Carbon Trading: A Joint Effort Between the Delta Institute, Illinois and Michigan

Fast Facts

Activity: No tillage, conservation tillage, grass planting, afforestation, reforestation and forest management

Program Duration: Agriculture/afforestation launched Jan 2006; Managed Forest launched Aug 2007; Program ended June 2011

Purpose: Help a diverse pool of private agricultural and forest landowners access carbon markets and provide incentives for environmental stewardship, carbon sequestration, and retention of private lands

Forest Ownership: Private non-industrial; no minimum acreage requirement

Start-up Funding: Agriculture/afforestation: IL Environmental Protection Agency; Managed Forest: MI Forest Stewardship Program

Protocol: Chicago Climate Exchange (CCX): 1) Continuous Conservation Tillage and Conversion to Grassland Soil Carbon Sequestration, and 2) Forestry Carbon Sequestration, including wood products

Registry: CCX

Aggregator: The Delta Institute

Verifier: CCX-approved Contractor

Payment Mechanism: Connection to existing market platform through non-profit aggregation; "pools" calculated on a yearly basis

Market: CCX

Participation: (IL and MI combined, as of 2009) Agriculture/ afforestation: 223,801 acres; 1,179 landowners. Managed forests: 125,678 acres; 109 landowners

Climate Benefits: (IL and MI combined, as of 2009) Agriculture/ afforestation: 579,100 tCO_2e sequestered, at a cost of $1,741,525. Managed forests: 514,282 tCO_2e sequestered, at a cost of $469,230

Co-Benefits: Sustainable forest management, watershed protection, reduced runoff and erosion, wildlife habitat, source of income

Overview

The Delta Institute Carbon Trading Program provides an innovative example of a joint effort between state agencies, non-governmental organizations, and private businesses to provide incentives for environmental stewardship and carbon sequestration on agricultural and forestland. Owned and operated by the Delta Institute from January 2006 to June 2011, the Carbon Trading Program connected private, non-industrial landowners to carbon markets by aggregating credits generated on agricultural and forestland, trading those credits on the Chicago Climate Exchange, and distributing revenue to participating landowners. Landowners from at least 16 U.S. states participated in Delta's Carbon Trading Program; however, Illinois and Michigan are unique in that state agencies not only helped to initiate and develop the program, but provided ongoing resources critical to the program's success within their respective states.

This case study describes the Carbon Trading Program and the partnership between the Delta Institute, Illinois, and Michigan. In Illinois, the program was known as the Illinois Conservation & Climate Initiative. In Michigan the program went by two names: the Michigan Conservation & Climate Initiative and the Michigan Working Forest Carbon Offset Program. This study describes the administrative partnerships and programmatic structure unique to these programs, as well as the development of the programs, challenges encountered along the way, and lessons

learned. It also provides data on participation and cost, and details the roles of players in bringing carbon offset projects to market.

A market chain map and a brief exploration of opportunities and barriers experienced by participating landowners are included in this case study. Eight program administrators/partners were interviewed in the fall of 2009 and two were interviewed again in 2013. Eleven landowners (out of one hundred and three) were interviewed in the spring of 2010.

This case study contributes to broader research being conducted at the University of Vermont, which focuses on opportunities and barriers to, as well as models for, carbon market participation by small-scale and community-based forestry. Two sides of the Delta Carbon Trading program, an agriculture/afforestation side and a managed forest side, are included in descriptions of programmatic features, history, and approaches to addressing barriers to participation. However, because of the research's focus on forestry, special consideration is given to forest landowner participation in the program throughout the case study, and only forest landowners were recruited for the landowners interviews. Additionally, because very few IL landowners were participating in Delta's managed forestry program at the time of this research, only MI landowners were recruited.

The Program

Delta's Carbon Trading Program allowed farmers and landowners to earn greenhouse gas emissions credits for conservation tillage, grass and tree planting, and forest management (1) (2). Because credits were sold on the Chicago Climate Exchange (CCX), the program used CCX protocols and standards. There were two distinct protocols, market chains, and hence "sides" to the program. One side offered carbon credits for agricultural soil carbon capture through no-till/conservation tillage, grass planting and afforestation (using the CCX *Continuous Conservation Tillage & Conversion to Grassland Soil Carbon Sequestration* and *Afforestation* protocols). The other offered carbon credits for sequestration through reforestation (using the CCX *Reforestation* protocol) and management of existing forests, including working forests that produce wood products (using the CCX *Sustainably Managed Forests* protocol).

From the perspective of the Delta Institute, the Carbon Trading Program functioned as a whole, and Delta administered the ICCI in Illinois and the MCCI in Michigan. The sides diverged into two separate programs in Michigan, where the managed forest portion of the program was called the Michigan Working Forest Carbon Offset Program, and the agricultural/afforestation side was referred to as MCCI. The MI Forest Stewardship Program supported the working forest program, whereas MCCI received support from the MI Department of Agriculture. In Illinois, the IL Environmental Protection Agency provided primary support for both portions of the program under the name of ICCI. However, IL state agency websites emphasized agricultural lands, whereas working forest lands were more prominently placed on MI state agency websites. Enrollment followed the same trend, with a stronger emphasis on managed forests in MI and agricultural lands in IL. This distinction was due to multiple reasons, one of which is different resource utilization patterns in the states. The watersheds of the Mississippi, Ohio, Illinois and Wabash Rivers provide fertile farm land in Illinois; in 1997, 80% of the total Illinois land area was utilized by farms (3). In contrast, Michigan's 19.3 million acres of forests cover over 50% of the land area of the state and represent an integral part of the state's cultural heritage (4).

The agricultural/afforestation and the managed forest sides of the program used different accounting methods and featured different costs and requirements (see Table 1). For both, Delta's aggregation fee, CCX's trading fee, and third party verification costs were all

Table 1: Program Requirements (1) (2)

	Agriculture/ Afforestation	Managed Forests	Cost Frequency	Cost
3rd-Party Verification	Yes	Yes	First and final years at minimum, back-end	Varies
Management Plan	No	Yes	One-time, upfront	Varies
3rd-Party Certification	No	Yes	Either, upfront	Varies
Baseline Inventory	No	Yes	One-time, upfront	Varies
Delta Aggregation Fee (% of gross revenue)	Yes	Yes	Annual, back-end	Ag/Affor=8% Man For=10%
CCX Trading Fee	Yes	Yes	Annual, back-end	.20/tCO_2e
Conservation Easement	No	No	-	None
Letter of Intent (15 yr. agreement)	Yes	Yes	-	None
Re-inventory	No	Yes	CO_2e loss only	Varies
20% Reserve Pool—released at contract end	Yes	Yes	Annual, back-end	None

deducted from the proceeds of the sale of carbon credits (i.e., "back-end"). Yearly carbon accrual through conservation tillage/grass planting was assigned a fixed rate. Yearly carbon accrual through afforestation was calculated with look-up tables. Yearly carbon accrual for reforestation and managed forests was calculated from a single baseline inventory using the U.S. Forest Service Forest Vegetation Simulator modeling software. All three protocols used third-party verification to validate carbon calculations for a sample of participating landowners.

The program was designed to accept small as well as large landholdings. To accommodate small-scale participants, the aggregation services of The Delta Institute were essential. Credits were sold by a pool number, not by individual landowners. Delta assigned a single pool number to all landowners who joined during year-long enrollment periods. The program calculated CO_2e accrual for each year of a landowner's contract life, beginning with the baseline year, and added that amount to the pool. The year during which the carbon was sequestered was considered the "vintage" of the associated carbon credits

Landowners signed a letter of intent to maintain, according to the principles and practices of sustainable forest management, the enrolled forested lands as forest for at least 15 years from the enrollment date (2). Years during which carbon credits could be registered for sale were limited to contract years, which ended in 2010 for the first pool and 2012 for subsequent pools. Payments were made annually, though Delta reserved the right to delay sale until more favorable market conditions prevailed. This means that landowners in pool three, for example, could have had vintage 2007 and 2008 credits registered with CCX.

The upfront costs of project development in the first year are often a barrier to small landowner participation in carbon offset markets. Table 2 provides a cost/revenue calculation for a hypothetical forest landowner of 300 acres for the first year. It includes all upfront costs landowners can expect and a carbon price necessary to break even in the first year. Because many of these costs are not annual, *net revenue potential* does not necessarily reflect expected annual returns. As stated previously, Delta's aggregation fee, CCX's trading fee, and third party verification costs were deducted from the proceeds of the sale. To comply with the CCX managed forest carbon offset protocol, this hypothetical landowner would have had to pay "upfront" for third-party certification, a carbon-specific inventory, and a management plan (1) (2) (5).

Table 2 suggests that the carbon price necessary to break even, $4.10/tCO_2e, is well within the range of historic CCX prices per tCO_2e. Two factors could alter the scenario presented in Table 2. First, the landowner could lose carbon through tree removal or a natural event resulting in substantial tree demise. This would trigger a costly re-inventory and a reduction in available carbon credits. Second, the sale of vintage year one could be delayed in order to obtain a better price.

Partners

The Carbon Trading Program was owned and operated by the Delta Institute. State agencies played a central role in the development of the program and continued to support it within their respective states under the names of ICCI, MCCI, and the MI Working Forest Carbon Offset Program. Local and national conservation programs, private forestry firms, and Soil and Water Conservation Districts also played important

Table 2: Upfront Costs & First Year's Revenue for Low/High CCX Market Values

Michigan Working Forest Carbon Credit Program Hypothetical Participant with 300 acres of forest (assuming 3 tCO_2e/ac/yr sequestration)[1]		
	Low estimate	High estimate
Gross Annual Tonnage:	900 tCO_2e	900 tCO_2e
multiplied by low and high historic CCX prices	$1/$tCO_2e$	$7.50/$tCO_2e$
***equals* gross revenue potential:**	**$900[2] ($3/ac)**	**$6,750[2] ($22/ac)**
less Delta aggregation fee (10% of gross revenue):	$90	$675
less CCX trading fee ($.20/$tCO_2e$):	$180	$180
less 3rd party verification fee ($.10/ac[3]):	$30	$30
less 3rd party certification fee (IMG yearly charge at Grossman[3]):	$25	$25
less inventory fee ($8/ac[3]):	$2,400[4]	$2,400[4]
less management plan fee (using 50% cost share for Forest Stewardship Program[3]):	$675	$675
***equals* net revenue potential:**	***- $2,500 (neg)***	**$2,765**
Carbon Price Required to Break Even:	$4.10/$tCO_2e$	

1.) Management plan and inventory are one-time costs. All others are annual.
2.) Does not reflect reserve pool insurance against catastrophic events. 20% of annual tonnage is reserved until end of contract, upon which time it is sold and revenue transferred to landowner.
3.) Estimate based on personal communication with partners. Actual fees vary according to acreage, service provider, and pool size.
4.) Does not include defrayal of costs by a revolving technical assistance fund, which is 50% for Forest Stewardship Program enrollees.

roles. Only the central partners and their operational roles are described here.

Delta Institute: Headquartered in Chicago, the Delta Institute is a 501(c)(3) nonprofit organization formed in 1998 to work on environmental quality and community economic development projects in Illinois and the Great Lakes region. The Delta Institute was an aggregator with CCX and traded carbon credits on the CCX trading platform.

The Delta Institute's primary goal is to generate improvements in local water quality. According to Todd Parker, Associate at the Delta Institute, carbon trading was seen as an opportunity to fund conservation practices that improve water quality. By implementing sound ecological practices that further its primary mission, Delta hopes to "transform the Great Lakes region into the center of the emerging green economy," says Parker.

Delta worked with IL and MI state agencies and MI forestry firms to develop the Carbon Trading Program's operations, as well as the managed forest protocol adopted by CCX. As the administrator of the program, Delta had primary responsibility for reviewing and approving applications, arranging for the verification and registration of credits through CCX, monitoring and initiating yearly measurements of carbon accrual, and distributing payments. Delta worked closely with state agencies and partners to carry out its duties and to locate good candidates for the program.

Chicago Climate Exchange: CCX operated a voluntary cap-and-trade system from 2003 to 2010. Parties motivated to reduce their greenhouse gas emissions joined CCX and, as Members, made a legally binding commitment to meet annual emissions reduction targets. Those Members who reduced below the targets had surplus allowances to sell or bank; those who emitted above the targets complied by purchasing excess allowances from other Members or carbon offset credits. Only part of Member commitments could be met by purchasing credits. These credits could be generated through land-based carbon sequestration, such as soil conservation and forest growth, and purchased through programs like the Delta Carbon Trading Program. Offset credits were purchased by both Members and non-Members, and transactions occurred either as a "commoditized" purchase where the source of the offsets was unknown, or on a project-by-project basis where the source was known and, at times, purposefully arranged. Verifiers and protocols used to create carbon credits were approved by CCX.

Member contracts ended in 2010, as did crediting periods for offset project. CCX officially closed carbon trading on December 31st, 2010. However, CCX retained its registry function when, in 2011, it launched the Chicago Climate Exchange Offsets Registry Program.

Illinois Environmental Protection Agency: The IL Environmental Protection Agency provided start-up funds ($20,000) and staff support to initiate ICCI. The agency supported the ICCI through outreach/marketing, education, consultation with the ICCI Advisory Group, and coordination of the ICCI with conservation programs and the Soil and Water Conservation Districts. Conservation programs included the Conservation Reserve Program, the Conservation Security Program and the Conservation Reserve Enhancement Program.

Illinois Department of Natural Resources and Department of Agriculture: Both the Department of Natural Resources and Agriculture participated in the development of program application forms and provided ongoing outreach as well as consultation with the ICCI Advisory Group.

Michigan Department of Natural Resources Forest Stewardship Program: The Forest Stewardship Program is a national conservation program funded by the U.S. Forest Service and carried out by states. MI's Forest Stewardship Program provided start-up funds ($150,000) and staff support to initiate the Michigan Working Forest Carbon Offset Program and to develop the managed forest protocol. The program provided financial support to the working forest program, as well as outreach/ marketing, education, consultation with the MCCI Advisory Group, and coordination with forestry firms and with the Forest Stewardship Program management plan cost-share program.

Michigan Department of Agriculture: The Department of Agriculture provided support to the agriculture/ afforestation portion of MCCI through outreach/ marketing, education, consultation with the MCCI Advisory Group, and coordination of MCCI with conservation programs and the Soil and Water Conservation Districts.

Soil and Water Conservation Districts: The Soil and Water Conservation District Associations in both MI and IL worked with landowners participating in the agriculture/afforestation portion of the program to complete paperwork and communicate with Delta. In addition, they acted as the CCX-approved verifier for the programs.

Private Foresters: Private foresters worked closely with landowners participating in the Michigan Working Forest Carbon Offset Program and the managed forest portion of ICCI to complete the requirements of the programs, as well as recruit new participants.

Startup: Agriculture in Illinois

Delta's Carbon Trading Program originated when IL Environmental Protection Agency Associate Director Ron Burke and Agriculture and Rural Affairs Advisor Richard Breckenridge approached the Delta Institute late in 2005 about aggregating offset credits through an existing CCX protocol for conservation tillage, grass planting and afforestation. The agency was interested in promoting water quality and conservation practices in the state. According to Breckenridge, both he and Burke believed that a carbon credit program for agricultural lands would further such interests (6). Both had a background in carbon sequestration and had examined other successful examples in the U.S., primarily the Iowa Farm Bureau Carbon Credit Aggregation Pilot Project and the National Farmer's Union Carbon Credit Program in North Dakota (http://carboncredit.ndfu.org) and Nebraska. Because they were designed to sell credits on the now closed CCX market, these three programs are no longer offered.

Breckenridge considered several options for aggregation, including IL commodity groups and the Farm Bureau. Because the IL Environmental Protection Agency already worked with Delta on a number of policy initiatives, and because Delta had an established reputation in the region and experience working with CCX, the Delta Institute emerged as a worthy choice. The Delta Institute did not have a carbon program at the time; however, Delta was very interested in the potential such a program held for ecological enhancement and economic development.

The agency provided Delta with start-up funds in the amount of $20,000, legal and staff assistance, and outreach. The development of ICCI for agricultural lands took about six months, the ease of which was attributed to pre-existing relationships that were drawn on to operationalize the program. These included a relationship between Delta and CCX, between Delta and state agencies, and between state agencies and the IL Soil and Water Conservation Districts. The fact that CCX had been selling credits from an existing offset program for conservation tillage, grass planting, and afforestation for years also paved the way for a quicker development process.

The model developed for the ICCI agriculture/afforestation program integrated Soil and Water Conservation Districts as the local entry point for landowners and targeted national and state conservation program participants for enrollment, such as the Conservation Reserve Program, the Conservation Security Program and the Conservation Reserve Enhancement Program (though participation in one of these programs was not required). Whether contact was initiated by the conservation districts, state agencies or Delta, most agricultural landowners were eventually referred to their local conservation districts, which provided assistance with paperwork and performed the verification. This process not only gave the program a county presence, but tapped into a pool of conservation-minded landowners who were more likely to be interested.

The fact that payments from conservation programs and ICCI were "stackable" was an important feature of the program, in that a landowner could receive payments for a conservation practice from both ICCI and, for example, the Conservation Reserve Enhancement Program. According to Breckenridge, "Stackability is a key concept that we envisioned…as a way to further incentivize those programs." That the program was linked to a *market* for carbon credits was another important characteristic. Partners in both states recognized that the ICCI and MCCI/MI Working Forest Carbon Offset Program were designed to further enrollment in conservation programs beyond what government payments or cost sharing would incentivize. According to Breckenridge, "Our ultimate goal is to have farmers making decisions based upon the market place… beyond what the government programs might incentivize. Then we will have a truly sustainable program." (6)

The Next Step: Forests in Michigan

Once the agricultural side of ICCI was up and running, Delta submitted a proposal to the MI

Department of Natural Resources Forest Stewardship Program for a pilot project to establish a framework for quantifying the carbon sequestration benefits from sustainably managed forestlands. At the time, neither Parker nor Debra Huff, then coordinator of the MI Forest Stewardship Program, were aware of any program or protocol in the country for quantifying carbon credits from existing managed forests. The Department of Natural Resources awarded Delta with a $150,000 Forest Stewardship Grant in the fall of 2006, initiating the creation of the Michigan Working Forest Carbon Offset Program.

The MI Forest Stewardship Program decided to participate in and fund the pilot project because, according to Huff, such a program had potential to enhance sustainable forest management practices and provide an additional incentive to retain lands for private forest owners in MI. Moreover, the project represented a unique opportunity to encourage citizens to recognize the value of carbon sequestration as an important ecosystem service.

During the pilot project, the technical rules and guidelines for the program, which addressed issues of ecological and economic viability, were developed jointly by Delta, the Department of Natural Resources, the Forest Stewardship Program and two Michigan-based private forestry firms: Grossman Forestry Company and Forest Resources Services, LLC. The forest management protocol created by the MI Working Forest Carbon Offset Program pilot project served as the basis for the Sustainably Managed Forest protocol released by CCX in December 2007.

Memorandums of Understanding were drawn between Delta and Grossman Forestry Company, Forest Resources Services and the MI Forest Stewardship Program, bringing them into a close working affiliation with Delta. The program committed itself to private, non-industrial landowners by making that designation a requirement. Thirty-six landowners representing 48,665 acres were recruited during the pilot project, the majority of which were recruited through Grossman Forestry Company.

After the inception of the two sides of the program, Delta consolidated its work with IL and MI and created the Delta Carbon Trading Program. Delta used its own funding to set up the agriculture/afforestation side of the program in MI and the managed forest side in IL. These programs used linkages between state agencies and other partners similar to their counterparts. Steve Shine, Conservation Programs Manager of the MI Department of Agriculture, also evaluated several aggregation options for conservation tillage/grass planting/afforestation in MI, and chose Delta for reasons similar to those of the IL Environmental Protection Agency. One notable difference between the managed forest portions was that the program in IL did not work with the IL Forest Stewardship Program.

Program Maturation

Table 3: Accomplishments through Aug 2009 - Michigan (5)

	Ag/Affor	Managed	Total
Acreage – Total	51,821	124,376	176,197
Landowners	285	103	388
Acreage – Range	1 – 5,313	20 – 34,000	1 – 34,000
Acreage – Average per contract	181	1,207	454
Tons CO_2e Sequestered	76,200	511,300	587,500
Gross Sales of Carbon	$242,080	$469,230	$711,310

Table 4: Accomplishments through Aug 2009 - Illinois (5)

	Ag/Affor	Managed	Total
Acreage – Total	171,980	1,302	173,282
Landowners	894	6	900
Acreage – Range	1 – 3,450	69 – 477	1 – 3,450
Acreage – Average per contract	192	228	192
Tons CO_2e Sequestered	502,900	2,982	505,882
Gross Sales of Carbon	$1,499,445	$0	$1,499,445

The MI Working Forest Carbon Offset Program moved beyond the pilot project phase. The MI Department of Natural Resources Forest Stewardship Program awarded the Delta Institute another grant in June 2008, this time a three-year grant for $63,000 through the U.S. Forest Service's Northeastern Area State & Private Forestry Competitive Grant Program. The purpose of the grant was to promote carbon-related outreach and education in MI; the funding helped the Delta Institute conduct outreach beyond what would normally occur through the assistance of the two forestry firms, and helped them bring an additional firm, Green Timber Consulting Foresters, into a closer working relationship.

When taken together, both sides of the program have enrolled 349,479 acres, sequestered 1,120,272 tCO_2e and generated $2,210,755 gross from the sale of carbon as of 2009 (see Tables 3 and 4). In table 4, *tons CO_2e*

sequestered represents all carbon sequestered for all participants in that category. Only a portion of the *tons CO_2e sequestered* were sold to generate the figured under *gross sales of carbon*. Outside of IL and MI, landowners from at least 14 other states also enrolled in the program.

By the time the program ended in 2011, Delta had sold entire vintage years from several pools from the agricultural/afforestation portion (5). Perhaps more of an accomplishment was the sale of the first managed forest vintage year (2007) in pool one (i.e., the pilot phase in MI) in the fall of 2008. After administrative fees and $55,000 for repayment of the technical assistance fund, the initial 34 landowners, representing 48,665 acres and roughly 173,000 tCO_2e, earned $334,097 net for that year, averaging about $6.80 per acre. This was noteworthy at the time because it was one of the first carbon sales for small-scale landowners under a managed forest protocol in the U.S. Several pools featuring multiple vintage years were awaiting sale on the CCX registry when it closed.

The market chain map summarizes the roles of participants and contributors to market-based initiatives (7). The Enabling Environment section indicates the external factors that facilitated the development of the program. The Market Chain Actors and Linkages section includes the producers (rectangles), purchasers (rectangles), facilitating intermediaries (ovals) and flow of funds (arrows). The Supporting Institutions section lists entities that provided critical support, but were not part of the market transaction. Because carbon markets are newly emerging, the same organizations may appear in more than one capacity as they work to develop all of the components needed for a successful, market-based program. The thicker green arrows indicate flow of funds and the thinner green arrows indicate payment for a service. The grass and tree icons indicate carbon sequestered.

Market Chain Map

In the Market Chain (see next page), the Delta Institute managed the entire process of connecting forest landowners to CCX, including taking inventory information from foresters and performing carbon accounting, expediting third party verification and certification, and facilitating the sale of credits on the CCX trading platform. In Supporting Institutions, Illinois Environmental Protection Agency (for the agricultural side) and the MI Department of Natural Resource Forest Stewardship Program (for the managed forests side) provided critical financing. For the managed forest side, this financing was critical to the existence of the program, the development of the protocol, and the creation of the technical assistance fund. For both sides, access to participant lists of other programs, such as the Conservation Reserve Enhancement Program and the Forest Stewardship program, aided recruitment. The program's existence can also be attributed to enablers such as a state commitment to seek alternative sources of funding for conservation and a connection to the only carbon market platform in the U.S. at the time (CCX).

Addressing Barriers

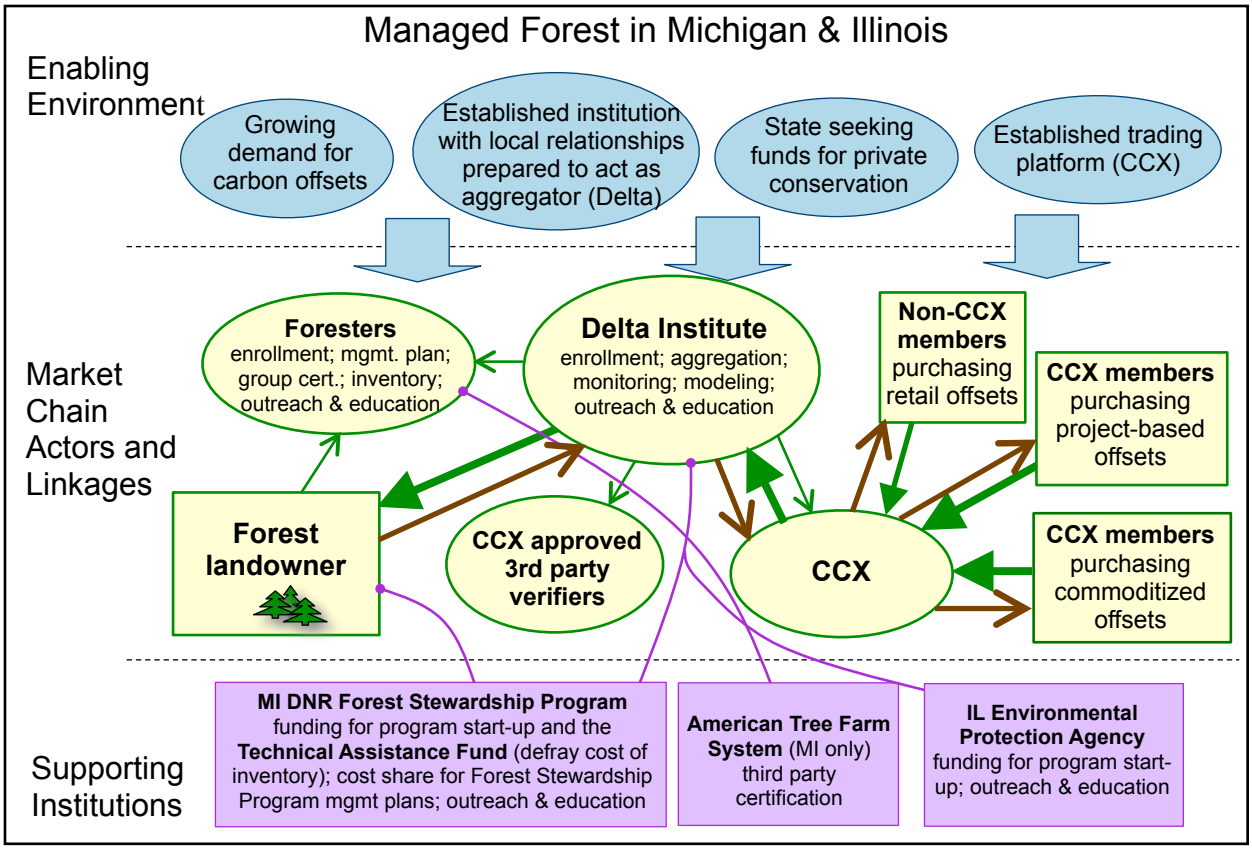
The Delta Carbon Trading Program presented a new market opportunity for private, non-industrial landowners in the U.S. to earn money through the sale of carbon, possibly the first of its kind for forest landowners. Partners developed the program with land holdings of all sizes in mind, including small-scale landowners for whom participation might be more difficult. As with any new market, and particularly with emerging markets for ecosystem services such as carbon, uncertainties are high and returns less assured. Most market actors are typically willing to invest time and money in a market opportunity with proven returns, whereas early adopters are willing to take a risk in an new and unproven market. Program administrators understood that, in order to capture these unusual early adopters among landowners, particularly among small-scale private landowners, they would need to reduce barriers to a point substantially lower than they might be in a fully developed market.

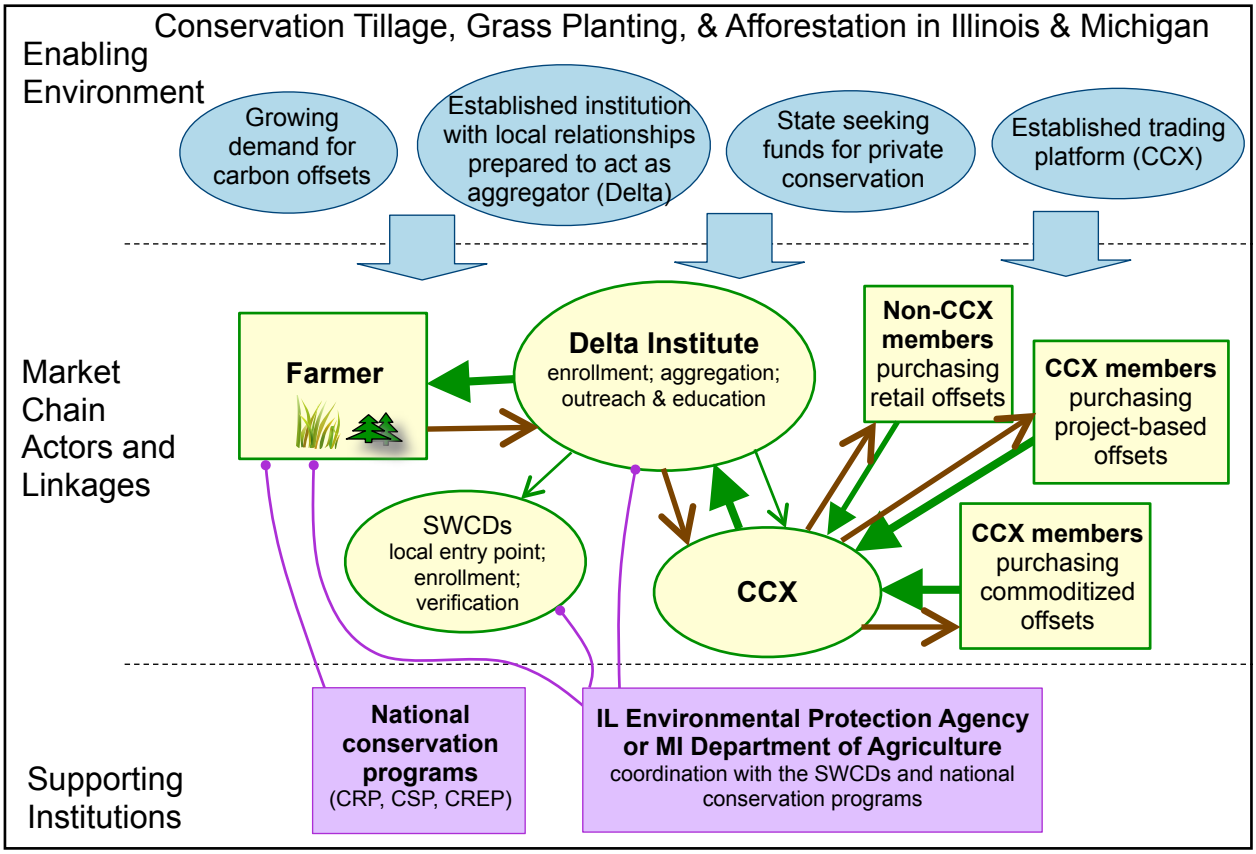
Small-scale landowners attempting to engage markets of all types can face barriers such as low returns vs. high upfront costs (i.e., problems associated with scale), high investment of time, lost income from foregoing alternative land uses, and risk. The program's experience with these barriers, along with how they were addressed, are discussed in this section.

Reducing upfront costs

The managed forest protocol featured heavier upfront costs than the agricultural/afforestation protocol. In fact, because many agricultural landowners were coming from other conservation programs, like the Conservation Reserve Program, many had no upfront costs, since the sequestration activity was initiated previously in fulfillment of the other program's requirement. Third-party certification, a carbon-specific inventory, and a management plan could all be upfront costs for a forest landowner.

The three forestry firms provided a pool of landowners with whom foresters had an existing client relationship and who were already actively managing





Acronyms
CRP: Conservation Reserve Program
CSP: Conservation Security Program
CREP: Conservation Reserve Enhancement Program
DNR: Department of Natural Resources
SWCDs: Soil & Water Conservation Districts

Key: = revenue flow from sale of carbon credits; = payment for services; = supporting relationship; = flow of carbon credits

their forests. This meant that prospective participants were more likely to have a management plan and third-party certification, and were more likely to be interested in a forest management program like the Carbon Trading Program. For forest landowners outside this group, program administrators worked to reduce upfront costs in the following ways.

Inventory

Almost all participants needed to pay for a carbon-specific inventory, even if an inventory has been done previously for other purposes. The MI Working Forest Carbon Offset Program pilot project featured a $75,000 revolving technical assistance fund that defrayed 100% of inventory costs until credits were sold, at which point the fund was repaid from the proceeds (the IL managed forest program did not feature an assistance fund). As loans were repaid, funds were redeployed to new enrollment pools. The money for the fund came from the initial Forest Stewardship Program $150,000 grant. According to partners, this fund was a critical piece of the success of the managed forest program; it made the difference between joining and not joining for many. For landowners in the first pool with preexisting management plans and certification, all upfront costs were either non-existent or deferred.

Due in part to a delay in the sale of the first pool's credits, and in part to the enrollment of a large hunt club whose inventory costs were substantial, the technical assistance fund was almost exhausted after the close of the first enrollment period. After the pilot phase, the Delta program instituted provisions to limit fund availability to help extend the life of the fund. As of January 2009, landowner awards were limited to $300 plus $1 per acre, not to exceed $2,000.

Third-party Certification

For those landowners who came to the program without third-party certification, other programmatic relationships cut costs. Certification in particular can be a major hurdle for small- to medium-sized landowners. The three forestry firms who aligned with the program were the only three in MI to possess Independently Managed American Tree Farm Groups (IMGs) under the American Forest Foundation's Standards of Sustainability. IMGs are maintained by private foresters whose programs have been certified by a third party. According to partners, until the summer of 2009, an IMG Tree Farm certification was the only CCX-approved option that was affordable for small-scale landowners. For example, Grossman Forestry's charge for joining their IMG is only $25/year (8). All enrolled forestlands in pool one received third-party certification through the IMGs maintained by the three forestry firms (9).

According to partners, the managed forest portion of the program in IL was severely limited because no IMGs existed in IL. In MI, the existence of only three IMGs presented a bottleneck for completion of third-party certification. This bottleneck was alleviated in MI in the summer of 2009, when the American Tree Farm System applied for and received certification from the Programme for the Endorsement of Forest Certification for its entire state-run Tree Farm program under four regional group certifications. Because of this certification, CCX began accepting all American Tree Farm System certified properties, not just IMGs, including any state tree farmer belonging to a state tree farm committee. Landowners certified through their state tree farm committee lost some of the convenience of a forester acting as a single point of contact, which, according to one partner, created challenges for the flow of information between the landowner and the aggregator.

Management Plan

For those who did not have a management plan, the program utilized the Forest Stewardship Program's 50% cost-sharing incentive for management plans. By way of Delta's program, the Forest Stewardship Program experienced an increase in enrollment, in part due to the fact that a forest stewardship plan was required to access technical assistance funds. According to Gerald Grossman, owner of Grossman Forestry Company, as many as half of the inquiries into the MI Working Forest Carbon Offset Program ended up adopting a forest stewardship plan without participating in the program. Grossman said that, for many of these people, such as those with smaller acreages or skewed forest stand structures, the program was not practical. "But that doesn't matter," said Grossman. "We got them in the door… so it's been another avenue to encourage landowners to take advantage of an existing program." (8)

Scale vs. Cost:

Partners on both sides of the program recognized that, while opening a new door for many small-scale participants, the program was not economically viable for the smallest participants. Partners stated that it often was not practical to enroll landowners with fewer than 20-40 acres for the agriculture/affo(12)restation side, and 60-100 acres for the managed forest side (5) (6). Gross revenue potential depended on highly variable factors, such as a fluctuating market price, soil productivity and forest stand structure. Net revenue potential depended on the sequestration activity in question. The agricultural/afforestation side did not require a costly management plan, inventory, or forest certification. However, forest management offered potentially higher carbon sequestration rates than grass planting and afforestation, and therefore greater payoff, according to Parker.

As Delta began tapping into pools of landowners from sources outside partnering foresters and conservation programs, program administrators found landowners who needed more assistance, education and preparation. Program administrators and partners mentioned the need for higher carbon prices to ensure sustainability for the program. According to Grossman, for landowners already working with a private forester, a minimum of $2.00 per tCO_2e could provide favorable financial returns (8). According to the cost/revenue calculation in Table 2, the price per tCO_2e would need to be roughly $4.10 for the owner of 300 acres of forestland to break even in the first year of the working forest program contract.

Attempts were made to address the issue of scale through public outreach activities and the adoption of an online carbon project calculator tool on the ICCI and MCCI websites. With this tool, landowners estimated potential losses and profits by calculating their carbon sequestration potential and likely cost of participation.

Institutional Capacity

Lack of institutional infrastructure is often a barrier for small-scale forestry initiatives trying to access carbon markets (10). Small-scale producers often do not have the resources to hire a project developer or the time to act as a project developer on their own behalf. Program administrators were fortunate in that they were able to take advantage of the only functioning carbon market platform in the U.S., CCX. They were also fortunate to have a relationship with the Delta program, a non-profit with a proven reputation in the region that was prepared to act as the aggregator. Moreover, the forestry firms provided a single point of contact for the flow of information between the landowners and the aggregator, and substantially alleviated landowner administrative burden.

Lack of Credentialed Foresters

A dearth of foresters with credentials that met CCX requirements presented a barrier for the Delta program. According to these requirements, the inventory must be completed by a forester who is either licensed by their state, a full member of the Association of Consulting Foresters, or certified through the Society of American Foresters. Delta discovered that, outside of MI, finding a forester with one of those three credentials became difficult, creating a bottleneck for completion of the inventories.

Learning Curve

Program administrators asserted that outreach and education was often an intensive effort resulting in with fewer enrollees than hoped for. The complexity of how carbon offsets work presented a steep learning curve. Parker spoke about the difficulties of teaching the fundamentals in a 45-minute presentation to an audience in which skepticism exists about both the veracity of climate change and the ability of carbon offsets to mitigate climate change.

Parker pointed out that, despite a steep learning curve, landowners continued to express interest. According to him and other partners, many participants joined the program out of the desire to be a part of the solution to climate change; however, even some climate change skeptics joined. They attributed this to the opportunity presented by the program for conservation-minded people to be recognized and rewarded for a job well done.

Risk and the Closing of CCX

Partners described a perception among landowners of a high degree of economic risk associated with participation. Partners said that many landowners felt they might ultimately lose money in the event of tree loss, which releases carbon back into the atmosphere. Though the Forest Carbon Reserve Pool served as an insurance policy that limited the liability of each individual landowner, partners said that, in the face of costs and restrictions, people anticipated greater risk than was actually present. Delta increased outreach and education about the potential economic benefits of participation and the risks associated with various ecological and management approaches, so as to help overcome participant risk-aversion and misconceptions.

Perceptions of risk can be overcome with education. However, the risk of market collapse is real and, indeed, occurred for Delta participants. After Delta sold credits from the pilot project (the first pool) in the

fall of 2008, the price of carbon credits on CCX steadily declined from $5-$7/credit to $.10/credit in the spring of 2010. The principal reason for this decline was the fact that CCX was a pilot project, with Member contracts ending in 2010. In 2009, Parker spoke about landowners enrolling despite a low carbon price: “Folks are signing up despite the low CCX price. It’s amazing how people want to be a part of it and prepare themselves for the future.” Delta hoped that CCX would move into a renewed contact period and held the sale of carbon credits until for more favorable prices prevailed. However, with the dual failures to pass climate legislation in the U.S. and produce a viable replacement for the Kyoto protocol at Copenhagen’s late 2009 Conference of the Parties, it became clear to Delta that CCX would close at the end of 2010. Delta eventually sold portions of some pools, but many credits did not sell before the Delta Carbon Trading program ended in 2011.

Without a flow of revenue, the technical assistance fund could not operate as a revolving loan. Delta Carbon Trading Program partners tried unsuccessfully to move a few of the larger landholdings over to the Climate Action Reserve, in which landowners could participate either in the the voluntary market or the compliance offset program for California’s AB32 cap-and-trade legislation. According to these partners, protocol requirements for additionality and permanence were too restrictive, even for the largest landholdings (5) (6) (8).

Additionality and Permanence

Meeting requirements for additionality and permanence can be a barrier for small-scale landowners, particularly in light of the uncertainty of returns in an new market. To make participation feasible for forest landowners, program administrators felt they needed to develop a protocol that lowered barriers. Hence, the managed forest protocol developed by partners and adopted by CCX featured comparatively simple requirements for additionality from later protocols in the developed in the U.S., and a relatively short contractual obligation with no requirement for a permanent conservation easement. Additional carbon was simply yearly accrual from stock growth above baseline (i.e., base year approach) minus any harvests. Baseline was determined by a carbon-specific inventory at the time of enrollment.

The CCX-approved agriculture/afforestation protocol had been in use for many years before the Delta program. CCX required that afforestation or reforestation projects be initiated on or after January 1, 1990 on unforested or degraded land. It required that grass planting be initiated on or before January 1, 1999. For conservation tillage, landowners simply committed to continuous conservation tillage until 2012.
et markets have evolved since Delta’s program was first initiated, and new managed forest protocols utilize more demanding standards for assuring offset validity; the CCX’s carbon offset protocols have faced some criticism for not adequately assuring additionality or permanence. However, demanding standards may not be feasible until incentives are reliable and sufficient. If the market develops sufficiently over time, it may be possible to increase contract length and rigor for additionality standards, while ensuring access for a broad range of land holding sizes.

Role for State Government

Partners agreed that states could play an important role in the development and maintenance of carbon offset market opportunities. According to partners, the role of aggregator or verifier might work in a case where a state has money to appropriate to such efforts; however, partners acknowledged that in most cases states would not have the funding, and so those roles might not be as commonplace. Rather, states would assist in education, outreach and coordination.

Landowner Perspective

Overview of Interviewees

Landowners were interviewed in the spring of 2010. Eleven MI-based landowners participating in the managed forest portion of the Delta program agreed to be interviewed. Length of forest ownership ranged from 8 years to over 100 years (of family ownership). Ages of interviewees varied from 50s to 70s. Family forest ownership varied in size from 96 to 280 acres. Three individuals represented recreational clubs varying in size from 640 to 10,000+ acres. Four landowners reported earning less than $50,000/year in household income, whereas only one reported earning over $200,000.

Most of the Delta interviewees appeared to be actively managing their forestland before joining the Delta program. One interviewee was a forester by trade. Another had already enrolled land in the agricultural portion of the Delta Carbon Trading program. Yet another worked in land conservation and had been looking for opportunities to earn revenue from her forest. Another had been managing income streams from multiple land uses before enrolling in the program. Landowners belonged the either pool 1, 2, or 3, representing three years of carbon accrual and participation in the program.

Importance of Foresters

Landowner interviews supported the assertions made by program administrators that private foresters played an important role in the program. Most interviewees had already engaged the assistance of a professional forester before entering the program. Most had had a management plan and inventory done, and about half had certified their land before entering the program (Table 5), which reduced the cost of joining the program. Moreover, foresters appear to have reduced the administrative burden on landowners. Foresters introduced some of the interviewees to the program, assisted some with paperwork, fielded questions, and acted as the liaison between Delta and the landowners.

Table 5: Indicators of Active Management before Participation

(N=11)	Yes	No	Not sure	Total answers
Did you have a written forest management plan?	9	2	0	11
Was your forestland certified?	5*	4	2	11
Did you have a conservation easement on your land?	1	8	1	10
Had you had a recent forest inventory done on your land?	8	1	1	10

*All certified by the American Tree Farm System

Payment for Ecosystem Services

Landowners were primarily motivated to join the Delta Carbon Trading Program by the chance to earn income from the sale of carbon offsets, but within the context of conservation. Seven of the eleven Delta landowners stated that their primary reason for joining was financial. The remaining four responded that their primary motivation was both financial and ecological. Most landowners described how, rather than trying to maximize timber profits, they took a conservation-oriented management approach that benefited everyone but lowered their income potential. Landowners saw in the program a chance to be compensated or recognized for their conservation efforts, as well as earn revenue. For example, one landowner said, *"The primary motivation for [joining] the program was that we could get a financial return for following land stewardship goals that have other motivations behind them [besides profit]."*

It is possible that this program could serve as an example of how payment for ecosystem services could be used to alleviate pressure on landowners that often leads to land conversion. Delta landowners spoke about poor maple sugaring years, a bad economy, low demand for timber products and high taxes. Several were refraining from engaging the poor timber market, and hoped that payments from Delta might replace lost income. Others spoke about using the money to pay for taxes, a management plan, the services of a forester and new tree plantings. All in all, the Delta landowners appear to be looking for money to help retain their ownership and strengthen their stewardship of their forest land. In the words of a landowner, *"The main benefit is having the feeling that we are doing the best job – [being] the best caretaker – that we can of the property that we have."*

Payment for Co-benefits

Landowner goals included conservation efforts such as wildlife habitat and riparian rehabilitation. These types of ecological goals, which are additional to carbon storage, are called co-benefits under carbon market protocols such as the Kyoto Protocol. Revenue from the Delta program supported these types of landowner goals, for which remuneration otherwise might not exist.

Chance to Address Climate Change

Seven out of ten interviewees were uncertain about whether or not climate change was a result of man-made greenhouse gases. Responses broke down as follows (N=10):

- Three stated a strong belief that climate change is a direct result of man-made greenhouse gases.
- One stated that climate change was a natural cycle.
- Six suggested that manmade greenhouse gases were only a contributing factor to a natural cycle, or stated that science or they themselves did not know enough to say for sure.

Still, four Delta landowners rated climate change as a very important factor in their decision to join, only two of whom expressed a strong belief that climate change is a result of anthropogenic greenhouse gases. The data suggest that some landowners support carbon sequestration to combat climate change regardless of the source of greenhouse gases. Furthermore, the fact that the skeptical landowners still joined the program can be viewed as a sign that the market incentive is working to broaden participation beyond those individuals motivated solely by a desire to offset anthropogenic climate change, even among early adopters.

The primary concern elicited from interviewees about joining the program (five expressed this concern) was about the ability of the program to effect real reductions in carbon emissions. Though only two landowners completely discounted carbon offsets as a useful method to address climate change, landowners did express a level of concern about how heavily carbon

offsets should be relied upon. According to one landowner, "*I think we need some big cultural changes. I think that [carbon markets] are really only addressing a very small portion of the sources of greenhouse gases and contributing factors. It's just one piece of a much bigger puzzle.*" Even so, some interviewees were supportive of the potential of offsets to help large polluters and businesses to reduce their emissions over the long term.

Landowners overcame their concerns about climate change impact differently. For one landowner, it was his desire to not be left out of a market opportunity. Another overcame her concern when she learned that the companies that purchased the credit had *"...made a commitment to actually make real change to reduce their carbon footprint…"* Yet another came to see the program as another barrier to development and, hence, an aid to conservation, despite his doubts about its impact on climate change.

Costs of Participation

There are two types of costs facing participants of a carbon program: the cost of meeting requirements of the program upon joining and the cost of lost revenue potential from alternative land uses. Regarding the costs of meeting requirements, the program was designed to minimize costs, as discussed in previous sections. Landowner interviews support the conclusion that costs were not a substantial barrier for participants. Six interviewees did not recall how much they paid to participate. Almost every landowner had no concerns about upfront costs to participate, many referring to costs as "nominal" or "minimal".

Regarding lost revenue potential, one might expect Delta landowners to express concerns about foregoing timber harvests, or losing the ability to sell one's land or convert one's land to other land uses for the length of the contract. However, few ongoing concerns of these types were elicited. Some landowners pointed out that a Delta contract presented no barrier to selling land, since it can be transferred in the event of a sale. One landowner believed he could sell his land for a higher price because of his participation in the program.

Four landowners were concerned about their ability to sell timber, though this concern persisted after signing the contract for only one landowner. Based on comments, it would appear that most interviewees did not need to make significant changes to their management plan to participate. For example, one landowner stated, *"It looked like it was too good to be true, to get money for doing something that I was going to do anyway."* If this is true, then the risks to them posed by lost income potential would be significantly reduced. Because of the contract brevity, some Delta landowners were able to insert the contract period between harvests. The fact that small-scale landowners often harvest less frequently (11) might also play a role.

Moreover, the program fit into landowner goals, the details of which were as unique as the landowners themselves. For example, some landowners did not have plans to convert or sell during the contract period. Others were not going to harvest anyway because of the poor timber market. Some prioritized wildlife habitat and aesthetics as management goals over timber harvesting. Still others viewed the contract as a welcomed barrier to development.

Only one interviewee experienced a real concern about foregoing a timber harvest after signing the contract. He paid $2,000 for the inventory outright rather than using the technical assistance fund, and expected revenue from the Delta program to offset this cost, as well as lost revenue from a foregone timber harvest. When his credits did not sell, he wanted to be released from his contractual obligation by buying back the credits himself (which he estimated would have cost him about $100). At the time of the interview he had taken no action, since Delta needed time to investigate the ramifications.

Additionality

Participants followed the CCX protocol for managed forests, in which additionality is determined with a base year approach. Based on comments, the CCX requirement for additionality did not present a barrier, as it would appear that this approach fit in with landowner goals. For example, one landowners stated, *"I'm getting paid to do what I was going to do anyway. I do what I do because it's the right thing to do with land."* Yet another landowner stated, *"... it was a way to be rewarded for something we're already doing."*

Market Risk

Four landowners stated that they were concerned about the risk and uncertainty involved in participation with a market before signing the contract and joining the program. (Related to this, an additional landowner identified the congress's rejection of cap-and-trade legislation as a barrier.) For two of these landowners, the fact that the their credits had not sold was a barrier to rejoining, if they had it to do over again. Indeed, at the time of the interviews (spring of 2010) the only three landowners to have earned revenue were part of the first pool. The remaining eight were waiting.

Many interviewees had signed up for the program during a time when the price of carbon suggested the potential to earn a certain amount. Some landowners expressed disappointed hopes. One of the landowners who would not join again pointed out that,

though a management plan and some professional guidance might be benefits of the program, there are cheaper ways to obtain it.

However, despite the wait, nine interviewees said they would still join in retrospect. Many landowners had joined the program with the knowledge that they might not earn revenue. In the words of a landowner, *"I said it was worth a chance to try it, and if I did [make money], I did, and if I didn't, I didn't."* For them, the cost to join was low, and/or they saw other values to participation. Three landowners said they would rejoin the program because conservation was more of a motive than financial gain. One said, *"I stood to gain regardless, so I didn't see [the financial costs and benefits] as a make-or-break situation. I still felt the overriding concern was what we can do for the environment."* Other values mentioned included the development of a management plan at little cost, being well positioned for future markets, or learning about one's natural resource. Furthermore, the Delta Carbon Trading Program was a comparatively a better risk than a very poor timber market for some of these small-scale producers.

Take-Home Messages

The Delta Carbon Trading Program and its participating landowners were early pioneers in the area of carbon credits, particularly managed forest carbon. Given the complex and controversial nature of carbon offsets and the instability and uncertainty of the market, three program accomplishments stand out:

- Nearly 1,300 (as of 2009) private landowners in IL and MI with as little as 1 acre of agricultural land and 20 acres of forestland risked time and money to enroll.
- Small-scale, private forest landowners (interviewees) with as little as 160 acres earned a profit from selling managed forest credits. Profit-earners with fewer acres could exist outside the group of interviewees.
- Nine out of eleven interviewees would still enroll in the program if they had it to do over again, including six who had not yet sold a credit.

Program administrators believed the program was successful, particularly in light of the fact that the program developed without the driver of federal regulation. In the words of a program administrator: *"I think that the fact that we've actually gotten some carbon on the market and gotten money back in the hands of landowners is a huge accomplishment. And we're proud that we were able to find a model that was easy to use for these uneven aged forests to participate in carbon markets. And we didn't have cap and trade and we were still able to do it. I think that's quite an accomplishment."*

Several insights gleaned from this case study are listed here:

- Though markets are still uncertain, landowners are interested in participating. Programs such as this can provide them with an opportunity to do so in a way that fosters a greater understanding of and rewards for good conservation practices.
- Early adopters among landowners tended to be conservation-oriented, engaged in active land management, and already exploring moneymaking opportunities from land-based activities. Utilizing other assistance programs (such as the Conservation Reserve Program and the Forest Stewardship Program) is an effective way of finding and approaching these types of landowners who are well-placed to withstand high market risk.
- External market forces, such as a declining timber market, play a part in landowner choices as well.
- Not all landowners are motivated by the chance to address anthropocentric climate change. Market incentives may be working to broaden participation in climate mitigation beyond individuals who are focused on solutions to climate change.
- Consider the long-term restrictions and administrative burden a target population can reasonably bear, and look for ways to fill the gap. Restrictive requirements for additionality and permanence may be unreasonable for small-scale landowners in an uncertain market. Until the market develops, it may be valuable to see offsets as a way to create a system of incentives for conservation.
- Understand the fixed costs of creating land-based offsets relative to ownership size. Some land holdings are too small to generate profit, unless carbon prices are sufficient. Look for efficient ways for landowners to learn about the costs and benefits, such as an online tool.
- Minimize upfront costs through program design. Identify barriers and ways to overcome those barriers during the development phase. Examples from this case study include establishing a revolving load fund, aggregation, and engaging accredited foresters with access to an inexpensive group certification system.
- Look for synergies with existing operational structures within state agencies, non-profits, and private businesses. Examples from this case study include conducting outreach and marketing through state agencies, utilizing the Forest Stewardship Program's 50% cost sharing for management plans, and engaging foresters or the Soil and Water Conservation Districts as local entry points for landowners.

Contact Information

Delta Institute:

Todd Parker
(517) 482-8810
tparker@delta-institute.org

Michigan:

MI Dept. of Natural Resources
Shawna Meyer
Forest Stewardship Coordinator
(517) 335-3355
Meyers6@michigan.gov

MI Dept. of Agriculture
Steve Shine
(517) 373-9798
ShineS@michigan.gov

Grossman Forestry Company
(906) 293-8707
http://www.grossmanforestry.com/

Illinois:

Illinois Environmental Protection Agency
Richard Breckenridge
(217) 558-6818
richard.breckenridge@illinois.gov

The Authors:

Rachael Beddoe
University of Vermont
Rubenstein School of Environment & Natural Resources
rbeddoe@uvm.edu

Cecilia Danks, Ph.D.
Assistant Professor
University of Vermont
Rubenstein School of Environment & Natural Resources
cdanks@uvm.edu

- Related to the above, forging partnerships with other state conservation programs can increase participation in those programs as well. An example from this case study is an increase in participation in the Forest Stewardship Program.

It is possible that the Delta Carbon Trading Program could serve as an example of how payment for ecosystem services could be used to alleviate pressure on landowners that often leads to land conversion. State agency partners spoke about their hopes that the program would help reduce parcelization, increase participation in existing state programs, and promote ecological and economic benefits for the state. They affirmed their commitment to build upon the precedent started by ICCI, MCCI, and the MI Working Forest Carbon Offset Program. Breckenridge spoke about creating new markets for ecosystem services that could augment existing programs, such as payments for water nutrient enhancement. The MI Forest Stewardship Program was exploring the potential to achieve landscape-scale sustainable forest management through landscape-based aggregation of multiple ecosystem services.

The development of ICCI, MCCI, and MI Working Forest Carbon Offset Program presents a compelling case of non-governmental organizations, public entities, and private businesses working together to help landowners achieve greater stewardship of their land. This case study suggests that if individual landowners have sufficient support, they will join efforts to address climate change. If given a steady market, it is possible that programs like the Delta Carbon Trading Program could be self sustaining, and could offer a piece of that support.

REFERENCES

(1) Delta institute. (2009). Managed Forest Carbon Offset and Trading Program Enrollment Instructions.
(2) Delta Institute. (2009). Application for Participation in Chicago Climate Exchange Forestry Offset Pool.
(3) Illinois Department of Agriculture (http://www.agr.state.il.us/about/agfacts.html).
(4) Michigan Department of Natural Resources (MDNR). (2003). Michigan Forest Legacy Program Assessment of Need.
(5) Parker, T. (2009; 2013). Personal communication.
(6) Breckenridge, D. (2009; 2013). Personal communication.
(7) Practical Action Consulting (2009). Small-scale bioenergy initiatives: Brief description and preliminary lessons on livelihood impacts from case studies in Asia, Latin American, and Africa. Prepared for PICES and UN FAO. Available at www.pices.or.ke/pubs/index.html.
(8) Grossman, G. (2009; 2013). Personal communication.
(9) Delta P2E2 Center Press Release. (2008) Delta Institute generates over $400,000 in carbon credit revenue for Michigan landowners. Accessed Sept 2009: http://michiganclimate.org/data.php.
(10) Smith, J. & Scherr, S.J. (2003). Capturing the value of forest carbon for local livelihoods. World Development. 31(12): p. 2143-2160.
(11) Butler, Brett (2008). Family-forest owners of the United States, 2006. General Technical Report NRS-27. Newtown Square, PA, USDA Forest Service, Northern Research Station. 72 pp.