an additional 171 billion kwh of renewable electricity is required to meet the 2020 RES. This is in addition to the renewable electricity that is expected to result from already enacted state level RESs.

- The majority of this increase in renewable electricity is expected to come from wood and other biomass. The EIA estimates that 94% of the increase in renewable electricity is to come from wood and other biomass – this equates to approximately 32 million tons of biomass – $15.7 billion in electricity (based on generation price of electricity under base cap-and-trade scenario).

  - The additional wind and solar demand expected to come from the RES is minimal in comparison to the biomass demand.
    - Wind and hydro are expected to be major contributors to overall renewable electricity supplies; however, their added contribution resulting from a federal RES is expected to be minimal.
    - The growth of wind power beyond reference case levels in major cropland areas that are also key wind and solar areas is limited by infrastructure. They have the supply but demand is limited by the lack of major interstate transmission lines, which are necessary to get the energy from the farm to urban areas where large quantities of energy are demanded.
    - In addition, carbon payments and other government incentive programs for biomass production, such as BCAP (Biomass Crop Assistance Program) provide economic incentives for increased biomass production.

Table 3: 2020 Renewable Electricity Generation

	2020		
	Reference	**Basic**	**Additional Generation**
Total Renewable Generation	*(billion kilowatthours)*		
Conventional Hydropower	298.72	299.65	0.93
Geothermal	21.86	24.22	2.35
Municipal Solid Waste	24.41	28.06	3.65
Wood and Other Biomass	**138.93**	**300.08**	**161.15**
Solar	20.11	20.07	-0.04
Wind	203.47	206.27	2.80
Total	**707.50**	**878.34**	**170.84**
	(million dry tons)		
Total Biomass	27.56	59.53	31.97

*Basic – Represents a federal RES under the base EIA cap-and-trade carbon price scenario.
Source: EIA; Informa Economics analysis

  - The 32 million tons of additional biomass can come from four possible biomass categories: agricultural residues, energy crops, forest residues and urban wood waste/mill residues.
    - Agricultural residues account for a relatively small share of the overall increase in biomass demand due to a federal RES.
    - Informa estimates that energy crops could represent approximately 50-75% of the overall increase in biomass demand. At average energy crop yields of 5-10 dry tons/acre (yield is weighted by projection that majority of production will occur in southern regions), approximately 1.6-4.8 million additional energy crop

acres will be required. Sensitivity analysis is conducted on various assumptions within the full report.

- The potential revenue impact of this increased demand will vary greatly from one farmer to another based on future crop yields, production costs, and the impact on biomass prices.
  - A case study is presented in the full report. Under this specific case study, net revenue from switching from wheat to switchgrass production increased by $18/acre relative to wheat returns on marginal lands where yields where 20% below Prairie Gateway regional averages. Net revenues did not increase relative to revenues obtained using average wheat yields and costs.
  - Despite the range in potential net revenue impacts due to the RES, a few generalities can be made regarding potential revenue opportunities:
    - Due to the increased demand resulting from cap-and-trade, biomass prices will be increased relative to reference case levels.
    - By 2020, the carbon payment for switching from traditional row crop production to a perennial grass is projected to be $41/acre.
    - Other government programs will provide additional financial incentives to produce biomass. For example, the BCAP will pay the producer:
      - Matching payments for the first two years for the amount paid for the collection, harvest, storage and transportation of eligible material by a qualified Biomass Conversion Facility, up to $45/ton - at a biomass yield of 5 tons/acre, this equates to $225/acre;
      - Up to 75% of establishment costs;
      - If within an eligible project area, an annual payment for up to 5 years based on market-based rental rates (a producer cannot receive matching payments and annual payments simultaneously).

F. EPA Regulation Scenario

Under Title V of the Clean Air Act (CAA), any entity that has the potential to emit more than 100 tons of a regulated pollutant must obtain a permit to operate. This limit impacts a wide range of agricultural operations. In 2007, the Supreme Court, in *Massachusetts v. EPA*, ordered the EPA to determine whether heat-trapping gases harmed the environment and public health. Then, on December 7, 2009, the EPA announced its determination that GHGs "threaten the public health and welfare of the American people," meaning these gases are to become regulated pollutants under the Clean Air Act. This finding implies that unless alternative legislative action is taken, the EPA is required to regulate GHGs from any entity with the potential to emit more than 100 tons of GHGs per year.

- Under properly structured policy, the net revenue impacts from cap-and-trade are projected to be positive; however, there will be no opportunity for positive impacts under direct EPA regulation and the potential negatives are greater. The cost impacts are greater under direct EPA regulation and the potential benefits are zero.

  - Energy price impacts will be higher under direct EPA regulation than under cap-and-trade for the following reasons.
    - There is substantial support behind the idea that a cap-and-trade based approach to GHG regulation would be less costly than a "command-and-control" approach, which is likely to be employed under a EPA regulating scenario.
    - Offsets are used in the cap-and-trade scenario to help mitigate emission reduction costs; these would not be available under direct EPA regulation.
    - Despite discussion regarding who the EPA will and will not regulate, according to the Clean Air Act, the EPA could potentially regulate agricultural producers that emit more than 100 $mtCO_2e$ per year. This regulation would be a direct cost to many agricultural producers and it would be in addition to the energy price impacts stemming from regulation on energy producers.
  - An EPA regulated scenario does not provide offset revenue opportunities that could mitigate energy price impacts.

- Production cost impacts could potentially be multiple times more than that of cap-and-trade, with no offset revenue opportunity.
  - At minimum, the cost impacts from direct regulation will be at least that presented under the cap-and-trade analysis (2025 = $3.64/acre increase). Plus more because…
  - There will not be any fertilizer allowances to help mitigate energy price impacts on fertilizer prices (adds $3.39/acre);
  - There will not be any domestic or international offsets to mitigate energy price impacts;
  - Direct regulation is less efficient than market based approaches and thus there will be an inefficiency cost; and
  - There will be a direct compliance cost on some agricultural producers (none are regulated under cap-and-trade).

G. Acreage Shift Implications

In addition to the array of carbon credit opportunities that can be employed on the farm, there are also carbon credit opportunities that can be gained by switching to a carbon crop such as forestry or perennial crop production. If the "carbon crop" offers these lower returning crop producers with a greater net return, then there will be an economic incentive present for these farmers to switch to the alternative crop called "carbon."

The USDA analysis indicated that by 2035, 34.4 million crop and pastureland acres will be converted to forest, with approximately 60% of this shift coming from cropland acres. Their analysis shows that the Corn Belt is impacted particularly hard, accounting for 12.2 million of the total 21 million cropland acres expected to be converted to forest by 2035. It is interpreted that the 21 million acre loss projected for cropland by 2035 is just the shift toward forestry and does not include the shift from traditional row crops to perennial crops. However, according to a recent (3/15/10) memo from Dr. Joseph

Glauber, Chief Economist of the USDA, the agency is currently working with the EPA to review the assumptions and update their model.

The University of Tennessee analysis concluded that under a carbon scenario that goes up to \$27/mtCO_2, conversion of pastureland to energy crops and hay land account for the majority of acreage shifts by 2025. Their analysis did not find large shifts in cropland acreage going toward afforestation and very minimal corn, soybean and wheat acreage shifts (e.g., 1.2 million corn acres shifted primarily to energy crop production).

Informa addressed the issue of potential cropland acreage shifts by comparing expected net returns to land for corn, soybeans and wheat with expected net returns from carbon offsetting activities. In addition to economic comparisons, cultural and sociological factors where taken into consideration, as well as other government programs and incentives such as the Renewable Fuel Standard and the RES. In Informa's assessment, the acreage shifts are projected to be in between that of the USDA and the University of Tennessee. However, the key difference between Informa's assessment and USDA's is that Informa does not project large cropland shifts within the Corn Belt and other prime cropland areas.

As with any analysis forecasting 20+ years into the future, there is a high degree of uncertainty and a large set of assumptions are required in order to reach meaningful conclusions, particularly given the complexities that are created when dealing with a future policy where the details are not yet fully developed. Thus, the analysis should be viewed as a guide to assess the potential magnitude, direction, and relative acreage shift.

<u>General Conclusions</u>

- Early on, the majority of the acreage shifts due to afforestation will likely come from pastureland, as the net returns for pastureland are typically lower than the net returns of traditional row crops.

- Initially, the majority of cropland shifts will be to perennial crops, with the exception of certain regions where barriers to entry for forestry are lower.

    - Increased demand for forage and energy crops will support the net returns of perennial crops.
        - The shift in pastureland to forest, along with the RES and RFS will increase the demand for perennial crops. This increased demand, along with the carbon credit payment which increases overtime, will provide economic incentive for some cropland acres to shift to perennial/grassland crops.
        - Under base scenario conditions, Informa projects that by 2035, roughly 11-18 million acres of corn, soybeans and wheat (5-8% of baseline acres) could potentially switch to perennial crops.

  - There is less risk associated with shifting to perennial crop production relative to shifting to forestry.
    - Shifting to perennial crops require less of a time commitment than switching to forestry.
    - Producing a perennial crop requires fewer learning curve adjustments beyond the scope of the typical farmer's bounds of expertise. However, in areas of the country where forestry production is currently more common (e.g. the Southeast and the Northeast), this risk can be reduced.

  - Perennial crops offer an annual income stream in addition to the carbon payments. Whereas, it could be 20+ years before any forestry revenues in addition to the carbon payment are obtained.

  - Initial start-up costs will generally be greater for forestry than for perennial crop production. This may pose a cash flow barrier, particularly for areas of the country that typically produce lower valued crops.
    - However, in cases where land could be leased to an already existing forestry company, these start-up costs are minimized.

  - In addition to economic reasons, there are also cultural reasons why many farmers will switch to perennial crop production before switching to forestry.
    - For many farmers, farming is a way of life, and for many, it is the only life they know. There may be a general resistance to switching to forestry in an effort to continue farming, and perennial crop production may provide a viable economic alternative. Yet, for other, more part-time farmers, there will be less cultural resistance to switching to forestry.

- As the carbon price increases, particularly in the years beyond 2035, more cropland can be expected to go into forestry.

  - As the carbon payment for forestry becomes large the economic incentive to switch to forestry becomes greater, causing more row crop acreage to shift into afforestation.
    - Under base scenario conditions, Informa projects that by 2035, roughly 5-9 million acres of corn, soybeans and wheat (2-4% of baseline acres) could potentially switch to forest.

- Yet, even at the 2035 nominal carbon price level of \$167/mtCO_2e, prime cropland will not shift to forestry or perennial crop production.

  - Prime cropland is not expected to shift to forestry or perennial crop production as expected net returns under average yields are greater than the expected net revenues (including carbon payment) from either forestry or perennial crop production.
    - Marginal/lower yielding land is expected to shift away from traditional row crop production before prime cropland.

- Informa estimates that by 2035, approximately 16-27 million corn, soybean and wheat acres could switch to forestry (5-9 million) or perennial crop (11-18) production, relative to baseline levels. Yet, this 7-12% loss in acreage would account for a lower, 4-7% reduction in production.

    - Because lower yielding acres account for the vast majority of projected acreage losses, production is not reduced to the same extent as acreage.

- Regions and crops with larger net returns can expect to see less acreage shifting to these alternative carbon crops than regions with lower net returns. Furthermore, areas with wider yield and profitability distributions can also expect to see larger acreage shifts.

    - Wheat acreage is expected to decline the most as a percentage of its baseline acres, relative to corn and soybeans.
        - For landowners, a shift to forestry or perennial crop production is a positive, as the shift occurs because returns are greater.
        - For producers who rent the land, a shift to perennial crops could be positive if the full revenue increase is not captured in higher land rents.
        - For producers who rent the land, a shift to forestry would be a negative.

    - The Prairie Gateway region is expected to experience the greatest reduction in row crop production, both as a percentage of baseline acres and in terms of total acreage losses.
        - Wheat returns in the Prairie Gateway are lower than the returns of any crop or any region, and the climatic conditions of this region are well suited for energy crop production, such as switchgrass, which requires relatively little water.

    - The Northern Crescent is another region that is projected to lose more acres relative to other regions.
        - The majority of the acres leaving row crop production in this region are expected to be corn acres, as corn is the low returning crop for this region. As previously discussed, corn farmers within this region will have a harder time adopting no-till due to climatic conditions.
        - The majority of this shift is expected to go into forestry.

    - Other wheat producing areas are also expected to lose crop acreage. Regions such as the Basin and Range, the Northern Great Plains and the northern areas of the Fruitful Rim can all expect to lose wheat acres.
        - While these regions have higher wheat returns relative to the Prairie Gateway, on average, their returns are less than corn and soybeans produced in other regions.
        - However, the alternative carbon crop returns in some areas of these regions may be limited.

- The more southern regions (e.g., the Southern Seaboard, the Eastern Uplands, and the Mississippi Portal) are expected to have moderate acreage shifts out of corn, soybean and wheat production and into both forestry and perennial crop production.

- Due to the returns and narrow yield distributions typical in the Heartland, this region is expected to lose the least amount of cropland. Only the marginal/lower yielding land is expected to shift away from traditional row crop production in this region.

- While soybeans typically have lower net returns than corn, the expected acreage shifts from soybeans is less than from corn.

Given the many assumptions that were required to reach the acreage shift conclusions sensitivity analysis was conducted. The key assumptions identified as having the greatest impact on acreage shifts were the carbon/energy price scenario, the forest and perennial grass sequestration rates and the net row crop revenue growth.

H. Overview of Potential Carbon Revenue Opportunities for Livestock under Cap-and-Trade

Livestock production directly adds CO2e to the environment through the normal digestive process, or enteric fermentation, and manure management systems. And since this sector is not capped, emission reductions could be eligible for offset credits.

- Enteric fermentation emissions are twice as large a market as GHGs from manure. Enteric fermentation emissions are approximately 140 million metric tons versus 60 million metric tons from manure waste management systems (WMS).
- Ruminant animals are the source for over 95% of enteric fermentation emissions.
- Reducing enteric fermentation emissions are an opportunity for the beef and dairy industry to receive carbon credits without large capital outlays.
- Dairy has the greatest opportunity to capture revenues from cap-and-trade legislation – both dairy and beef have an opportunity to reduce enteric fermentation, dairy have a greater opportunity to reduce emissions from manure.

Table 4: Enteric Fermentation Annual Carbon Sequestration Payment by Animal

	2010	2015	2020	2025	2030	2035
Bulls	$ -	$ 10.97	$ 17.71	$ 28.53	$ 45.56	$ 72.55
Dairy Cows	$ -	$ 17.26	$ 27.86	$ 44.89	$ 71.69	$ 114.15
Beef Cows	$ -	$ 10.53	$ 17.00	$ 27.39	$ 43.74	$ 69.65
Dairy Heifers	$ -	$ 8.19	$ 13.22	$ 21.30	$ 34.02	$ 54.17
Beef Heifer	$ -	$ 8.19	$ 13.22	$ 21.30	$ 34.02	$ 54.17
Heifers (Slaughter)	$ -	$ 6.87	$ 11.10	$ 17.88	$ 28.55	$ 45.47
Steers	$ -	$ 6.87	$ 11.10	$ 17.88	$ 28.55	$ 45.47
Calves	$ -	$ 6.87	$ 11.10	$ 17.88	$ 28.55	$ 45.47

Source: IPCC and Informa

- Dairy and swine have the greatest opportunity to collect carbon credits by reducing the GHG emissions off of WMS.
  - Methane digesters are the best system to dispose of manure from an environmental standpoint. From an economic standpoint, methane digesters are cost prohibitive, except for large wet manure collecting dairies. As engine technology improves, electricity prices increase, and carbon credit prices increase, smaller dairies will be able to profitably install methane digesters, but the larger operations clearly enjoy an economy of size advantage. The legislation will reinforce the trend to larger dairy operations.
  - Swine operations have an opportunity to flare off methane from the manure collection system.

Table 5: Manure Annual Carbon Sequestration Payment by Species

	2010	2015	2020	2025	2030	2035
Dairy Cows	$ -	$ 13.78	$ 22.25	$ 35.85	$ 57.25	$ 91.16
Swine	$ -	$ 2.24	$ 3.62	$ 5.83	$ 9.32	$ 14.83

Source: IPCC and Informa

- Poultry operations will incur the costs of cap-and-trade legislation and do not have any real opportunities to benefit.
- The ability to grow trees for carbon credits or plant renewable fuel crops to meet the RES will provide alternative opportunities to land owners of a cow/calf operation, other than current cow/calf operations. Cow/calf operations that do not own their land could be forced into liquidation. Areas of the country that are unable to plant trees and renewable crops will increase their market share of the cow herd.
- Feedlots depend on cattle numbers to make money. Any legislation that increases the cow/calf operators' ability to engage in other activities, which do not produce calves is negative for the feedlot industry

I. Policy Implications and Options

If structured properly, cap-and-trade has the potential to provide significant long-term benefits to a large segment of farmers; however, there are also plausible policy design outcomes that could be very harmful. A lack of engagement could leave agriculture in a weaker position, if and when a final bill comes to fruition.

Informa identifies policy issues or implications that can represent a risk or an opportunity to the agriculture sector. A few key policy points the agriculture sector can work on include:

- Carbon allowances distributed to the fertilizer industry are critical in keeping the cost impacts down – it is important that these allowances are maintained and that language in the legislation is inserted to ensure that this benefit is passed on to the farmer;
- Maximizing the number of carbon offsetting opportunities available;
- Ensuring that continued enrollment in these offset programs is available for a long as is justifiable; and
- Involvement in establishing methodologies used to calculate sequestration rates for various carbon offsetting activities.

These and additional issues/implications are outlined below in Table 3.

Table 6: Cap-and-Trade Policy Implications and Options

Subject	Issue	Policy Option
Fertilizer Allowances	• H.R.2454 provides an allocation for up to 15% of total emission allowances to go toward Trade-Vulnerable Industries, which begins to significantly decline starting in 2026. However, it is not clearly stated which specific industries are included under Trade-Vulnerable Industries, nor is there a requirement like there is for electric utilities that this benefit be passed on to consumers.	• Extend the quantity and timeframe under which these allowances are allocated by as much as possible. • Adding phrasing similar to that found within the section of H.R.2454 that allocated allowances to the electric utilities and directs them to pass on this benefit to the consumer would ensure that the farmer does in fact receive the benefit of allowances allocated to Trade-Vulnerable Industries. • It should be made as clear as possible which industries are included under Trade-Vulnerable Industries.
No-Till Definition	• What qualifies as no-till will be determined by the USDA. However, these rules will be critical determinants of who can and cannot participate in no-till.	• The bill should define no-till as clear as possible in advance and be flexible enough to adequately include new technologies.

Subject	Issue	Policy Option
"Acts of God" Provisions	• Currently, the secretary of USDA can lower the penalty for defaulting on a continuous no-till carbon contract if the reason is due to a catastrophic event. Due to the local nature and timing of agriculture, non-catastrophic events, such an unusually cold, wet spring, could prevent an optimal stand under no-till practices, which will reduce yields.	• The bill should direct the Risk Management Agency (RMA) to develop an insurance policy that covers the risk of the farmer being forced to break the continuous no-till contract. This will decrease the risk associated with no-till and increase the adoption rate.
Definition of Continuous vs. Rotational No-Till	• Although rotational no-till is estimated by CTIC to be 24% of total U.S. cropland in 2004, continuous no-till was only 6%.	• The bill should define continuous no-till and rotational no-till. This difference should be stressed when addressing concerns regarding additionality.
Starting Point for No-Till Qualification	• When evaluating whether or not a particular farmer already practices no-till for purposes of meeting the additionality requirements of the bill, selecting any one year as a starting point will result in farmers being excluded from the program based on rotational no-till practices. However, just because the farmer may practice rotational no-till does not mean that the farmer practices continuous no-till, which is what would be required under the bill.	• If the bill has to have a starting point for no-till adoption, it should be based on the number of acres that have been in no-till for the previous five years.
Starting Point for Carbon Offset Projects	• There is language in H.R.2454 that could be used to extend the starting date for practices such as no-till to January 1st, 2001. However, this will still leave a segment of farmers without the potential to earn a credit.	• One option is to extend the cutoff date to prior to January 2001. • Another option would be to grandfather farmers that have already adopted continuous no-till practices, since no-till in particular is easily reversible.
List of Carbon Sequestration Activities under Title V	• H.R. 2454 includes several practices as examples (i.e., H.R. 2454 used the word "such as" instead of "including"). This leaves an open door for interpretation and changes.	• The bill should establish the current list of offset practices as a minimum set – not as examples. • The bill should allow for other potential practices to be added.
Carbon Sequestration Rate Calculation Methodology	• The methodology to calculate carbon SRs is not exact, and while the base sequestration rate set by the final legislation/rule making process will certainly have a strong science component, this rate can be influenced. • There is currently room in the wording of the bill to establish a standardized SR by region/type of land and offset practice or more crop/region specific methodologies.	• Much of the methodology to estimate SRs will be decided after cap-and-trade is passed (if it is passed). However, language could be added to the final legislation to ensure that non-government, agricultural interests are well represented throughout the rule making process. If only left to USDA, the methodology used to calculate sequestration rates may or may not be in favor of most farmers.

Subject	Issue	Policy Option
Conservative and Adequate Margin of Safety – Sequestration Rate Calculations	• The bill states that SR baselines should reflect a conservative estimate of performance to ensure the environmental integrity of the offset credits. The statement could be used to justify a low or significantly lower sequestration rate during the rule making process or during subsequent revisions.	• There is no need to include language that can only lower carbon sequestration rates. However, if such language is deemed necessary, there should be a limit agreed upon beforehand as to the degree by which the sequestration rates could be discounted.
Potential to "Stack" Carbon Credit Practices	• While there is language in the bill that appears to allow a farmer to qualify for more than one credit (e.g., fertilizer management and no-till), the statement is not explicit enough and could be misinterpreted during the rule making process.	• The bill should be more explicit and state that a single offset project developer (i.e., producer or designee of the producer) can obtain credits for more than one practice even if these are performed in the same year and farm (or farmland).
Limitation on Number of Credit Re-enrollment Periods	• Limiting the number of offset credit periods in which a producer can re-enroll their offset practice will limit offset credits available to farmers in later years when the cost impact of cap-and-trade is greatest.	• While there are varying opinions throughout the literature and within government information, there is evidence that suggests that no-till practices can sequester carbon for a number of years. It would be beneficial to the agricultural sector if this number or the process and methodology to calculate this could be properly established or agreed upon in advance, so as to avoid future regulations from setting a shorter re-enrollment limit.
Carbon Saturation Points	• A carbon saturation limit of 10 to 15 years could be placed on no-till practices. However, there is not a clear consensus on the carbon sequestration saturation of no-till. Groups lobbing, directly or indirectly, against agriculture could use language within the bill to limit no-till and potentially other carbon offset practices.	• As with other methodological issues to determine the amount of carbon that a particular farmer can sequester, the process and methodology to calculate this should be properly established or agreed upon in advance to avoid future regulations from setting approaches that do not favor agricultural interests.
Periodic Revisions to the List of Offset Practices	• H.R.2454 calls for periodic revisions of the list of qualifying offset practices. While the ability to change the list of offset practices is important to allow new practices to become eligible, the clause also implies that practices that may be included (e.g., no-till, fertilizer management, etc) in the bill could be revised or potentially eliminated. Furthermore, if farmers make a long-term investment to sequester carbon, the rules should not change frequently (i.e., every two years).	• The language in the bill can be changed to state explicitly that offset credit practices cannot be eliminated for at least 10-15 years after they were introduced. Furthermore, farmers that enrolled in a particular offset practice should be grandfathered against future revisions and changes in legislation.

Subject	Issue	Policy Option
USDA Greenhouse Gas Emission Reduction and Sequestration Advisory Committee	• The interests of the agricultural sector need to be well represented in the USDA Greenhouse Gas Emission Reduction and Sequestration Advisory Committee.	• It is of critical importance to influence the shape and membership of this committee to ensure that the interest of farmers and rural America are well represented and that the committee follows a balanced approach between science and economic impact and development. • The Secretary of Agriculture is supposed to set up this committee no later than 30 days after the date of enactment of the bill; stakeholders of the Agriculture sector need to work in advance to identify candidates for the committee prior to the passage of a bill.
Carbon Offset Project Assistance	• Programs to assist in the adoption of no-till and other carbon offsetting projects are needed to lower adoption costs and increase adoption rates.	• There is a statement in H.R.2454 that directs the USDA to “provide technical assistance to offset project developers using funds appropriated to the Conservation Operations account.” This and other public/private program support should be developed to reduce adoption costs and increase adoption rates of carbon offsetting projects.