POTENTIAL IMPACTS OF CAP AND TRADE POLICY ON U.S. CORN, SOYBEAN, AND WHEAT PRODUCERS

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December 2009

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I. Executive Summary

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 emissions (GHG) 17% below 2005 levels by 2020 and 83% below 2005 levels by 2050. H.R. 2454 ("The Bill") 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. The Bill includes a separate offsets program for agriculture and forestry practices to be implemented by USDA. The Secretary of Agriculture 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 greenhouse gas emissions. In addition, the Bill specifically excludes "agriculture and forestry sectors" from being subject to the greenhouse gas emissions cap.

Senator John Kerry (Democrat-Massachusetts) and Senator Barbara Boxer (Democrat-California) 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 (Waxman-Markey bill) passed by the House. Although the House and Senate bills are similar, some of the major differences are:

- 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 Kerry-Boxer bill is expected to change substantially by the five Senate committees with jurisdiction over the measure. The Senate climate change legislation is not expected to reach the Senate floor for debate until the spring of 2010 because of other legislative priorities such as getting health care passed. In addition, Senate Majority Leader Reid will have to combine the various portions of the climate legislation from the six Senate committees as well as any proposals resulting from Senator Kerry's separate efforts. Senator Kerry's separate efforts include expanding nuclear power and oil and gas drilling which will likely play a key role in determining whether sixty votes can be reached. The EPA also needs at least five weeks to do its full economic analysis of the legislation and Senator Reid says that will only take place after all the Senate proposals are combined into one bill. It is also not certain whether Senator Reid will be able to bring climate change legislation to the floor because he will need sixty votes to break a Republican filibuster. Before a climate bill is signed into law, some of the issues that will need to be included in the legislation or resolved are:

- Mandatory forestry and agricultural offsets administered by the USDA
- Incentives for nuclear power and offshore drilling

- Border tariffs to protect manufacturing industries from competition from countries that refuse to negotiate solutions to global pollution concerns
- Cost impact on jobs and consumer prices
- Determine whether emissions reduction target will be 17% or 20% by 2020
- Determine share of domestic and international offsets
- Determine amount of free allocations that will be issued

On December 7 the EPA announced its determination that greenhouse gasses (GHG) "threaten the public health and welfare of the American people." This finding would allow the EPA to regulate greenhouse gases. 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 greenhouse gases. 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 next spring. The major reason cited by both opponents and proponents is EPA endangerment findings gives EPA "ownership" of the climate change issue and lawmakers will not have to take this issue into the 2010 elections.

A. Energy Price Impacts

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 from a carbon price in 2030 of \$13.92/MTCO$_2$e (2007\$), estimated by MIT, to \$190.52/ MTCO$_2$e (2007\$), estimated within EIA's high price scenario. These carbon price estimates in turn, directly impacted the 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 assumptions 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.

Alternative Energy and CCS Technologies - Studies assuming lower alternative energy technology cost projections (e.g., nuclear, wind, biomass) 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. Additionally, assuming lower carbon capture and sequestration (CCS) costs results 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). These carbon and energy price scenarios that are referred to throughout the remainder of this report are illustrated in the below table.

Table 1: Base, High, and Low Scenario Carbon and Energy Prices

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 average growth rate of 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)

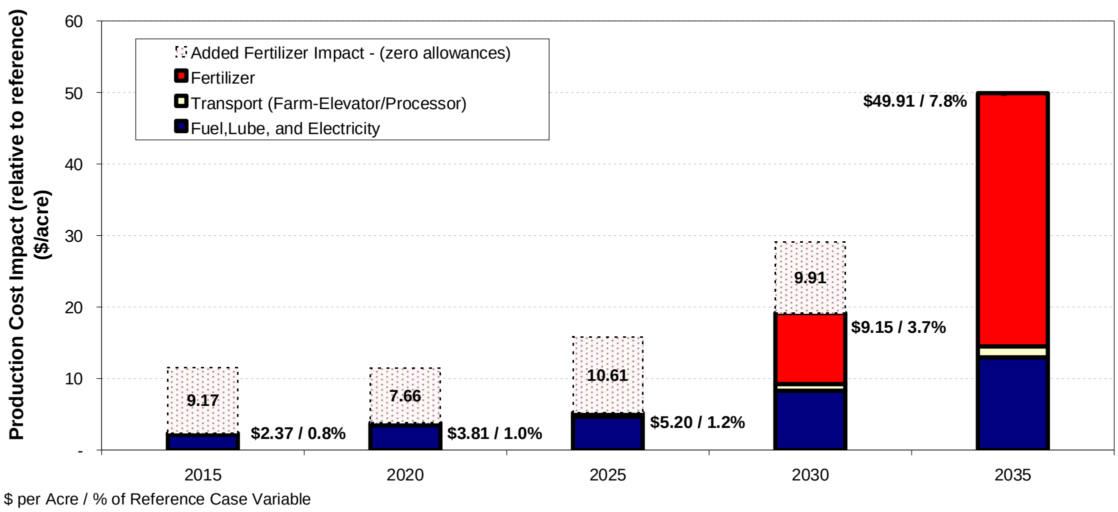
B. Cost of Production Impacts

For each of the primary crops produced within the U.S. (e.g., corn, soybeans and wheat), Informa modeled the impacts of potential cap-and-trade legislation on farm 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 (COP) model to forecast production costs utilizing the reference energy prices provided by the EIA within their updated *Annual Energy Outlook 2009* (April 2009). The EIA outlook reflects provisions from the American Recovery and Reinvestment Act (ARRA) and the recent changes in the economic outlook. These forecasts are then compared with cost projections resulting from the alternative energy price scenarios: EIA basic (base), EPA basic (low), and EIA No International/Limited (high).

1. 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.
- However, as the fertilizer allowances are phased out from 2025 to 2035, this impact increases substantially. By 2035, the impact is expected to be nearly $50/acre above reference costs.

Figure 1: Basic Scenario U.S. Corn Production Cost Impacts



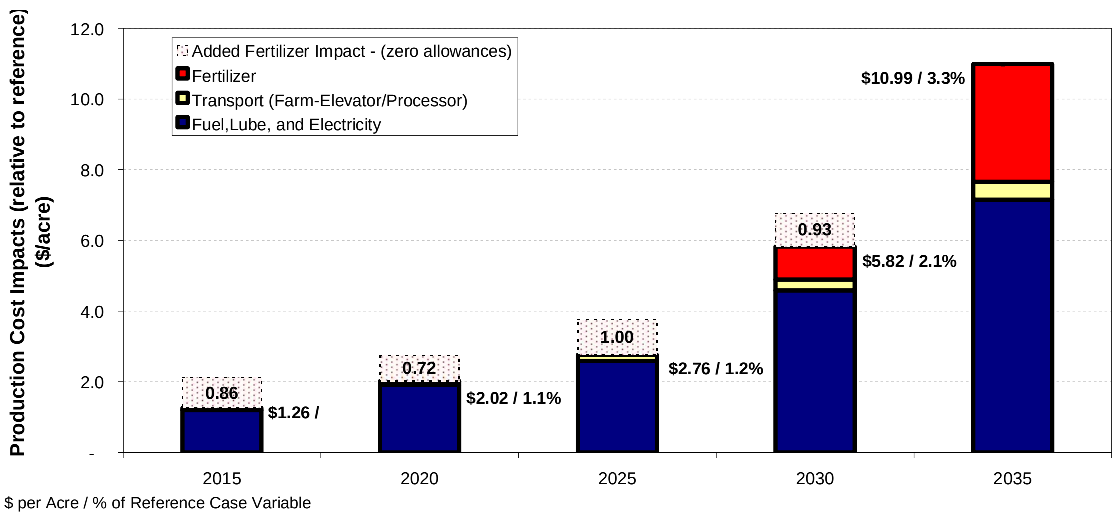
*Does not include fuel or fertilizer efficiency increases beyond that assumed in the reference case.
Source: Informa Economics, EIA and ERS

2. 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.
- By 2020 the impact 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.

Figure 2: Basic Scenario U.S. Soybean Production Cost Impacts

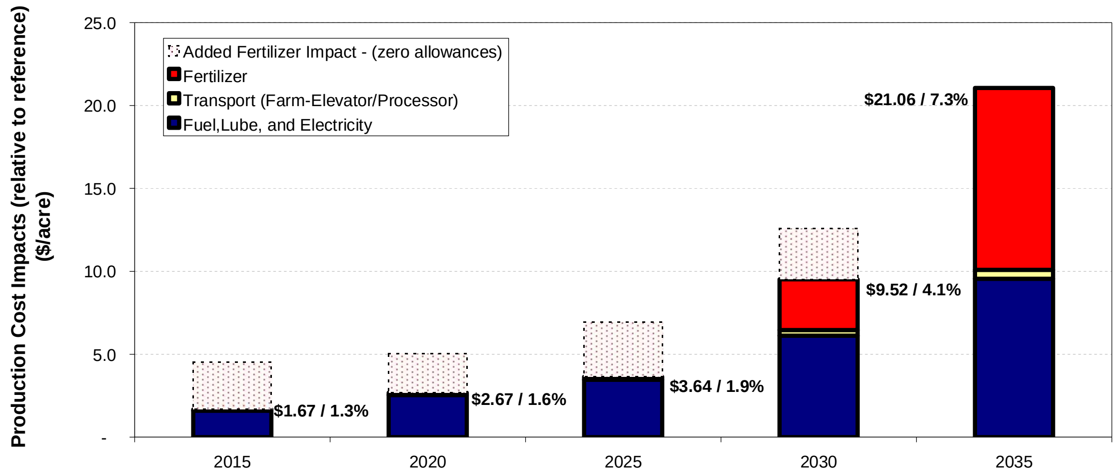


*Does not include fuel efficiency increases beyond that assumed in the reference case.
Source: Informa Economics and EIA

3. 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. Yet, in the out years of the forecast, as fertilizer cost impacts grow, corn which uses more nitrogenous fertilizer becomes more impacted than 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.

Figure 3: Basic Scenario U.S. Wheat Production Cost Impacts



$ per Acre / % of Reference Case Variable

*Does not include fuel efficiency increases beyond that assumed in the reference case.

Source: Informa Economics and EIA

4. Conclusions

- Production cost impacts are minimal in the short-term; up until 2025.
- Having the fertilizer allowances in sufficient quantities to offset rising natural gas prices is a key assumption that mitigates this production cost impact.
- As fertilizer allowances are phased out starting in 2025, the real impact on production costs begin to take effect.
- On a regional basis:
    - 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 price impacts begin to be felt, 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.

C. Cap-and-Trade Offset Credit Opportunities

H.R. 2454 and S. 1733 both establish offsets credits as an additional method to comply with the requirement to hold an emissions allowance for each metric tonne (mt) of greenhouse gas emissions. Instead of purchasing an emissions allowance, regulated entities can purchase an offset credit that represents reductions or increased sequestration of greenhouse gases. Then, 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 greenhouse gas emissions; this list includes practices under three broad categories.

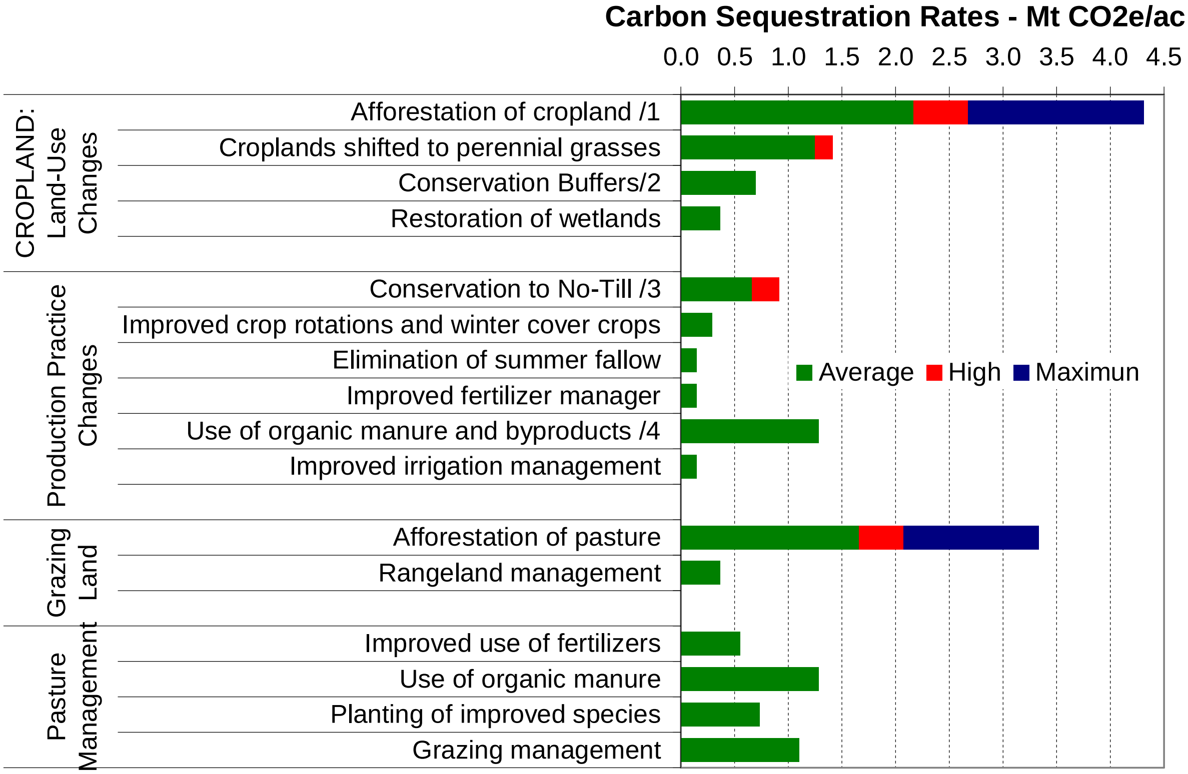
a. Agricultural, grassland, and rangeland sequestration and management practices (e.g., no-till conversion, fertilizer management)
b. Changes in carbon stocks attributed to land use change and forestry activities (e.g., afforestation of cropland and pasture, conversion from cropland to perennials).
c. 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 4 provides a perspective of the potential offset credit opportunities. In this illustration, the carbon sequestration rate (i.e., in carbon oxide equivalent units) for land and production management potential offset credit practices is provided. The offset credit would be equivalent to the sequestration rate (e.g., 0.53 Mt CO2e/ac/yr for conventional to no till) times the prevailing carbon price in a given year (e.g., $66 Mt CO2e in 2025). The offset credit for adopting no-till practice in 2025 would be $35 per acre)

Note that afforestation of cropland and pasture sequesters significantly greater amounts of carbon than other offset credit activities. Consequently, as the price of carbon increases, the potential to shift cropland to afforestation increases. For example, the no-till credit reach $35/ac (in nominal terms) per acre by 2025 while the credit for afforestation reach $100/ac by 2025; this amount is close to 3 times larger than the offset credit for no-till and other production practices. Also, if farmers can stack carbon credits from various production management practices (currently not explicit in H.R. 2454), then the potential offset credits and farmer adoption rates will increase.

Figure 4: Carbon Sequestration Rates (SR) by Practice



Notes to this table are included in page 100.
Source: USDA, CCX, DOE, Informa Economics

A critical point of carbon sequestration 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 (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 USDA, EPA 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 reference SRs will likely be done after a legislation is passed adds other layer of uncertainty about the scale of the potential offset credits available to farmers.

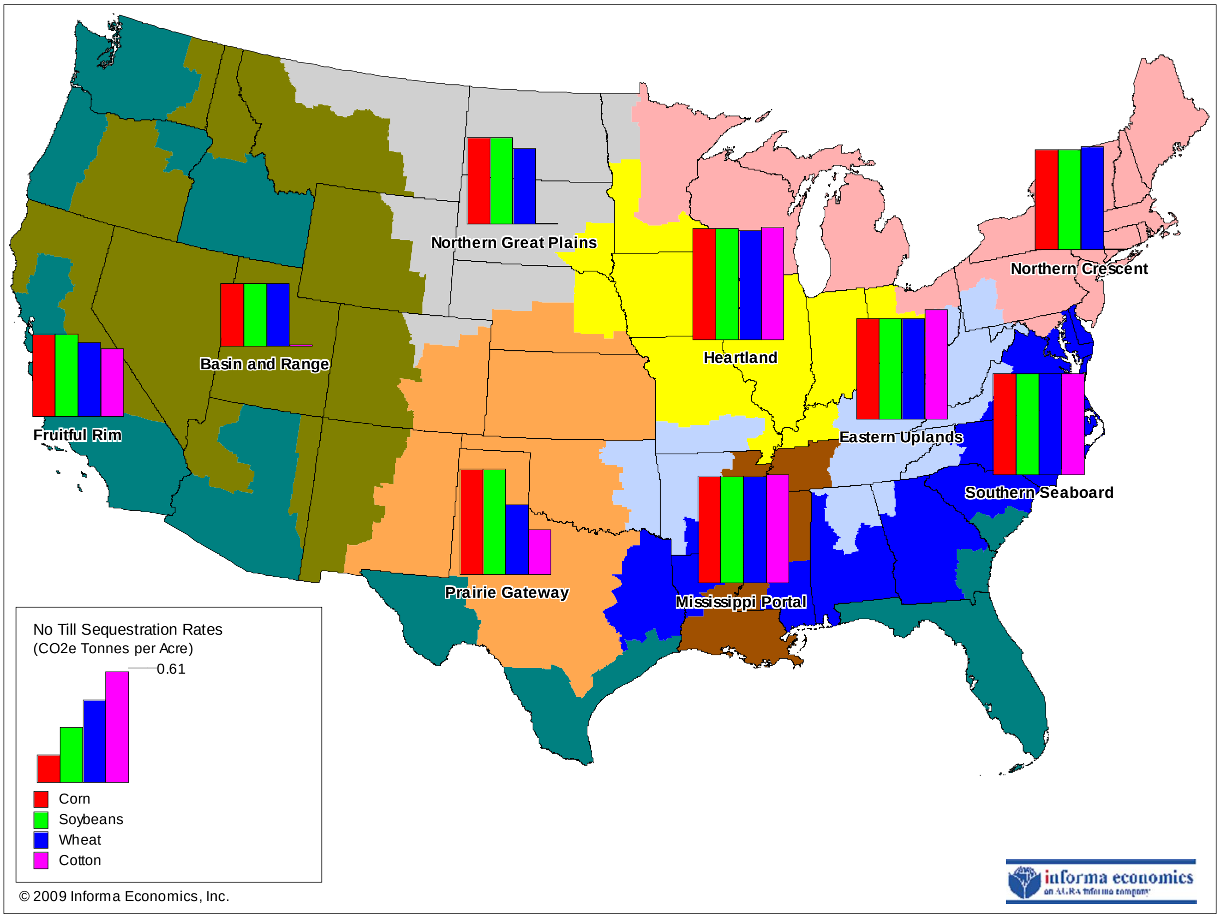
A change from conventional tillage to continuous year-over-year no-till is viewed as one of the main – not the only - avenue for farmers to sequester carbon and get a credit to offset the increased cost of production.

- Farmers in the Northern Great Plains and the Prairie Gateway will receive the 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 5: Average Carbon Sequestration by Region and Major Crop



Informa's assessment suggest that there is significant more uncertainty and risk about the potential carbon offset activities and credits to farmers than there is about the energy cost impacts from the Bill.

The methodology used to calculate SRs could have a significant impact in the scale of the offset credit opportunities 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:

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

D. 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 the greatest are Eastern Uplands and Southern Seaboard. Under H.R. 2454, the offset credit for no-till will required 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.

1. Advantages of Continuous No-Till

- For farms located on sloped land and/or have sandy soil, a continuous no-till system can reduce soil erosion by over 90% versus conventional tillage. In addition, land under continuous no-till systems has significantly less wind erosion.
- The build-up of organic material is essential for healthier, more productive soils. The combination of more top soil and healthier soil will eventually result in higher yields.
- Continuous no-till improves the soil tilth and structure, which improves the aggregate stability and makes the soil more resilient and resistant to erosion.
- Continuous no-till improves the soil water holding capacity and water use efficiency by increasing the soil's organic matter. In addition, having residue on the soil surface reduces evaporation and saves soil moisture.
- Continuous no-till can increase infiltration and reduce runoff dramatically, especially during the growing season.
- A farmer using no-till reduces labor requirements by not tilling the soil.
- No-till reduces the machinery operating costs and fuel costs.

2. Disadvantages of Continuous No-Till

- Many of the benefits of continuous no-till are long-term, but the costs are immediate. The farmer operates in a financial environment that is focused on the current crop year. It typically takes three to five years before improvements in soil properties are sufficient to be visually apparent. In addition, the farmer is going through a learning curve and mistakes will happen.
- If no-till is not done correctly, no-till can result in significantly lower yields.
- No-till works best as part of a diverse crop rotation. Although continuous no-till crop rotations may provide greater profit over the life of the crop rotation, many farmers plant the crop that will provide the greatest return that crop year.
- Uniform emergence is needed to obtain optimal yields. Germination of crops is impacted by the cooler, wetter seedbed environment that results from continuous no-till.
- Lack of adequate drainage is a problem regardless of the tillage system, but is more pronounced with no-till; especially during cool, wet springs.

- Many agronomists state it is easy to plant no-till into soybean residue, but planting into corn residue is difficult.
- The cost of new equipment for no-till is cited as a severe problem by some agronomists and other agronomists argue the farmers already own the equipment.
- Starter fertilizer is important for some no-till crops, especially corn and cotton. In the first five years of no-till, 10% more nitrogen may be required to produce an optimal yield.
- No-till practices require more chemicals to be applied to reduce weed and insect pressures.
- No-till practices do not allow the burning of the fields to control weeds and insect pressures. This is a no-till adoption barrier for some farmers; especially in the western regions.

E. Regional Continuous No-Till Adoption Rates

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

a) Corn

- The southern regions will be able to adopt continuous no-till corn faster than the northern regions.
- Due to the large percentage of corn acreage in the Heartland, the U.S. adoption rate is very similar.
- The projected U.S. adoption rate of continuous no-till corn under a cap-and-trade scenario with a carbon payment reaches 63% by 2035. This means 37% of the land in corn will only experience higher energy prices.
- The lower assumed carbon credits for the Northern Great Plains reduces the adoption rate in the out years.

b) Soybean

- Unlike corn, the regional continuous no-till soybean adoption rates are grouped closer together. Although the southern regions on average benefit more than northern regions, the yield variability in the southern regions is greater. For the farmer that is risk adverse, adopting continuous no-till soybeans in southern regions is more difficult.
- Prairie Gateway farmers experience higher yield variability and lower carbon credits. As a result, until 2035, it is projected that none of the risk adverse farmers in the region will be able to adopt continuous no-till.
- The U.S adoption rate of continuous no-till soybeans reaches 79% by 2035.

c) Wheat

- The continuous no-till wheat adoption rates are greater for the regions east of the Mississippi River than the regions west of the Mississippi River.

- The U.S. adoption rate of continuous no-till wheat reaches 83% by 2035. The wheat acreage in the far Western regions was included in the Northern Great Plains.

2. Implications

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

F. Net Revenue Impacts

On the one hand, there will be production cost implications resulting from increased energy prices that will stem from cap-and-trade. Yet, there will also be an opportunity for some farmers to gain despite these cost increases by participating in a carbon offsetting activity such as no-till, improved fertilizer management and cover crops. Net revenue impacts are examined by region and crop by weighing projected cost impacts versus potential carbon offset credit revenue opportunities.

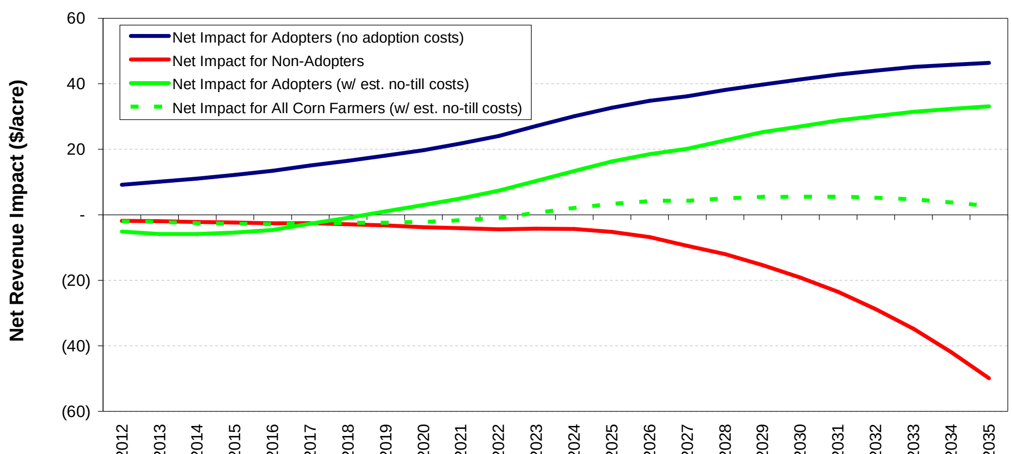
Much of the current net revenue impact discussions surrounding the potential cap-and-trade legislation have focused on two extreme net impact scenarios: (1) the production cost impacts of H.R.2454 assuming no carbon offsetting revenue and (2) the net benefit calculated by taking the carbon price multiplied by the sequestration rate minus the cost impact, assuming 100% no-till adoption and no adoption costs. However, not all farmers can or will adopt no-till, and for many, there is a cost/risk associated with adopting no-till. Thus, not everyone will be able to receive the carbon revenues that can be obtained from adopting no-till, and even those that can adopt, may not receive the full carbon payment once no-till costs are deducted.

For each crop and each region, the production cost impacts are weighed against the carbon revenues associated with adopting no-till, after taking into account any region specific costs of adopting no-till, this is illustrated within the following net impact diagrams by the dotted green line. While there are other potential carbon offsetting activities such as cover crops and improved fertilizer management, Informa has chosen to focus on the potential carbon revenues that could be generated from adopting continuous no-till. This 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. However, one should keep in mind that if no-till is not an available option for a particular farmer, there may be other opportunities for which the farmer may be able to gain offset credits, and the more activities that qualify as carbon offsetting projects the better-off U.S. agriculture will be.

1. Corn

- The net impact of cap-and-trade on the corn industry is relatively modest. While there is potential for losses up to around $50/acre by 2035, relative to the reference case, for farmers who cannot adopt a carbon offsetting activity, 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).
- 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 adoption in these northern regions.

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

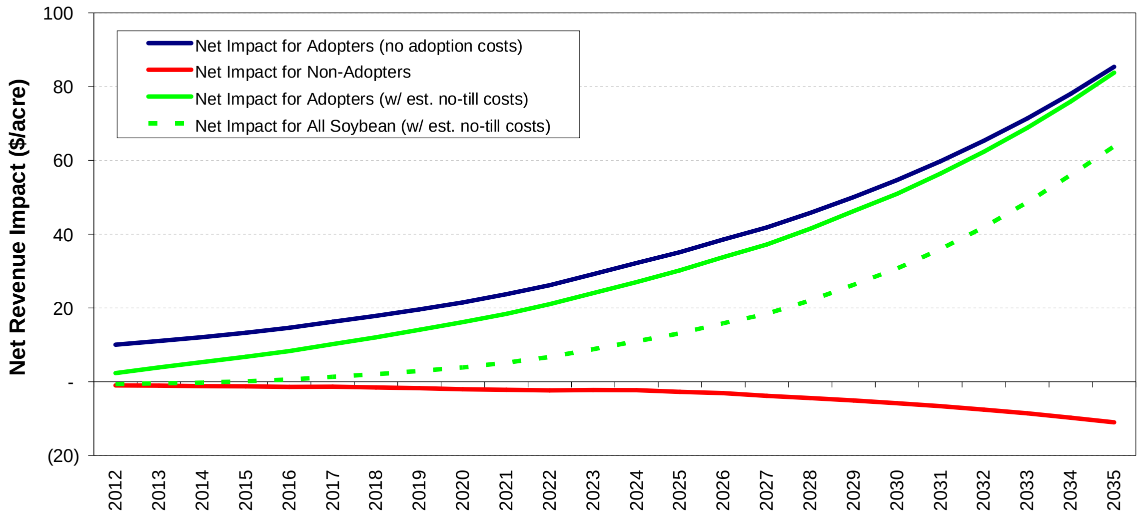


Source: Informa Economics analysis; EIA basic energy scenario

2. Soybeans

- Soybeans have a smaller potential loss and larger potential gain, as the production cost impacts were 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 carbon SR.

Figure 7: U.S. Soybeans: Base Scenario Net Impacts

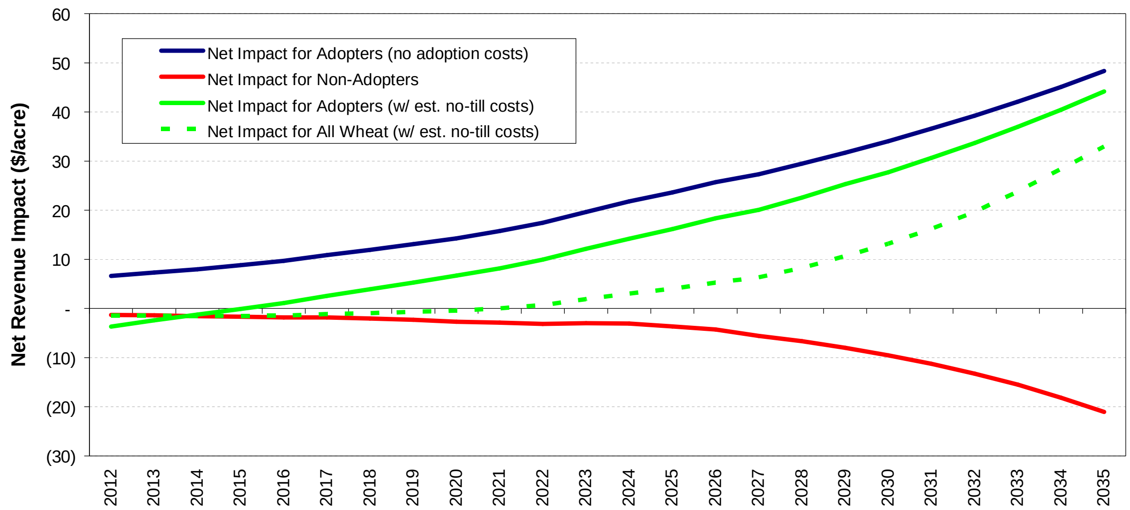


Source: Informa Economics analysis; EIA basic energy scenario

3. Wheat

- Wheat has a smaller potential loss and larger potential gain than corn, as the production cost impacts were lower for wheat than for 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 carbon SR.

Figure 8: U.S. Wheat: Base Scenario Net Impacts



Source: Informa Economics analysis; EIA basic energy scenario

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. These options may be particularly attractive to those farmers that are not able to offset the rising production costs with a carbon offsetting activity such as no-till or to those farmers that have marginal yields and lower net revenues. 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".

1. USDA and University of Tennessee Study Overviews

USDA

- The USDA analysis presented by Dr. Glauber on December 3, 2009[1] indicated that by 2035, 34.4 million crop and pasture land 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.
- Given the increase in Southeast cropland acres presented by the USDA, it is suspected (not confirmed) that these cropland changes include increases in perennial crops and grasslands. In other words, the 21 million acre loss projected for cropland by 2035 is just the shift toward forestry.

[1] The full USDA report had not yet been released by the time this report was written.

University of Tennessee

- This analysis concluded that under a carbon scenario that goes up to \$27/$MTCO_2$, conversion of pasture land 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).
- As a result of these minimal shifts, the analysis concluded that crop price changes would all be within 10% of baseline levels.

2. Informa Acreage Shift Assessment

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 - which can limit conversion from cropland - where taken into consideration, as well as other government programs and incentives such as the RFS and the RES.

As with any analysis forecasting 20+ years into the future, there is a high degree of uncertainty and a 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.

Informa did not use a large and complex “black box” like FASOM which is designed to take into account the various complexities of many intertwined supply and demand markets. This is not to disregard the value that these types of models can provide. Rather, Informa has chosen to use its years of experience in analyzing agricultural markets to provide an informed and logic driven analysis regarding potential crop acreage impacts, focusing primarily on corn, soybeans and wheat.

1) Early on, the majority of the acreage shifts due to afforestation will likely come from pasture land.

- o Lower net returns for pasture land

2) 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.

- o Increased demand for forage and energy crops
  - The shift in pasture land to forest, along with the RES, 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.

- Less risk
  - 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 your 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), there is a greater likelihood that farmers will either have knowledge and/or experience with forest production or will have greater access to this knowledge. Alternatively, producers in these areas could also have the opportunity to lease land out to forestry production companies.

- Additional income stream
  - Perennial crops offer an annual income stream in addition to the carbon payments that afforestation does not provide. Forestry revenues from afforestation will not be realized on an annual basis, and depending on how the carbon offsetting rules are designed, it could be 20 or more years before any forestry revenues in addition to the carbon payment are obtained.

- Lower start-up costs
  - 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.

- Cultural reasons – "Farming as a way of life"
  - 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.

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

- The carbon payment for forestry becomes large
  - 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 (see Table 16).

4) Yet, even at the 2035 nominal carbon price level of \$167/MTCO$_2$e, prime cropland will not shift to forestry or perennial crop production.

- Expected net returns under average yields are greater than the expected net revenues from either forestry or perennial crop production.
  - Marginal/lower yielding land is expected to shift away from traditional row crop production before prime cropland.

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

- Lower yielding acres account for the vast majority of projected acreage losses.

6) 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.

- 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 production, 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. Additionally, 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 that from corn.

3. Sensitivity Analysis

Given the many assumptions that were required to reach the acreage shift conclusions that were presented in the previous section, it was deemed necessary to conduct sensitivity analysis on a few of the key assumptions in order to determine which assumptions have the greatest degree of impact on the base scenario results.

The key assumptions identified as having the greatest impact on acreage shifts were:

Carbon/Energy Price Scenario

- Using the lower carbon and energy prices projected by the EPA resulted in total row crop acreage shifts that were 15-30% less than what were estimated using EIA's basic scenario prices.
- Using the highest carbon and energy price scenario projected by the EIA has one of the greatest impacts on acreage shift results. Increasing the carbon price to this level would increase the quantity of acres shifting toward forestry, as the carbon payment from forestry would be significantly larger and the production cost impacts, particularly in the years beyond 2025 would be greatly magnified.

Forest and Perennial Sequestration Rates

- Using the alternative forest and perennial crop sequestration rates did not have a significant impact on the total number of acres projected to switch out of row crop production.

- However, this assumption did have a significant impact on the percentage of these acres going toward forestry production, particularly under the highest forestry sequestration rate scenario.
- Therefore, the sequestration rates that are established for these alternative carbon crops will have a large influence on the percentage of acres that shift to forestry vs. perennial crops, and thus, they will have a significant impact on "cropland" acre shifts.

Net Row Crop Revenue Growth

- The assumption regarding the rate of net return growth for row crops has a significant impact on the overall acreage shifts. Under the base scenario it was assumed that row crop net return growth would be positive in real terms. This assumption was in part supported by positive real energy price growth projected in EIA's reference scenario.
- If real net return growth is 0% (2.3% nominal growth), then acreage shifts out of corn, soybean and wheat production can be expected to increase by over 30% relative to the base scenario.

H. 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. These issues/implications are outlined below.

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. • Additionally, 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.

"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 contain provisions to allow tillage if unusual weather patterns prevents no-till. Another option is for the Bill to order 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.
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.
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 sequestration rates (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 sequestration rates 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.

Conservative and Adequate Margin of Safety – Sequestration Rate Calculations	• The Bill states that the sequestration rate 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 that are required by the Bill.	• 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 Reenrollment 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 with 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 practice 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.

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.

I. Final Thoughts

Cap-and-trade legislation has the potential to be a transformational force to U.S. agriculture, a force to match the likes of "Freedom to Farm" and other wide reaching policies that have been key transformational forces throughout U.S. agricultural history. 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 very harmful.

On the one hand, there will be production cost implications resulting from increased energy prices that will stem from cap and trade, although thought to be relatively modest, these impacts will be incurred by all farmers – as well as all other sectors of the economy. Yet, there will also be an opportunity for some farmers to gain despite these cost increases by participating in a carbon offsetting activity such as no-till, improved fertilizer management and cover crops. There are also significant opportunities beyond these on-farm offsetting activities. Through the offsets provided for switching from conventional crop production to perennial crop or forest production, an additional crop becomes available to farmers – "carbon". This crop may provide revenues that exceed current cropping revenues and may provide additional income for some agricultural producers. Carbon credits for afforestation and conversion to pasture/perennials will shift acreage from cropland – these shifts will have regional impacts, with marginal – not prime – land switching first.

Many of these “potential” opportunities can be limited or not available if the farm sector is not actively engaged in the writing of Cap and trade and through the rule making and related processes that will come after. If one thing is clear, it is that these “potential” opportunities are critical to determining whether or not cap and trade will benefit or harm U.S. agriculture.