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# *SOIL HEALTH APPRASIAL SCALING ROADMAP*

WINTER 2024

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# *EXECUTIVE SUMMARY*

Midwestern farmers may improve their soil health and local water quality by adopting Soil Health Management Systems (SHMS) such as cover crops or no-till but require greater financial incentives to do so. Farmers may be incentivized to adopt SHMS if building soil health can demonstrably increase the value of their land, helping to provide a clear value proposition to undertake soil health- and water quality- focused efforts. To do so, soil health must be valued as a property characteristic and a replicable process to incorporate soil health into commonly accepted appraisal practices must be created. However, in Illinois (and more broadly in the Midwest), no real estate appraisal approaches currently exist to empirically assess the value ($/acre) of soil health.

Through funding by the Walton Family Foundation, Delta Institute and its partners Compeer Financial and the Soil Health Institute (the Project Team) tested a proof-of-concept approach to incorporate measurements of soil health into the farm real estate appraisal process on 11 subject properties in DeKalb County, IL that were viewed to be reasonably indicative of many Midwestern farm properties.

The Illinois Soil Health Appraisal Pilot Program (the Pilot Program) resulted in the creation of a modified Sales Comparison Approach, whereby appraisers collect soil health data from subject properties and create a simple “soil health index” in accordance with the Project Team’s replicable methodology. Due to the current lack of soil health appraisal marketplace evidence, although soil health was able to be analyzed as a valuation adjustment within the Sales Comparison Approach, the resulting review of the individual soil health index scores among pilot participant farms did not result in a land valuation adjustment since broad farmland appraisal data is lacking. In other words, for now appraisers lack the baseline data required to identify and isolate any quantifiable market reactions to soil health. Additionally, the Project Team identified other data-based barriers, such as limited information on the return on investment of building soil health and bottlenecks of soil testing, which may further prevent the institutional adoption of this novel appraisal methodology. Together, these findings suggest that a “missing market” exists for soil health in land valuation. Here, Delta prescribes the following next steps needed to build a foundation on which soil health may be valued as a standard feature within the agricultural real estate market:

1. Expand Soil Health Land Appraisal Use in Illinois
2. Explore Utilization in Indiana and Iowa
3. Perform Outreach and Engagement Across Upper Mississippi River Basin
4. Identify, Develop, and Implement Market Drivers that Leverage Soil Health Land Appraisal to Increase Adoption of Soil Health Practices

In summary, the next steps towards institutionalizing soil health as an asset in the agricultural real estate market is aggressively expanding the Sales Comparison Approach through soil health appraisal projects across Illinois, Indiana and Iowa to thus:

- Compile and demonstrate in-depth market evidence to raise awareness of the value and return on investment of building soil health to farmers and appraisers,
- Resolve bottlenecks in the soil testing industry, and,
- Actualize the proof of concept into a viable appraisal approach.

## About Delta Institute

Delta Institute collaborates with communities to solve complex environmental challenges throughout the Midwest. Delta exists because environmental, economic, and climate issues hit communities—urban and rural—through disinvestment, systemic inequity, and policy decisions. We collaborate at the community level to solve our home region's new and legacy issues, by focusing on the self-defined goals and needs of our partners.

Delta Institute improves the living conditions of more than five million Midwesterners by transitioning one million acres to more resilient, conservation-focused practices, and by improving water quality and reducing flooding by capturing 100 million stormwater gallons. By 2025 we will achieve these goals through our agriculture, climate, water, and community development projects.

This is what a more resilient, equitable, and innovative Midwest looks like. Visit us online at www.delta-institute.org.

## Acknowledgements


- This project was produced with generous support from the Walton Family Foundation.
- Compeer Financial is a member-owned, Farm Credit cooperative serving and supporting agriculture and rural communities. We provide loans, leases, risk management and other financial services throughout 144 counties in Illinois, Minnesota, and Wisconsin. Based in the upper Midwest, Compeer Financial exists to champion the hopes and dreams of rural America.
- The Soil Health Institute is a global non-profit with a mission of safeguarding and enhancing the vitality and productivity of soils through scientific research and advancement. The Institute brings together leaders in soil health science and the industry to conduct research and empower farmers and other landowners with the knowledge to successfully adopt regenerative soil health systems that contribute economic and environmental benefits to agriculture and society.


This document and the tools provided aim to be action oriented and to provide the most current, correct, and clear information possible, but some information may have changed since publication. We encourage practitioners to reach out to us at delta@delta-institute.org with questions, corrections, or to discuss implementation challenges.

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# *INTRODUCTION*

In prior stages of work, Delta Institute (Delta) partnered with Michigan State University's College of Agriculture and Natural Resources to better understand the role that soil health plays in the current appraisal and valuation of agricultural land and the ways in which this role may expand in the future. These efforts yielded a viable model based on rigorous analysis connecting land value and soil health, which then served as the underpinnings of Delta's Pilot Program (Gammans & Cheu, 2021). This model outlined three conditions, which the Project Team believes should be met for the creation of a viable market for soil health appraisal.

First, soil health must demonstrably be able to increase future profits, and farmers and real estate stakeholders must be aware of the role soil health plays in profits. The value of farmland is equal to its discounted returns or how much value the land is expected to generate in the future. This can be estimated by the sum of present values of all future cash flows. The future cash flow depends on factors such as agricultural sales, input costs, and agricultural subsidies. We focus on the role of soil health that might play in these cash flows and how this may affect farmland valuation. A growing body of research suggests that enhanced soil health may improve both production and decrease input requirements over time (American Farmland Trust, 2019; American Farmland Trust, 2020; Soil Health Institute, 2021; Stevens, 2019). However, there is a lack of consensus among key stakeholders in the agricultural real estate market (e.g., appraisers, farmers, mortgage loan officers, insurance agents) that building soil health creates more profitable farm operations than "business as usual" farm management.

Second, soil health must be observable to market players through testing. As the definition of soil health can feel abstract, it is more intuitive to see which indices represent soil health (e.g., soil organic carbon, potential carbon mineralization, aggregate stability). Soil health is difficult to observe without testing and can differ across a subject property. Hence, accurate testing needs to be available at relatively low costs to bridge this gap in information. At present, this condition is not met due to several reasons: testing is expensive and may be cost prohibitive for farmers or appraisers; the timeline for testing and analysis may not align with appraisal timelines (testing soil health indicators is ideally performed in Spring – creating a small window of opportunity for appraisers and farmers); recognition and testing methodologies of soil health indicators are not standardized across soil testing labs; and, soil labs that do test soil health indicators may lack capacity to provide services at scale. Further, standardized soil health data collection methodology is lacking across the Midwest, necessitating a more uniform approach.

Finally, soil health must be a desirable asset for purchase. Costs may include time taken to enhance soil health, lower yields or profit loss in the short run, and additional costs to adopt different farm practices—thus resulting in a demonstrable asset, no different than other on-farm improvements. If it is not costly for farmers to produce healthier soil, then there would be no value in buying land that already has these characteristics. Otherwise, buyers would simply buy the farmland and improve soil health for themselves if necessary for production.

Taken as a whole, if the effects of soil health on incomes and costs to produce healthy soil are large enough, and the means to measure soil health are efficient enough, there exists demand for healthy soil in the market. When all these conditions are met, soil health is traded in the market and farmland owners have market incentives to change their practices to enhance the soil health and to expect appreciation of their farmlands.

# *STEP 1: SCALE AND EXPAND SOIL HEALTH APPRAISAL USE IN ILLINOIS*

The results of the Pilot Program showed that farmland real estate appraisers require more comparable sales data, such as the soil health index scores of subject properties, and more market evidence of the effects of soil health on net incomes to be able to ascribe value to soil health in the appraisal process. In other words, to move toward establishing a true comparable baseline for the soil health valuation methodology, more data is needed across the Midwest that is verifiable and demonstrable to the appraiser community.

Therefore, Delta suggests using the modified Sales Comparison Approach (detailed in Delta's *Illinois Methodology and Pilot Overview, 2024* report), inclusive of the soil sampling and soil health index creation methodology, to appraise additional subject properties in Illinois to further develop a body of baseline data that can be used to compare subject properties.

The Sales Comparison Approach, while allowing the appraiser to adjust based on inherent soil properties such as texture (clay, silt and sand content), location and market trends, does not capture the increased value of the land resulting from sustainable management since there may not be any properties like that for comparison. Furthermore, there is no good database of comparable parcels and adjustments based on soil improvements related to conservation focused management.

**In Brief: Sales Comparison Approach**

Appraisers identify 5-10 comparable properties sold in the vicinity and determine the value of the land based on those sales. Adjustments can be made by looking at pairs of properties to estimate the value of improvements or features of the property (e.g., dwelling, grain bin, tile drainage). This is a cyclical process that amounts to a slow-moving average of land values in the area. Currently, improvements typically considered are structural in nature.

To fill this information gap, Delta will:

- Engage producers through project partners such as Compeer Financial, Iroquois Valley Farms, the Soil Health Institute, and Soil and Water Conservation Districts for participation.
- Explore a different Major Land Resource Area (MLRA) than the 2024 Pilot Program, serving to diversify our samples, scale the project, and test the rigor of our standard operating

procedures for sampling and metric creation. MLRAs represent a specific geographic area of constrained parent material and climate. The Pilot Program focused on MLRA 108: Illinois and Iowa Deep Loess and Drift (please see *Figure 1*).

- Partner with another Appraisal Consultant and the Soil Health Institute to conduct Soil Health Appraisals with a cohort of at least 10 farmers in another identified MLRA in Illinois to further expand baseline data available to appraisers, while addressing a current core market need (soil health appraisal data at a reasonable scale). These appraisals will collect baseline data and identify the highest achievable levels for key soil health indicators intrinsic to the MLRA.

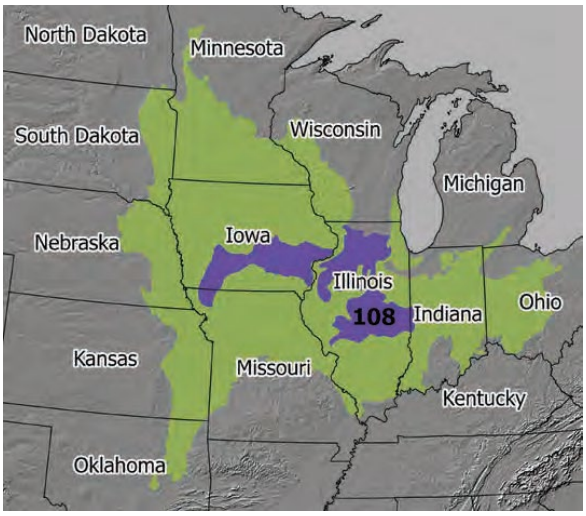


*Figure 1: Location of MLRA 108, which covers 32,967 miles$^2$. Source: USDA Agriculture Handbook 296, 2022.*

The results of this expansion will be incorporated into the calculations of a "baseline" soil health index, which will increase the accuracy of the data and further the application of the soil health methodology in appraisals across the state. These steps will allow the modified Sales Comparison Approach to be refined as needed based on farmer and appraiser feedback, needs, and work experience.

Delta is deeply interested in compiling market evidence of the effects of building soil health on net farm incomes to build consensus on the value of soil health. As previously mentioned, a growing body of research suggests net incomes may be higher for farmers who adopt SHMS due to lower operating costs and higher revenues (American Farmland Trust, 2019; American Farmland Trust, 2020; Soil Health Institute, 2021; Stevens, 2019). Also, the Project Team has collected evidence from conversations with farmland investing firms that institutional investors/absentee landowners (e.g., Real Estate Investment Trusts) value regenerative land stewardship over returns on investment. For context, Delta has multiple years of experience working with land trusts on stewardship-focused revenue and financing mechanisms.

**Income Capitalization Approach**

Based on the idea that present value is indicated by future benefits such as rental income (leases) or production income (owner-operators). The capitalization of net income can be based on direct (single year) or yield (future set period) capitalization. Collecting income data is time intensive and is typically based on rental income. Capitalization rates may not be designed to take changes to soil health due to different farmland management approaches into account.

Therefore, **while it is clear that adopting soil conservation practices has the potential to make farms more profitable and land more valuable, with direct water- and soil- health benefits, no market currently exists on a broad basis to enable that trade.** The Project

Team plans to explore this gap by performing a thorough investigation of the effects of adopting SHMS on farm net incomes via partial budget analyses. This effort may also open the possibility for appraisers to consider valuing soil health using the Income Capitalization approach.

For example, if net returns can be shown to be affected by soil health indicators (e.g. “parcels in MLRA 108 with > 4.5% Soil Organic Carbon were shown to have a net return of $1.25/acre”) then appraisers may be able to ascribe empirical monetary value to measurements of soil health on farmland. This may be accomplished in several ways. First, the project team may quantify the benefits of building soil health via *partial budget analyses* to compare the costs and benefits of adopting SHMS to conventional, or “business as usual” management. Given that building soil health takes approximately two years for demonstrable impact, a *net present value approach* may be used, which discounts the dollar amounts in future years to account for their lower value compared to current-year dollars. Thus, the Project Team would explore case studies of farms in Illinois and the Cornbelt region to collect farm budget data and costs/benefits of SHMS.

*Table 1* shows a preliminary partial budget analysis performed by Delta staff of corn and soybean farms across the four regions of Illinois. Estimates of Illinois’ 2023 corn and soybean farm budget data was sourced from research published by the Department of Agricultural and Consumer Economics at the University of Illinois (Schnitkey et al., 2022). Reduced expenses (e.g. fertilizer or fuel use) and additional revenues (e.g. increased yield) believed to be the result of adopting SHMS were sourced from prior research of Illinois corn and soybean farmers published by the Soil Health Institute (Soil Health Institute, 2021). Indeed, preliminary analyses suggest corn and soybean farmers across all Illinois regions could increase future returns and reduce operating costs by adopting SHMS (*Table 1 and 2*). Detailed versions of Tables 1 and 2 can be found in Appendix I.

***Table 1: Abbreviated Partial Budget Analysis of Corn and Soybean farms among the two northernmost regions of Illinois before and after adopting Soil Health Management Systems.***

| | Northern Region | | | | Central – High Region | | | |
|---|---|---|---|---|---|---|---|---|
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Gross revenue | $1,215.20 | $1,244.71 | $871.00 | $900.21 | $1,271.20 | $1,300.71 | $964.80 | $994.01 |
| Total Direct Costs | $555.00 | $499.19 | $275.00 | $235.97 | $582.00 | $526.19 | $288.00 | $248.97 |
| Total Power Costs | $208.00 | $189.64 | $162.00 | $138.32 | $183.00 | $164.64 | $159.00 | $135.32 |
| Total overhead costs | $104.00 | $93.01 | $82.00 | $72.21 | $93.00 | $69.01 | $85.00 | $75.21 |
| Total non-land costs | $867.00 | $781.84 | $519.00 | $446.50 | $858.00 | $759.84 | $532.00 | $459.50 |
| Operator & land return | $348.20 | $462.87 | $352.00 | $453.71 | $413.20 | $540.87 | $432.80 | $534.51 |
| **Farmer Return ($/acre)** | **$47.20** | **$161.87** | **$51.00** | **$152.71** | **$72.20** | **$199.87** | **$91.80** | **$193.51** |

***Table 2: Abbreviated Partial Budget Analysis of Corn and Soybean farms among the two southernmost regions of Illinois before and after adopting SHMS.***

| | Central-Low Region | | | | Southern Region | | | |
|---|---|---|---|---|---|---|---|---|
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Gross revenue | $1,237.60 | $1,267.11 | $857.60 | $886.81 | $1,047.20 | $1,076.71 | $790.60 | $819.81 |
| Total Direct Costs | $558.00 | $502.19 | $272.00 | $232.97 | $511.00 | $455.19 | $280.00 | $240.97 |
| Total Power Costs | $179.00 | $160.64 | $158.00 | $134.32 | $200.00 | $181.64 | $176.00 | $152.32 |
| Total overhead costs | $90.00 | $79.01 | $88.00 | $78.21 | $115.00 | $104.01 | $113.00 | $103.21 |
| Total non-land costs | $827.00 | $741.84 | $518.00 | $445.50 | $826.00 | $740.84 | $569.00 | $496.50 |
| Operator & land return | $410.60 | $525.27 | $339.60 | $441.31 | $221.20 | $335.87 | $221.60 | $323.31 |
| **Farmer Return ($/acre)** | **$128.60** | **$243.27** | **$57.60** | **$159.31** | **-$9.80** | **$104.87** | **-$9.40** | **$92.31** |

The Project Team is very interested in performing a comparative study of farmland prices ($/acre) and SHMS adoption rates in IL between 2017 – 2024. The Project Team would utilize publicly available county-level agricultural land value datasets such as the USDA Census of Agriculture and Association of Farm Managers and Rural Appraisers annual surveys of land values. Variables such as climate, inherent soil features, and government payments must be controlled and accounted for within this analysis. A recent study utilized similar datasets, merged with a satellite-based no-till adoption dataset (Conservation Technology Information Center, n.d.), to demonstrate a 1% increase in no-till adoption rates increased county-level agricultural land values by $14.75 per acre (Chen et al., 2022). The comparative study will expand upon CTIC's methodology to include other SHMS practices in addition to cover cropping.

## *STEP 2: EXPLORE UTILIZATION IN INDIANA AND IOWA*

Iowa and Indiana share similar cropping systems and soil characteristics to Illinois, which may be relevant to their agricultural real estate markets. For this reason, it follows logically that Indiana and Iowa would represent the next layer of ideal regions for the Project Team to expand soil health appraisal pilot programs to further refine the modified Sales Comparison Approach and grow readily available baseline data for farmland appraisers. Through shared findings from the success of the Illinois Pilot Program, the Project Team will implement this framework with relevant soil characteristics for Indiana and Iowa to be incorporated into the appraisal process.

Given state-specific differences in appraisal laws and norms, the Project Team has identified the following steps to be taken:

- Engage Indiana and Iowa soil scientists and appraisers, facilitating meetings, and conducting market research to establish a shared consensus of soil health characteristics important to each state, as well as awareness of existing place-based appraisal methodologies for land valuation.
- Utilizing our findings from Illinois and additional convenings within Iowa and Indiana, we will develop an outreach strategy to engage land valuation stakeholders in each state. These conversations will further establish a network of interested producers and appraisal organizations who will participate in pilot versions of this program in each respective state.
- Identify one major land resource area (MLRA) in both Indiana and Iowa to recruit a farm cohort of at least 10 farmers. These producer-owned parcels will be appraised through state-specific methodologies and incorporate findings from soil test data and interviews regarding management history.

By expanding the geographic range of these Pilot Programs, the Project Team may also be able to compile on-farm evidence of the costs and net returns of adopting SHMS to further build evidence of SHMS as an investment. To do so, the Project Team could partner with Iowa and Indiana Soil and Water Conservation Districts or conservation-focused organizations such as the Practical Farmers of Iowa to recruit a new cohort of farmers that have adopted SHMS and document their investments in building soil health. This may be beneficial to appraisers using the modified Sales Comparison Approach, wherein “improvements” to a property (e.g., tile drainage, windbreak) increase the value of the parcel based on the price of implementation.

Additionally, as previously mentioned, the cost and logistics of soil testing have proven to be a choke point towards incorporating measurements of soil health into the land valuation process. Expanding pilot programs into Iowa and Indiana will allow the Project Team to better understand the landscape of soil testing across the Midwest and refine the soil health index used in the Illinois pilot program.

## *STEP 3: BUILD CONSENSUS ACROSS THE UPPER MISSISSIPPI RIVER BASIN*

Throughout the Pilot Program, Delta staff presented the soil health appraisal framework methodology at conferences such as the Soil and Water Conservation Society’s annual meeting and engaged industry professionals at meetings such as the Sustainable Agriculture Summit and the Regenerative Food Systems Investment Forum. These presentations allowed the Project Team to solicit feedback from experts and stakeholders and refine our approach.

Now that a proof-of-concept has been established through the completion of this Pilot Program, Delta has presented the Program’s results to several appraisal and lending organizations, such as Soil Upside, Iroquois Valley Farms, Steward Ag, and Transformational Investing in Food Systems. At the conclusion of these meetings, several organizations provided the Project Team with Letters of Support indicating their interest in furthering Walton Family Foundation-supported efforts. In addition to this, several potential collaborators indicated they would like to play a proactive role in the development of future pilot projects.

Outreach and education have proven to be valuable strategies towards developing and implementing a successful Pilot Program. However, the results of the Program clearly show that

information gaps regarding the return on investment of building soil health and how best to address logistic bottlenecks during soil testing remain a major barrier towards the scaling of soil health inclusive appraisal methodologies. To overcome these gaps, Delta will accomplish the following:

- Organize and facilitate field days or educational events with the target audience being farmers and conservation professionals that assist farmers to adopt soil conservation practices.
- Develop a suite of educational materials showing the value and benefit of SHMS practices and implementation advice. These would be available via print and digital. In addition, the project team outreach strategy would include social media, podcasts, and other media.
- Schedule one-on-one and focus group meetings with relevant stakeholders across the Mississippi River to continue to educate, gain feedback, and build consensus on the Soil Health Land Appraisal process.
- Refine Delta's soil health appraisal training module materials; partner with an appraisal education expert on refinement and coursework approach; and host 3 online training courses for appraisers to learn about the modified appraisal approach and receive Continued Education credits, with a goal of further regional buy-in.

## *STEP 4: IDENTIFY, DEVELOP, & IMPLEMENT MARKET DRIVERS THAT LEVERAGE SOIL HEALTH LAND APPRAISAL TO INCREASE ADOPTION OF SOIL HEALTH PRACTICES*

Delta knows and internalizes—via both direct engagement and partner feedback—that interventions that align soil health and land valuation through the appraisal process must be pragmatic, market-based, and easily integrated into existing business tools and processes for them to be of actual use.

Our prior work on soil health appraisal methodologies, lease agreements, and soil testing guides clearly indicated that easy-to-use templates and resources are in demand by our main practitioner audiences. Throughout this project's lifespan, Delta convened stakeholders across the agricultural real estate market value chain to solicit feedback and identify potential collaborators.

Looking forward, Delta has identified loan officers as crucial partners needed to catalyze the creation of a soil health market and identify the emerging market pathways and platforms in which the appraised value of soil health may be traded. For example, if building soil health can be tied to greater land values and deliver more equity to farmers, then farmers may adopt soil conservation practices to secure lower interest rate operating loans. Building upon lessons learned from these meetings, Delta recognizes the importance of the transfer of capital from lenders to producers as a critical next step in facilitating wider adoption of soil health practices.

To begin to break down these barriers, Delta will:

- Collaborate with and build consensus with lending organizations and agricultural banks who

previously indicated support for this project and use their network to research pathways for better operating loans or other incentives for producers and demonstrate how soil health management practices lead to increased equity in their land.

- Engage small to mid-size retail investment firms with an interest in sustainable management to reach consensus on best practices for producers pursuing these loans or other incentives, such that this information can then be relayed to farmers and alleviate some of the perceived risk when adopting new soil health practices.
- Delta will also evaluate how different land types might utilize the soil health land appraisal process and what those impacts might be. For instance, degraded farmland may be a focus area, since the increase in land value could increase at a faster rate. This could also allow for more farm access for new farmers.
- Partner with Real Estate Investment Trusts and the American Society of Farm Managers and Rural Appraisers to better understand the buyer motivations for property that has been managed sustainably. If soil health can be advertised to buyers interested in stewardship as well as return on investment, Delta's modified appraisal approach may be of utility.
- Delta will also evaluate potential unintended negative consequences such as increased tax burden to ensure the Soil Health Land Appraisal process does not create any barriers.

# *CONCLUSION*

Soil health is measurable and may be improved by adopting Soil Health Management Systems (SHMS) (e.g., cover crops and no-till). Building soil health also protects local water quality and may make farm operations more climate resilient and profitable. However, Illinois farmers lack the incentives needed to adopt SHMS at scale. No farm real estate appraisal approaches currently exist to empirically assess the value ($/acre) of soil health. Soil health is more than yield; therefore, appraisers cannot explicitly establish a link between soil health and land value.

The Illinois Soil Health Appraisal Pilot Program resulted in a scalable and replicable methodology for appraisers to incorporate measurements of soil health into the farmland appraisal and valuation process across the Midwest. However, based on consistent and routine feedback, appraisers lack the baseline data required to identify and isolate any quantifiable market reactions to soil health. While soil health was able to be analyzed as a potential adjustment within the Sales Comparison Approach, a review of the individual soil health statistics among pilot participant farms did not warrant an adjustment simply due to lack of market evidence.

For soil health to become a standardized metric and SHMS to become widely-adopted on farms across the Midwest, Delta must build upon the findings of our 2024 Illinois Soil Health Appraisal Pilot Program to compile and demonstrate in-depth market evidence to raise awareness of the value and return on investment of building soil health to farmers and appraisers, resolve bottlenecks in the soil testing industry, and actualize the proof of concept into a viable appraisal approach. Expanding partnerships to and building consensus among lending organizations and agricultural banks has the potential to catalyze our efforts and open pathways for Midwestern farmers to invest in the stewardship of their land and pay dividends for future generations.

**Is through expanding soil health land appraisal use in Illinois, Iowa and Indiana; engaging farmers and real estate stakeholders across the Upper Mississippi River Basin;**

**and partnering with industry experts to identify, develop and implement market drivers that leverage soil health land appraisal, Delta will address the apparent information gaps that are characteristic of a "missing soil health appraisal market" that will provide market-based adoption of SHMS across the Midwest.** Addressing and overcoming this "missing market" for soil health within the land valuation and appraisal process is essential to market-driven conservation adoption by farmers throughout the Mississippi River Basin (and broader Midwest), to thus improve the quality and wellbeing of our soil and water.

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# *APPENDIX I: PARTIAL BUDGET ANALYSIS*

Tables 3 and 4 below demonstrate the use of partial budget analyses to explore the economic costs and benefits of building soil health. Both tables compare the costs and benefits of adopting SHMS to conventional, or "business as usual" management on corn and soybean farms in four regions of Illinois. Estimates of IL's 2023 corn and soybean farm budget data was sourced from research published by the Department of Agricultural and Consumer Economics at the University of Illinois (Schnitkey et al., 2022). Reduced expenses (e.g. fertilizer or fuel use) and additional revenues (e.g. increased yield) believed to be the result of adopting SHMS were sourced from prior research of IL corn and soybean farmers published by the Soil Health Institute (Soil Health Institute, 2021).

***Table 3: Detailed Partial Budget Analysis of Corn and Soybean farms among the two northernmost regions of Illinois before and after adopting Soil Health Management Systems.***

| | Northern Region | | | | Central – High Region | | | |
|---|---|---|---|---|---|---|---|---|
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Yield per acre | 217 | 222.27 | 65 | 67.18 | 227 | 232.27 | 72 | 74.18 |
| Price per bu. | $5.60 | $5.60 | $13.40 | $13.40 | $5.60 | $5.60 | $13.40 | $13.40 |
| Crop revenue | $1,215.20 | $1,244.71 | $871.00 | $900.21 | $1,271.20 | $1,300.71 | $964.80 | $994.01 |
| **Gross revenue** | **$1,215.20** | **$1,244.71** | **$871.00** | **$900.21** | **$1,271.20** | **$1,300.71** | **$964.80** | **$994.01** |

*Table 4 (continued): Detailed Partial Budget Analysis of Corn and Soybean farms among the two northernmost regions of Illinois before and after adopting Soil Health Management Systems*

| Direct Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Fertilizer | $250.00 | $221.09 | $95.00 | $82.80 | $250.00 | $221.09 | $95.00 | $82.80 |
| Pesticide | $108.00 | $94.74 | $64.00 | $47.62 | $123.00 | $109.74 | $74.00 | $57.62 |
| Seed | $130.00 | $121.36 | $83.00 | $77.55 | $130.00 | $121.36 | $84.00 | $78.55 |
| Drying | $27.00 | $27.00 | $4.00 | $4.00 | $34.00 | $34.00 | $4.00 | $4.00 |
| Storage | $3.00 | $3.00 | $1.00 | $1.00 | $6.00 | $6.00 | $5.00 | $5.00 |
| Crop Insurance | $37.00 | $32.00 | $28.00 | $23.00 | $39.00 | $34.00 | $26.00 | $21.00 |
| **Total Direct Costs** | **$555.00** | **$499.19** | **$275.00** | **$235.97** | **$582.00** | **$526.19** | **$288.00** | **$248.97** |
| **Power Costs** | | | | | | | | |
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Machine hire/lease | $28.00 | $12.91 | $27.00 | $7.34 | $20.00 | $4.91 | $18.00 | -$1.66 |
| Utilities | $8.00 | $8.00 | $7.00 | $7.00 | $7.00 | $7.00 | $7.00 | $7.00 |
| Machine repair | $50.00 | $50.00 | $31.00 | $31.00 | $41.00 | $41.00 | $37.00 | $37.00 |
| Fuel and Oil | $40.00 | $36.73 | $26.00 | $21.98 | $34.00 | $30.73 | $26.00 | $21.98 |
| Light vehicle | $3.00 | $3.00 | $1.00 | $1.00 | $2.00 | $2.00 | $1.00 | $1.00 |
| Mach. Depreciation | $79.00 | $79.00 | $70.00 | $70.00 | $79.00 | $79.00 | $70.00 | $70.00 |
| **Total Power Costs** | **$208.00** | **$189.64** | **$162.00** | **$138.32** | **$183.00** | **$164.64** | **$159.00** | **$135.32** |

*Table 5 (continued): Detailed Partial Budget Analysis of Corn and Soybean farms among the two northernmost regions of Illinois before and after adopting Soil Health Management Systems*

| Overhead Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Hired Labor | $27.00 | $16.01 | $25.00 | $15.21 | $25.00 | $14.01 | $22.00 | $12.21 |
| Building repair & rent | $5.00 | $5.00 | $7.00 | $7.00 | $8.00 | $8.00 | $7.00 | $7.00 |
| Building depreciation | $25.00 | $25.00 | $11.00 | $11.00 | $14.00 | $1.00 | $12.00 | $12.00 |
| Insurance | $12.00 | $12.00 | $11.00 | $11.00 | $13.00 | $13.00 | $13.00 | $13.00 |
| Misc. | $12.00 | $12.00 | $11.00 | $11.00 | $13.00 | $13.00 | $13.00 | $13.00 |
| Interest (non-land) | $23.00 | $23.00 | $17.00 | $17.00 | $20.00 | $20.00 | $18.00 | $18.00 |
| **Total overhead costs** | **$104.00** | **$93.01** | **$82.00** | **$72.21** | **$93.00** | **$69.01** | **$85.00** | **$75.21** |
| **Total non-land costs** | **$867.00** | **$781.84** | **$519.00** | **$446.50** | **$858.00** | **$759.84** | **$532.00** | **$459.50** |
| **Operator & land return** | **$348.20** | **$462.87** | **$352.00** | **$453.71** | **$413.20** | **$540.87** | **$432.80** | **$534.51** |
| Land cost (cash rent) | $301.00 | $301.00 | $301.00 | $301.00 | $341.00 | $341.00 | $341.00 | $341.00 |
| **Farmer Return** | **$47.20** | **$161.87** | **$51.00** | **$152.71** | **$72.20** | **$199.87** | **$91.80** | **$193.51** |
| **Breakeven Price to Cover** | | | | | | | | |
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Non-land costs | $4.00 | $3.52 | $7.98 | $6.65 | $3.78 | $3.27 | $7.39 | $6.19 |
| Non-land and land costs | $5.38 | $4.87 | $12.62 | $11.13 | $5.28 | $4.74 | $12.13 | $10.79 |

*Table 6: Detailed Partial Budget Analysis of Corn and Soybean farms among the two southernmost regions of Illinois before and after adopting Soil Health Management Systems*

| | Central-Low Region | | | | Southern Region | | | |
|---|---|---|---|---|---|---|---|---|
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Yield per acre | 221 | 226.27 | 64 | 66.18 | 187 | 192.27 | 59 | 61.18 |
| Price per bu. | $5.60 | $5.60 | $13.40 | $13.40 | $5.60 | $5.60 | $13.40 | $13.40 |
| Crop revenue | $1,237.60 | $1,267.11 | $857.60 | $886.81 | $1,047.20 | $1,076.71 | $790.60 | $819.81 |
| **Gross revenue** | **$1,237.60** | **$1,267.11** | **$857.60** | **$886.81** | **$1,047.20** | **$1,076.71** | **$790.60** | **$819.81** |
| **Direct Costs** | | | | | | | | |
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Fertilizer | $246.00 | $217.09 | $95.00 | $82.80 | $230.00 | $201.09 | $95.00 | $82.80 |
| Pesticide | $120.00 | $106.74 | $74.00 | $57.62 | $109.00 | $95.74 | $75.00 | $58.62 |
| Seed | $130.00 | $121.36 | $70.00 | $64.55 | $118.00 | $109.36 | $76.00 | $70.55 |
| Drying | $23.00 | $23.00 | $5.00 | $5.00 | $18.00 | $18.00 | $5.00 | $5.00 |
| Storage | $5.00 | $5.00 | $2.00 | $2.00 | $4.00 | $4.00 | $3.00 | $3.00 |
| Crop Insurance | $34.00 | $29.00 | $26.00 | $21.00 | $32.00 | $27.00 | $26.00 | $21.00 |
| **Total Direct Costs** | **$558.00** | **$502.19** | **$272.00** | **$232.97** | **$511.00** | **$455.19** | **$280.00** | **$240.97** |

*Table 7 (continued): Detailed Partial Budget Analysis of Corn and Soybean farms among the two southernmost regions of Illinois before and after adopting Soil Health Management Systems*

| Power Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Machine hire/lease | $19.00 | $3.91 | $18.00 | -$1.66 | $19.00 | $3.91 | $16.00 | -$3.66 |
| Utilities | $8.00 | $8.00 | $7.00 | $7.00 | $9.00 | $9.00 | $7.00 | $7.00 |
| Machine repair | $41.00 | $41.00 | $37.00 | $37.00 | $52.00 | $52.00 | $52.00 | $52.00 |
| Fuel and Oil | $30.00 | $26.73 | $26.00 | $21.98 | $37.00 | $33.73 | $26.00 | $21.98 |
| Light vehicle | $2.00 | $2.00 | $2.00 | $2.00 | $2.00 | $2.00 | $2.00 | $2.00 |
| Mach. Depreciation | $79.00 | $79.00 | $68.00 | $68.00 | $81.00 | $81.00 | $73.00 | $73.00 |
| **Total Power Costs** | **$179.00** | **$160.64** | **$158.00** | **$134.32** | **$200.00** | **$181.64** | **$176.00** | **$152.32** |

*Table 8 (continued): Detailed Partial Budget Analysis of Corn and Soybean farms among the two southernmost regions of Illinois before and after adopting Soil Health Management Systems*

| Overhead Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Hired Labor | $21.00 | $10.01 | $28.00 | $18.21 | $35.00 | $24.01 | $34.00 | $24.21 |
| Building repair & rent | $9.00 | $9.00 | $7.00 | $7.00 | $9.00 | $9.00 | $9.00 | $9.00 |
| Building depreciation | $15.00 | $15.00 | $11.00 | $11.00 | $21.00 | $21.00 | $21.00 | $21.00 |
| Insurance | $13.00 | $13.00 | $13.00 | $13.00 | $17.00 | $17.00 | $17.00 | $17.00 |
| Misc. | $11.00 | $11.00 | $11.00 | $11.00 | $13.00 | $13.00 | $13.00 | $13.00 |
| Interest (non-land) | $21.00 | $21.00 | $18.00 | $18.00 | $20.00 | $20.00 | $19.00 | $19.00 |
| **Total overhead costs** | **$90.00** | **$79.01** | **$88.00** | **$78.21** | **$115.00** | **$104.01** | **$113.00** | **$103.21** |
| **Total non-land costs** | **$827.00** | **$741.84** | **$518.00** | **$445.50** | **$826.00** | **$740.84** | **$569.00** | **$496.50** |
| **Operator & land return** | **$410.60** | **$525.27** | **$339.60** | **$441.31** | **$221.20** | **$335.87** | **$221.60** | **$323.31** |
| Land cost (cash rent) | $282.00 | $282.00 | $282.00 | $282.00 | $231.00 | $231.00 | $231.00 | $231.00 |
| **Farmer Return** | **$128.60** | **$243.27** | **$57.60** | **$159.31** | **-$9.80** | **$104.87** | **-$9.40** | **$92.31** |
| **Breakeven Price to Cover** | | | | | | | | |
| | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS | Corn | Corn w/ SHMS | Soy | Soy w/ SHMS |
| Non-land costs | $3.74 | $3.28 | $8.09 | $6.73 | $4.42 | $3.85 | $9.64 | $8.12 |
| Non-land and land costs | $5.02 | $4.52 | $12.50 | $10.99 | $5.65 | $5.05 | $13.56 | $11.89 |