

Iowa Smart Agriculture: Solutions from the Land A Vision for the Future

PROLOGUE

Iowa farmers are at the forefront of change as they seek to sustainably manage the land for multiple societal benefits--producing food, energy, healthy ecosystems including robust soil and water resources, and ensure profitability so they can continue to farm into the future. Farmers strive to make a living, adjust to volatile markets, adapt to major disasters such as flooding, derechos and drought, and anticipate emerging pressures from uncertainties in supply chains, seasonal weather and long-term climate shifts. The constant motion and accelerated turbulence of local and global conditions are driving forces in remaking day-to-day operational decisions and long-term strategic planning in their agricultural enterprises. In the search for resilience, many farmers are asking how together they can address water quality, reduce soil erosion and retain soil carbon, contribute to reductions in greenhouse gas (GHG) emissions, and create and capture value from their land resources to make a living.

Resilience for Iowa farmers is the capacity to continually question what we do and why; the ability to be open to change; the willingness to experiment, innovate and seek better ways of farming; and access to sufficient resources to economically flourish while providing multiple societal and environmental benefits from our farming enterprises.

Resilience has a day-to-day *operational* meaning- i.e. the capacity to deal with the unexpected, uncertainties and changing complexities of day-to-day-experiences and decisions and still keep the farm functionally operating. This is the capacity to bounce back under changing conditions and return to existing position following events that disturbed the normal operations of the enterprise.

There is also a *strategic* component of resilience that entails capacity to plan, adjust, and embrace change in ways that enable the enterprise to bounce forward into a better future. This is distinctively different than accepting current operational resilience (I've survived one more day) and plan to continue the current path without examining how changing conditions might require changes in my production system, use of technologies, current attitude and mind-set.

Kellie Blair, of Blair Farm expresses it this way, "Plowing up black dirt was the big thing years ago; now it's no till and cover crops. Who knows what will be the next solutions to current challenges? Change is good, but you have to constantly ask yourself questions, what happened when we changed our practices or tried new technologies, and what do I need to do next to be prepared for the next unexpected? My husband and I continually reaffirm and remind each other, *everything we do on our farm is subject to change.*"

Many Iowa farmers are seeking best management practices that are profitable and environmentally healthy. They are tweaking and revising existing solutions to get better results. They are trying new ways of doing things to fuel innovation and improve production systems and market options. And they are asking how the outcomes of change can be better quantified. What are the differences we make at the end of the day? Is the hypoxic zone smaller in the Gulf of Mexico because of our efforts? Are we reducing off-field, off-farm nutrient losses into our water ways and building up our soils? Are our wetlands robust enough to store and hold excess floodwaters when too much rain and runoff threaten to overwhelm our systems? Iowa farmers are seeking direct paths forward and are challenging each other with, how is the “new” technology or approach better than what we are doing right now? Is the “pain” of not changing greater than the “pain” of change?

The most powerful lever for improving resilience is to develop flexible management strategies and dynamic systems that give capacity to adjust and adapt the farm to cycles of predictable and unpredictable change (Fiksel 2015).

The farmers of Iowa Smart Agriculture (IASA) seek to work together with other farmers to advance pragmatic, proven and innovative agricultural solutions that benefit producers, the agricultural value chain, consumers and the planet by increasing farm and landscape level resilience. This effort is based in the Solutions from the Land (SfL)¹ mission to inspire, educate, equip and mobilize agricultural leaders and rural communities to meet the challenges of today and the future and contribute to local and global goals for sustainable development.

Iowa Smart Agriculture’s vision for Iowa

To manage Iowa’s working landscapes to safely and sustainably provide an abundance of food, feed, fiber, and fuel, while protecting and building health in our soil; filtering and storing water; sequestering carbon and reducing greenhouse gas emissions; and ensuring economically compelling opportunities for our livestock producers, farmers, their families and communities.

IOWA SMART AGRICULTURE

Agriculture is the life blood of Iowa.² Our landscapes and communities are resilient and productive, but also challenged. We learned that in 2020 when the COVID-19 pandemic played havoc with the food supply chain and the distribution system interrupted local and global livestock and grain markets; and created scarcity for inputs ranging from equipment, repair

¹ Solutions from the Land is a nonprofit corporation focused on land-based solutions to global challenges. Its mission is to identify and facilitate the implementation of policies, practices, and projects at a landscape scale that will result in land being sustainably managed to produce food, feed, fiber, and energy while protecting and improving critical environmental resources and delivering high value solutions to combat climate change.

² Paul Trombino. Keynote Iowa Smart Agriculture Forum Savery Hotel, November 25, 2019.

parts, fertilizers, fencing, propane, and other resources necessary for day-to-day operations. Another challenge is water quality. The 2008 Gulf Hypoxia Action Plan calls for Iowa to reduce total nitrogen and total phosphorus loads by at least 45 percent. Although Iowa has been working for decades to protect and improve water quality, progress in meeting watershed scale targets set by US Environmental Protection Agency (EPA) to reduce nutrient loading to the Gulf of Mexico have been slow. Reducing soil erosion and the rebuilding of soil organic carbon across our landscape is another challenge if we are to continue to make a profitable living in agriculture into the future. The accelerated loss of soil, agriculture's most valuable resource, is exacerbated by changes in seasonal weather, longer term climate patterns and agricultural practices that make our soil vulnerable. In 2008 Iowa was declared a National Disaster with thousands of acres of croplands underwater, fertile soils buried in sands and coarse sediments deposited by river floodwaters. Soils were saturated, rivers throughout Iowa overflowed banks and levees on the Missouri River breached, pouring floodwater into fields ready to plant. This was not the first time in recent memory (1993, 2008, 2009, 2011, 2016) that extreme rain events flooded crops and communities in Iowa as the Des Moines, Iowa, Cedar, Raccoon Rivers and their tributaries poured their bounty (muddy waters and tons of rich Iowa soil) downstream into the Mississippi River (Lowery et al. 2009; Olson and Morton 2016).

"Iowa is smart about agriculture," says Dr. Daniel Robison, Iowa State University Dean of the College of Agriculture and Life Sciences. All across the spectrum of agricultural activities in Iowa there is a growing commitment to sustained productivity, environmental quality, and farm and community resilience. Differences lie in how to best achieve these goals. There is little doubt that our critical landscape infrastructure is increasingly challenged by highly variable weather in growing seasons, soil instability, water quality, and economic swings. Changing climatic conditions are a growing threat multiplier to the economic viability of our state's number one industry. Our farmers and businesses whose value-chain begins with sunlight, soil and water management require the continued pursuit of science and technology, as best applied to our landscapes, to meet those challenges for current and all future generations.

A collaborative group of Iowa farmers and partners committed to enhancing the quality of landscape management, with support from Solutions from the Land and in association with Iowa State University's College of Agriculture and Life Sciences, have been meeting to learn from each other and explore ways Iowa agriculture can become even smarter about how we do agriculture. The idea behind "Iowa Smart Agriculture" is to challenge us all to do more and do better in how we secure and sustain agricultural productivity, enhance our soil and water resources, ensure ecosystem integrity, and find profitable solutions in the face of today's known challenges and the unexpected ones tomorrow will bring. ***Solutions from the land must come from those that live with and manage the land, most especially farmers and our conservation partners.*** This paper is a farmer-to-farmer call to action to all who make decisions about Iowa's agricultural landscape, its croplands, livestock, wetlands, forests, rivers, and the complex value-chain that supports and extends Iowa's reach beyond state and national borders to the world.

CIRCLES OF LIFE

Iowa food and agricultural systems are much more than simple farms nested in rural landscapes producing one or two crops. Our farm systems are complex with capacities to produce multiple benefits ranging from safe and nutritious food supplies, renewable fuels and energy, high quality water, retention and storage of soil carbon, enhancement of wildlife and biodiversity, and profitable livelihoods. The resilience of food and agricultural systems have a legacy based in our planet's circle of life, the original circular system. **The natural circular system is not linear and has no waste, everything is of value** (Figure 1). "One organism's waste is another organism's food, and nutrients and energy flow in closed-loop cycles of growth, decay, and reuse" (Jones et al. 2021, p.8).

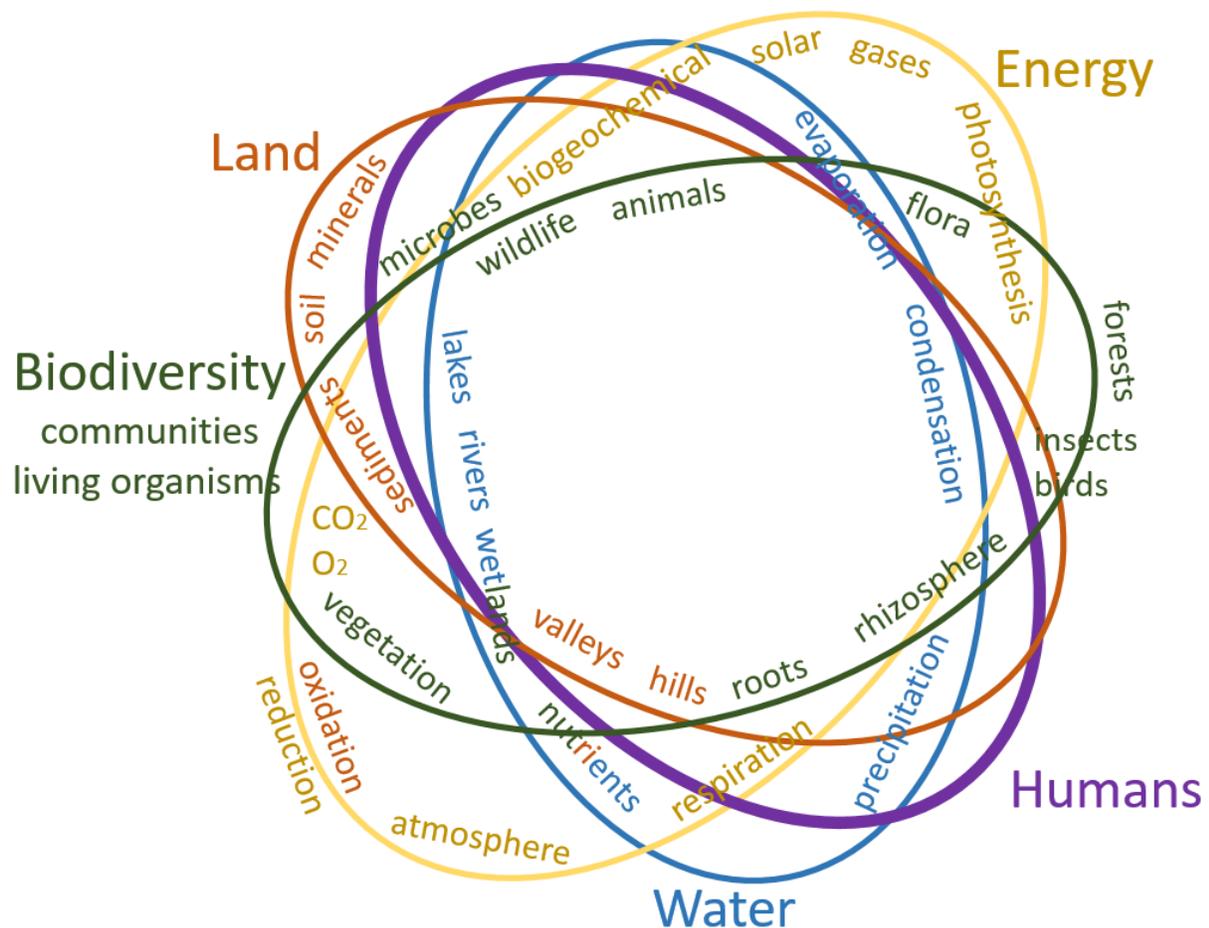


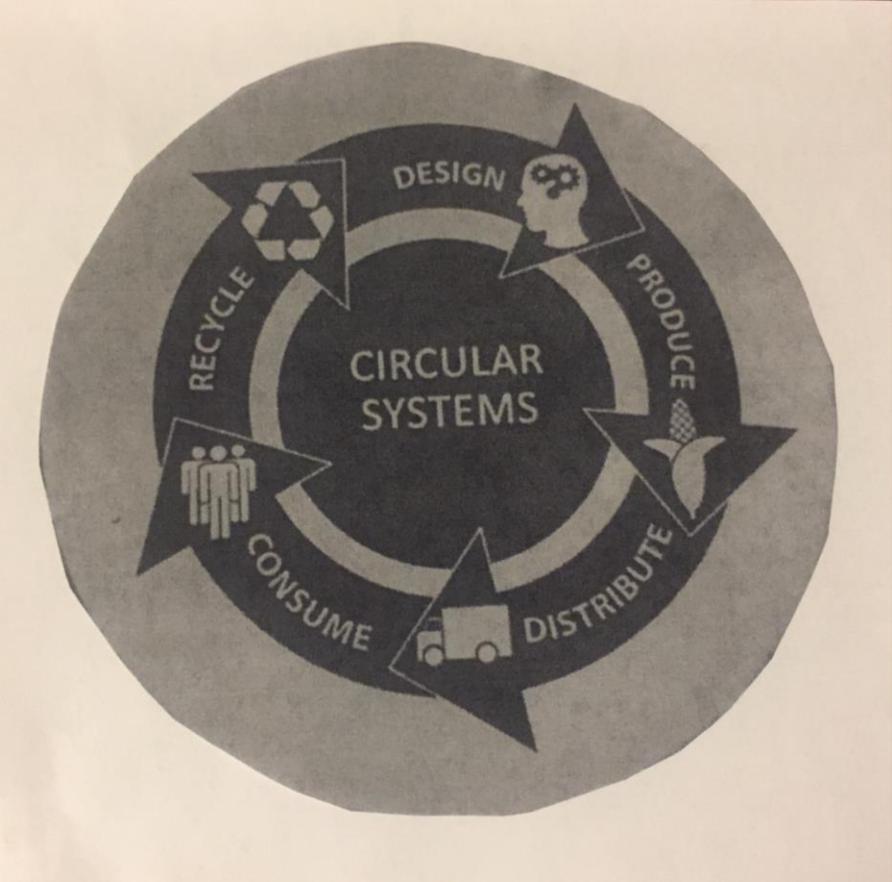
Figure 1. Circles of life: Dynamic, interwoven cycles and processes over space and time

Circular systems are dynamic, continually adjusting and adapting as other parts of the system shift and change. For example, land-based forest, plant and soil ecosystems have potential to remove about 30% of carbon dioxide (CO₂) from human activities annually when they become a sink for carbon (Terrer et al. 2021). Plants use CO₂ for growth and along with soil nutrients, soil, and water are key factors in plant biomass and yields. When plant biomass dies, microbes in the soil feed on the biomass roots and litter and in conjunction with soil moisture and sunshine (or lack thereof) can accelerate or slow the decomposition process. Thus, soil can be a sink that stores carbon (soil organic carbon SOC) for future plant use and/or a source of carbon release into the atmosphere depending on gains via photosynthesis or losses via respiration (Terrer et al. 2021).

In managed agriculture systems we can accrue SOC in highly productive systems by balancing nutrient management with plant needs. There is a fine balance under changing atmospheric CO₂ levels between changes in SOC inputs and changes in SOC turnover which are dependent on root-microbe-mineral interactions in the rhizosphere. This example illustrates that the intertwining circles of water, carbon, soil, vegetation, and atmospheric gasses have multi-directional effects and influence within their systems and across other systems that are also dynamic and changing at variable and unpredictable rates.

Achieving Circular Economies in Agriculture

Processing, storage, transport, distribution, marketing and consumption make up 22% of US national GDP and employ more than 28% of the workforce (Jones et al. 2021). Byproducts of these value chains are often unused, discarded, unwanted materials considered as waste. Byproducts lost to the system are costly at many levels resulting in the loss of valuable resources. For example, excess crop fertilizers leak off-field/off-farm into proximate water and are no longer available for plant growth and have unintended consequences for water quality. Food wastes are dumped into landfills. With population growth and increasing scarcity of land, water and other natural resources, the cost of these lost resources has become exponentially problematic and in some cases locally and regionally destabilizing agricultural, rural, and national economies and the natural resource base. One way forward is for agriculture to acknowledge the value of circular and systems-interacting natural processes and find ways to learn from and mimic how these systems adjust and adapt.



[re-create and colorize this figure]

Figure 2. Circular systems offer opportunities at all levels for local, regional, national and global agriculture and food systems to intersect and expand beyond on-farm production systems and stimulate the redesign of entire value chains--producers, processors, and distributors to wholesale and retail markets to consumer demand and consumption and the reuse and recycling of materials into new systems and products. (Verma and Jones 2021)

Achieving more circular economies means modifying resource inputs and flows to increase on-farm and farm-to-farm reuse and recycling by redirecting outputs into new/recycled in-puts for other production systems (Figure 3) (Jones et al. 2021). **Replacing the “take resources, make, and dispose” strategy with circular “make, use, and recycle” processes offers profitable solutions for managing input costs and gaining income from wastes that otherwise might be lost income or harm the system.**

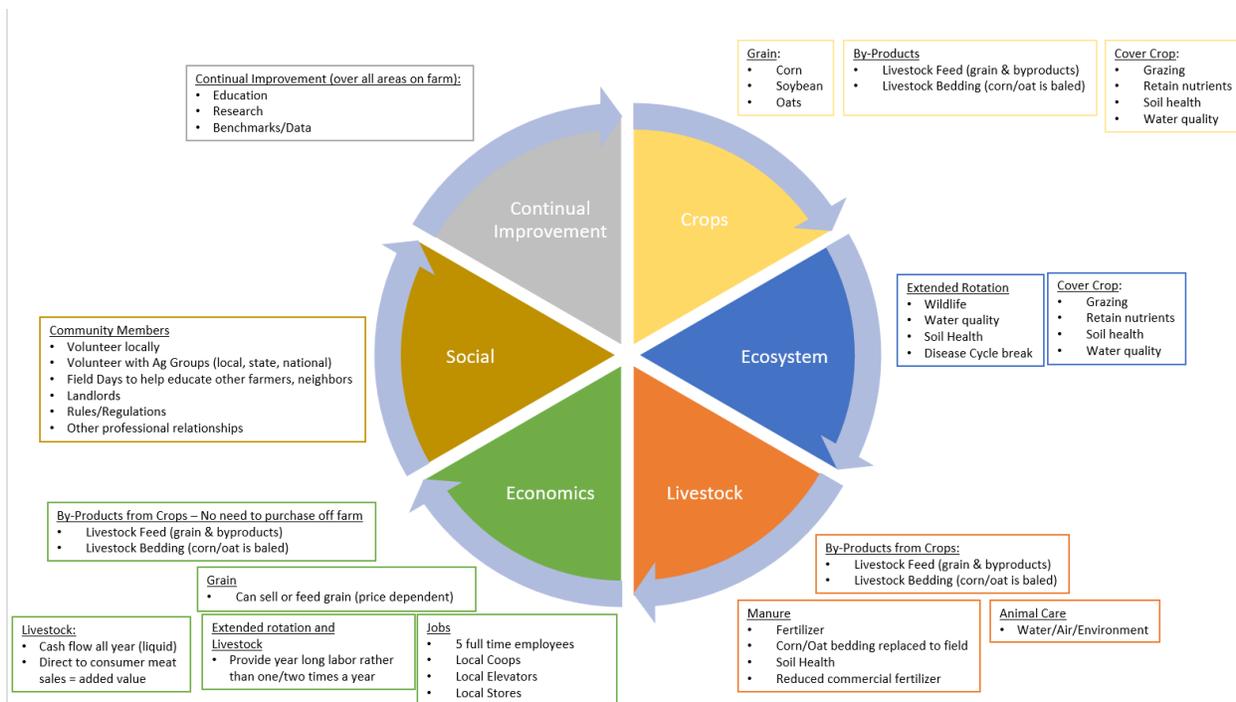


Figure 3. The Blair Farm, LLC Circle of Life is a continuous improvement process exemplifying a circular system; where adjustments and adaptations in a diversified crop-livestock system are evaluated in light of changing markets, weather, disease, soil and water resources. The byproducts from crops-- corn, soybean and oats can be used as inputs to livestock production so there is no need to purchase feed grain or bedding off-farm. Manure and bedding outputs are recycled as inputs into fields growing grain crops, providing crop nutrients and residues that improve soil structure and health. This balanced circle of life expands beyond the farm boundaries to nurture and embrace mutually satisfying social, environmental and economic goals and relationships.

CONVERSATIONS WITH IOWA FARMERS

What does all this mean for Iowa farmers? What can we learn from the natural circles of life? How do we apply those processes and cycles to create productive, profitable, environmentally sound circles of life on our farms? In April, 2020, IASA invited a dozen Iowa farmers to talk about the priority challenges in Iowa agriculture and what they needed to do to be better farmers than they are now. The farmers talked about managing for both short and long term and the need for flexible management to quickly pivot and change when weather, markets, and labor shift. They reaffirmed that managing is hard, seeing change and adapting is not always straight forward nor easy. It takes time, knowledge, technical skills, and resources to effectively respond to the increasingly variable and complex conditions in which they farm and make a

living. These farmers, representing different cropping systems and farm sizes, wanted feedback tools, to know if what they are doing is working or not. They were asking questions: Would cover crops work for my farm system? Do I need to change my fertilizer practices? Am I wasting money by applying too much fertilizer in the wrong places? Would tile water tests for nitrate help me know what adjustments to make?

These farmers wanted solutions that were offensive tools not defensive. They described key practices they were using that were mediating off-field and off-farm nutrient losses and had been profitable: 1) split applications of nitrogen (N) fertilizer, 2) cover crops, 3) tile line testing for nitrate to adjust N, 4) no-till (NT), and 5) vertical tillage. They wanted to see research and on-farm trials that show when, where and under what conditions cover crops and no-till (NT) are effective in retaining nutrients for the next crop, suppress weeds, improve soil structure (so you can drive on the field more quickly after high rain events), reduce soil compaction, and can reduce pesticide and herbicide costs without compromising water quality.

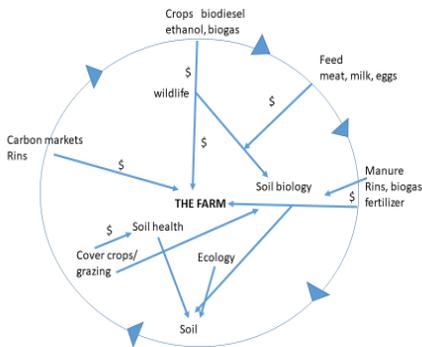
Part of the conversation was about how to quantify nutrients retained for next crops so they could pencil out dollars per acre profit rather than only focusing on yields. They wanted ways to improve return-on-profit per acre and the economics and logistics of change that would also be good for their soil health and water. They acknowledged they needed data to track profitability; what technologies are paying off and which are not. This meant they needed more information, both science-based and neighbor-to-neighbor experiential exchanges; and technical resources in using new technologies and practices.

A reoccurring theme was the loss of markets and local infrastructure that would enable farmers to capture more profit from the value-chain. They talked about the co-dependencies between farmers and consumers; and consumer preferences for wholesome, fresh, safe food and healthy agricultural landscapes. One farmer remarked, “Farmers need to tell their farm story better. Marketing that tells the consumer about the product and how it was produced connects with the consumer and gives meaning to their purchase.” And lastly, Iowa farmers are worried about their rural economies, how to provide local jobs and boost the reach and profitability of small businesses that service their communities.

A PATH FORWARD

These Iowa farmer conversations offer a path forward for finding and putting in place Iowa solutions for the land. Farmers are ready and want farm and landscape scale changes that are profitable and make positive contributions to water quality, healthy soil, biodiversity, pest management, and adaptation and mitigation to changes in short-term weather and climate. Three **non-linear system strategies (efficiency, substitution, and redesign)** can help land and livestock managers and landowners make better use of their existing land and resources and create new feedback loops and more circular systems within the farm enterprise and across the Iowa landscape.

[
[Insert Story 1. EFFICIENCY AND SUSTAINABILITY about here]



Efficiency strategies are focused on reducing wasteful management practices and making better use of on-farm and imported resources (Pretty 2020). Efficiency gains occur when nutrients are better managed. Precision targeting of fertilizer, pesticides and water use reduces costs, avoids wasting resources, and prevents excess nutrients being lost to the crop as they leak off-field and off-farm into water and natural systems. For example, the 4-Rs is a set of efficiency practices by which crop nutrient needs can be met without waste: 1) selecting the right type of nutrient needed by the crop, 2) using the right amount, 3) at the right time, and 4) placing nutrients in the field at the right location where they can be fully used by the crop.

Substitution replaces current technologies and practices with more sustainable, less wasteful practices. For example, diversified livestock-cropping systems make use of efficiency and substitution approaches to create circular systems where “waste” becomes an input into another system. Livestock-cropping systems take the manure output and substitute its nutrients and organic matter for off-farm fertilizer purchases to meet a portion of cropping systems’ nutrients needs. To take full advantage of manure as a crop input requires better understanding and additional science and improved practices to account for the nutrients different types of livestock manure contribute to different cropping systems. Knowing manure nutrient values enables the farmer to make better estimates on additional nutrients synthetic fertilizers can add. This can move the current “rule of thumb” crop applications of manure to more accurate estimates of manure nutrients and additional nutrient needs that synthetic and natural fertilizers can provide. This substitution strategy saves dollars on purchased fertilizers and reduces the potential of unused nutrients (P and N) leaking off-field into nearby streams. There is a research gap on what manure does and how it contributes to microbial health. Increasing our scientific knowledge enables the development of technologies and tools that can improve soil and address nutrient losses for farms of all sizes.

Integrated land management and diversification are ways to alter the straight line path into a circle of life path by focusing on within-farm and landscape level interdependencies. Ray

Gaesser, Iowa farmer from Corning, practices efficiencies and substitutions at the landscape level by exchanging resources with his neighbors using his outputs as inputs for his neighbors' crops or livestock. He says, "Our region is more diversified, hogs, chicken, and cattle as well as crops. Some of us are really good at growing corn and soybean but realize that livestock-cropping diversification can reduce waste and be beneficial to all. So we work together." Neighbors who have cows and chickens recycle their manure for use in neighbors' cover crops; and cover crops are shared back for fall grazing giving the cows a nutritious and low cost feed. In turn, the crop farmer gets manure back on the ground for the next crop—the circle of life in practice. Every farmer doesn't have to be good at raising animals or growing grain crops, but at the landscape level working together can contribute to neighbor-to-neighbor integrated systems. Iowa State University (ISU) scientist Dr. Lisa Schulte Moore sums up this circle of impacts by quoting Iowa farmer David Petersen (2015) "The soil feeds the crop, the crop feeds the cow, the cow feeds the soil."

[Insert Story 2. RESEARCH AND ADAPTATION: A TEAM EFFORT about here]

No-till systems are another substitution practice that reduce soil erosion, retain soil carbon, and improve the soil structure increasing soil resilience when excess rains saturate the soil and increase runoff potential. No-till equipment and satellite technologies replace the traditional plow in preparing the soil for seeding and weed management. Cover crops can also be substitutions for tillage (weed management), fertilization (N scavenging for the next crop), pesticides (attracts beneficials), and build soil organic carbon.

CALL OUT BOX Cover crops work best paired with livestock.

Iowa State University Extension economist, Alejandro Plastina reports on the economics of cover crop and finds, "when we add livestock to the analysis with the possibility of grazing or harvesting cover crop biomass, net returns become positive. We have a positive net return of \$7 per acre preceding corn and a \$1 positive net return for cover crop preceding soybeans." Plastina encourages growers to create their own partial budgets to determine net returns from cover crops on their farms. ISU has two online tools, Net Returns Calculator for Cover Crops Terminated with Herbicides; and a downloadable spreadsheet "the Economics of Cover Crops" on ISU Ag Decision maker website [Farm Progress Tyler Harris April 23, 2021]

Redesign of the agroecosystem and landscape entail transformational efforts to close the circle and harness ecological processes in the agricultural enterprise (Pretty 2020). The Iowa Nutrient Reduction Strategy [Reducing Nutrient Loss: Science Shows What Works \(iastate.edu\)](https://store.extension.iastate.edu/product/13960) (<https://store.extension.iastate.edu/product/13960>) proposes a number of land use and edge

of field redesigns that can reduce off-field/off-farm nitrogen (N) and phosphorus (P) losses. Replacing low producing corn-soy fields with perennial vegetation via CRP (Conservation Reserve Program), the use of perennial energy crops, and grazed pastures are land use redesigns that offer P load reduction and sources of income. Edge-of-field drainage management, building wetlands in strategic locations, bioreactors and vegetative buffers are effective in reducing nitrogen losses into nearby waters, increase biodiversity, and can reduce crop losses during flooding by providing modest water storage.

[Insert Story 3. YOUNG FARMERS TRANSITIONING TO NEW SYSTEMS about here]

Diversified systems encompass all three of these non-linear strategies, reinforcing the circles of life in ways that enable agriculture to offer multiple benefits to the producer and society. A 2020 meta-analysis of 5,160 studies comprising 41,946 comparisons between diversified and simplified practices revealed that diversification enhances pollination, pest control, nutrient cycling, soil fertility, water regulation and biodiversity without compromising crop yields (Tamburini et al 2020). They define *agricultural diversification as the intentional use of a variety of practices that increase functional biodiversity to cropping systems at multiple spatial and/or temporal scales*. There is no silver bullet, but rather each producer seeks to experiment and find the unique combinations of stacked practices best situated to their own enterprise and continually evaluates the effectiveness of practices in light of the balance of trade-offs and benefits among crop yields, profitability, soil health, water quality, biodiversity and other valued ecosystem services.

[Insert Story 4. A PASSION FOR COVER CROPS AND SOIL HEALTH DATA about here]

The integration of livestock of all types at the farm and landscape level can provide a wide variety of high quality protein and environmental benefits (Rowntree et al. 2020). Diversified livestock-crop systems give flexibility when weather and management timing changes unexpectedly. For example, when inter-seeded cover crops grow too high, there is the option to graze cattle or sheep and then terminate prior to planting. Multi-species pasture rotation systems which stack multiple animal production enterprises (i.e., chickens, cattle, sheep and pigs) on one landscape have been found to simultaneously produce quality protein while improving the soil health of degraded croplands, sequestering soil carbon, and reducing net GHG emissions. This is a useful model for alternative livestock production systems with good environmental outcomes, however there is a high land-use trade-off. Life cycle analyses of pasture-based rotation systems compared to conventional livestock production systems show multi-species pasture rotation systems require 2.5 times more land than commodity production system of each respective species (Rowntree et al. 2020). Cost and availability of farmable land

and levels of poverty and food insecurity will affect the evaluation of the food security-GHG emissions trade-off.

In this paper, we use an expanded definition of livestock to include bees and other pollinators, the microbes in biodigesters, and soil biology as livestock. These livestock are crucial for achieving productivity and ecosystem balance as we incorporate cropping system diversity into our agricultural systems. Biodigesters and their micro-organisms mutually contribute to achieving system circularity goals. Anaerobic digestion for biogas production (Figure 4) is another type of diversified enterprise that uses waste and by-products such as manure, crop residues, wastes from food industry and dedicated energy crops from agricultural production as feedstocks (Moller and Muller 2021).



Figure 4. Sievers Family Farms LLC, Stockton, Iowa generates biogas from a diversified crop-livestock system that produces diverse rotations of annual crops and beef. Manure and soiled bedding from cattle barns are mixed with food waste from neighboring industries and anaerobically digested on farm to produce energy that is converted to heat and electricity for on farm use with excess sold to the grid.

[Insert Story 5. BRINGING A LEGACY CONSERVATION FARM INTO THE FUTURE about here]

The circles of life and paths forward will look different for each farmer as they seek nature-positive and profitable solutions in the context of their farm size and system with a changing climate, dynamic supply chains, shifting and segmented consumer preferences, market volatility, environmental challenges, available resources and their personal knowledge, skills, values, and social networks. “Farmers have a really unique opportunity to not only provide the food, fuel and fiber for the world but also to solve carbon issues, water quality issues and flooding issues,” says Iowa farmer, Mitch Hora (Lamm 2021).

FARM AND LANDSCAPE LEVEL SYSTEMS RECOMMENDATIONS

Iowa farmers can lead agriculture into the future, a more sustainable, resilient, and profitable future. This report aspires to give voice to Iowa farmers and encourage efforts to embrace diversification, innovation, new technologies, and new systems of production that deliver economic, environmental and social value. Iowa’s universities, farm organizations, agricultural value chains and agencies are needed to provide research, technologies, education and technical support, funding, and help monitor outcomes. Farmers are seeking knowledge, tools and strategies that offer flexible, practical and profitable solutions to help them quickly pivot and change when weather, markets, and labor shift; and be ready for the unexpected and the unpredictable.

The five recommendations below invite farmers, foresters, livestock producers, landowners and land managers as well as public and private partners and consumers to take personal responsibility and work together to develop multiple solutions to shared challenges of ensuring safe and nutritious foods, clean water, healthy soils, diverse and robust ecosystem services, and profitable livelihoods.

1. Encourage agronomic and environmental performance for multiple beneficial outcomes through flexible, diversified and integrated systems approaches.

1) Challenge landowners and land managers to experiment and innovate with in-field, edge-of-field practices and redesign land uses at the whole farm level to be better positioned to produce profitable agricultural products, healthy soil and high quality water and a variety of ecosystem services to protect resources and take advantage of new markets and opportunities.

2) Promote and adopt new learning and perspectives on adapting, experimenting with practices and changing nutrient management including promotion of the 4R Plus. The 4Rs include the right source, right place, right rate, and right time of nutrient management. Plus practices include in-field (e.g., reduced tillage, cover crops, extended crop rotation) and edge-of-field practices (e.g., saturated buffers, bioreactors, prairie

strips, riparian buffers, oxbows) that work in combination with the 4R practices to protect soil health, clean water, and wildlife.

3) Educate farmers, others in agriculture, and society at large on the crucial role of strategically integrated native ecosystems within working landscapes (eg. restored floodplains, pothole wetlands, prairies, and forests). These areas help retain nutrients, sequester carbon, reduce flooding, provide habitat to sustain our native wildlife, provide recreational opportunities and can recharge and re-energize the human mind and spirit.

4) Equip and inspire landowners and land managers to learn and experiment with a spectrum of available low and high tech tools and practices to increase farm efficiencies, substitution options and identify low-productivity and environmentally vulnerable areas in their enterprise that would benefit from re-design.

5) Enable producers to quantify their annual deliverables beyond bushels to nutrient balance products, carbon storage, water quality improvement, water stores, and wildlife habitat. Measure carbon and other ecosystem service gains as an acre net, annual impact; rather than focusing on practice change, look at the net bottom line.

6) Broaden and increase flexibility in NRCS/government conservation programs to improve widespread use of conservation practices as part of whole farming systems.

7) Accelerate University research that advances innovative and effective conservation practices within existing and more diversified farm systems using current successful system-level conservation practices as baseline.

2. Reduce environmental impacts from externalities of agricultural production by promoting circularity of farm enterprise inputs, outputs, and outcomes at farm and landscape levels through optimizing resources and knowledge; replacing, reusing, and recycling water, energy and crop/animal genetics; and redesigning processes and systems (SfL 21st Century report p. 8). Specifically,

1) Integrate livestock-crop diversification systems at farm and community-levels to decrease agricultural wastes, increase recycling and reuse of inputs and outputs, and create new markets at farm and landscape levels.

2) Increase integrated systems science research and on-farm experimentation at all scales to innovate and evaluate “close-the-loop” strategies that are effective and profitable in reducing and eliminating waste and loss in the food and agriculture value chain; and holistically address the connections among agroecosystem practices and human management and use decisions.

- 3) Enable biogas production at all scales and consumption in ways that improve the recycling of organic wastes; increase atmospheric carbon removal and reduce local and global greenhouse gas (GHG) emissions; enable farmers to “close-the-loop” of the waste and loss in the agriculture and food value chain; develop innovative and profitable enterprises.
- 4) Improve the flexibility of government programs to enable farmers to divert grains and other agricultural and forestry crops to fuel, food or other markets to increase food and fuel security for our nation and other nations in the face of crisis caused by regional crop failures or energy shortages driven by sudden or prolonged conflict in oil producing countries.

3. Improve resilience, water quality and agricultural productivity by managing the water cycle. Acknowledge and prioritize through funding, infrastructure and practices the extreme variations in the hydrologic cycle marked by shifts in seasonal precipitation patterns, drought, evapotranspiration, increased and more intense precipitation events, erosive runoff, sediment transfers to rivers and oceans, and increasing degradation of soil and water resources.

- 1) Inspire, educate and equip Iowa land managers, landowners, crop and livestock advisors/consultants to the urgent and critical necessity of taking actions that protect Iowa’s water resources.
- 2) Continue to fund and support the Iowa Nutrient Reduction Strategies.
- 3) Fund and put in place strategies to realize the Conservation Infrastructure report and action plan co-led by the Iowa Department of Agriculture and Land Stewardship (IDALS) and Iowa Agriculture Water Alliance (IAWA).
- 4) Continue to prioritize University watershed research and extension outreach technical support, farmer-to-farmer learning (Iowa Learning Farm), and training in voluntary watershed leadership.
- 5) Provide market-based incentives that drive land use and watershed planning, adoption of conservation practices, improved nutrient management and systems-based adaptation of profitable best management strategies; and offer professional employment opportunities to Conservation and Farm Systems Agronomists.

4. De-risk innovation, system re-design and transition, and market volatility in agriculture and the food chain.

- 1) Inspire and equip landowners and land managers to adopt crop and livestock data management systems that enable real time feedback loops to guide operational and long-term strategic decision making for continuous adjustments and adaptation.

- 2) Establish public and private structural systems where the producers' advisors have knowledge and are able to participate in the economic gains from new social, environmental, and economic drivers.
- 3) Accelerate research that grounds terrestrial ecosystem models in observational science to better represent the mechanisms and critical processes driving carbon-water-nutrient cycles and plant-soil-microbial interactions. This research forms the foundation for evidence-based practices and market-based incentives with attention to the trade-offs among different agricultural systems in the co-production of agricultural and ecosystem outcomes.
- 4) Fund research, evaluation, training and outreach on decision support tools, new technologies, and practices that encourage whole system management at all farm scales.
- 5) Further enhance undergraduate university agricultural education to intently include on-farm, ecosystem resilience and whole system management for farmers, future crop advisors and extension/outreach educators, and develop a certification program for conservation, watershed and farm systems agronomists.
- 6) Accelerate opportunities for informal and formal farmer-to-farmer and scientists-to-farmer-to-technical advisors/educators exchanges, innovation, and learning.
- 7) Develop partnerships/exchanges that de-risk the time, knowledge, learning curve, and other costs of new technologies and practices, trying new products and markets.
- 8) Reform crop insurance to de-risk conservation practice adoption

5. Create Finance mechanisms to cover the costs of experimentation and transition to new systems and build **local, regional, and national infrastructure** that enables market flexibility, increases farmer capacity to pivot and change, and ensures profitability as demand for products and services in the value chain shift, and distribution and production conditions vary.

- 1) Fund and enhance the effective functioning of existing programs like EQIP, CSP, CRP, etc. so landowners, land and livestock managers have incentives to experiment and transition to new more efficient and effective systems (e.g., NRCS revisions that would permit grazing land cost share on row crop acreage).
- 2) Explore and identify regulations, incentives and investments that would shorten agricultural and food supply chains to help farmers capture more direct market value from their production systems and better meet consumer demands for safe, high quality, nutritious foods and agricultural products with nature-positive environmental impacts.
- 3) Review existing and identify gaps in Iowa supporting infrastructure to meet state/federal certification/standards and local and regional supply/demand needs for

protein processing, food grade grain and fruit/vegetable processing, and seed supply production for a variety of cover crops and novelty crops.

- 4) Increase availability of public cost-share and private investments in farm and landscape level infrastructure such as fencing; water storage and management; soil, water, protein and manure testing technologies; high technology manure application equipment; waste storage and distribution equipment; energy efficient equipment and structures; biodigesters; and other technologies that encourage nature-positive diversified farming systems such as livestock-cropping systems, specialty crops, and agroforestry-perennial cropping systems.

- 5) Ensure rural broadband service for farmers and rural communities that reliably delivers minimum speeds of 100 Mbps download and 100 Mbps upload.

Epilogue

Thanks to the hard work and innovation of Iowa's farmers, livestock operators and their academic, business, government, conservation and economic development partners, Iowa has evolved to become one of the most productive and efficient agricultural landscapes in the world. Through continuous improvement and innovation, we have demonstrated agriculture's ability to produce high quality food, feed, fiber, fuel and a wide range of high value bio-based products.

With an eye towards the future, Iowa agriculture is now positioned to respond to and meet 21st century state, national and global needs. The good news is that not only can Iowa's farms produce high quality and nutrient dense commodities, but they can also simultaneously provide high value agroecosystems services that filter and store water, improve air quality, enhance biodiversity, sequester carbon and reduce greenhouse gas emissions, nurture wildlife while underpinning vibrant local economies and communities.

Written by farmers, for farmers, *Iowa Smart Agriculture: Solutions from the Land A Vision for the Future* is a call to action to all who make decisions about Iowa's agricultural landscape, its croplands, livestock, wetlands, forests, rivers, and the complex value chain that supports and extends Iowa's reach beyond state and national borders to the world.

In a second phase of work, we are inviting stakeholders to join us in exploring the future of Iowa agriculture and forging consensus on the priority building blocks needed to achieve the IASA vision. We know we don't have all of the answers, and we seek to build on the past experiences and knowledge of farmer leaders and entrepreneurs, a growing body of science, and recent public investments in soil and water management.

Please join this coalition of champions that are aligning to advance the recommendations in the report so that Iowa working landscapes are not just profitable, but our soil and water resources are protected and treasured.

References.

Basso, F. J. Jones, T. Richard, C Sukup, L. Verma, M Matlock, R Mohtar, S Herbstritt, and R Martinez-Feria. 2021. Designing circularity into corn-soybean systems. Resource: Engineering and Technology for a Sustainable World. American society of Agricultural and Biological Engineers.

Conservation Infrastructure Report and Action Plan. [YEAR? url]

Fiksel, Joseph. 2015. Resilient by Design. Island Press. Washington. DC.

Harris, T. 2021. Cover crops work best paired with livestock. Farm Progress (April 23)

Iowa Nutrient Reduction Strategy [Iowa Nutrient Reduction Strategy | Iowa Nutrient Reduction Strategy \(iastate.edu\)](#)

Jones, J, B. Verma, B. Basso, R Mohtar, and M. Matlock. 2021. Transforming food and agriculture to circular systems: a perspective for 2050. Resource: Engineering and Technology for a Sustainable World. American society of Agricultural and Biological Engineers.

Lamm, C. 2021 Soil health data business earns Iowa Farm Bureau's renew rural Iowa entrepreneur award for promoting global sustainability. April 16. Iowa Farm Bureau news service.

Lowery, B, C Cox, D Lemke, P Nowak, K Olson and J Strock. 2009. The 2008 Midwest flooding impact on soil erosion and water quality: Implications for soil erosion control practices. Journal of Soil and Water Conservation 64:6:166A.

Moller, K and R Muller. 2012. Effects of anaerobic digestion on digestate nutrient availability and crop growth: a review. Eng Life Sci 3:242-257

Olson, K.R. and L.W. Morton. 2016. Managing Mississippi and Ohio River Landscapes. Soil and Water Conservation Society, Ankeny, IA
http://www.swcs.org/en/publications/managing_mississippi_and_ohio_river_landscapes/

Petersen, D. 2015. <https://www.usda.gov/media/blog/2015/06/30/through-conservation-iowa-farmer-keeps-water-clean-downstream>

Pretty, J. 2020. New opportunities for the redesign of agriculture and food systems. *Agriculture and Human Values* 37:629-630.

Rowntree, JD, P L Stanley, ICF Maciel, M Thorbecke, S T Rosenzweig, D W Hancock, A Guzman, and MR Raven. 2020. Ecosystem impacts and productive capacity of a multi-species pastured livestock system. *Frontiers in Sustainable Food Systems* 4:544984

Tamburini, G, R. Bommarco, T C. Wanger, C. Kremen, M.G.A. van der Heijden, M. Liebman, and S Hallin. 2020. Agricultural diversification promotes multiple ecosystem services without compromising yield. *Sci Adv* 6: eaba 1715

Terrer, C. R. P Phillips. BA Hungate, J Rosende, J Pett-Ridge, ME Craig, KJ van Groenigen, TF Keenan, BN Sulman, BD Stocker, PB Reich, AFA Pellengrini, E Pendall, H Zhang, RD Evans, UY Carrillo, JB Fisher, K Van Sundert, S Vicca, and RB Jackson. 2021. A trade-off between plant and soil carbon storage under elevated CO₂ *Nature*. 591:4599-

Verma, B and J. Jones. 2021 Transforming Food and Agriculture to Circular Systems. *RESOURCE* (March/April) American Society of Agricultural and Biological Engineers

Writing Team: Ray Gaesser, Kellie Blair, Bryan Sievers, Bill Couser, Jeff Frank, Mitch Hora, Jason Russell, Dan Anderson, Sean McMahon, Lisa Schulte Moore, Lois Wright Morton and Ernie Shea

Lead writers: Lois and Ernie

IOWA STORIES FROM THE LAND inserts/side boxes into text**Story 1. EFFICIENCY AND SUSTAINABILITY**

Jason Russell story

Jason Russell of Big Boulder Farms near Monticello, Iowa **embraces the future of his farm by using a blend of three strategies-improve efficiency, find substitute technologies that do a better job, and don't be afraid to redesign a system to get better results, improve soil health and improve profitability of the crop-livestock production system.** Jason and his wife Sarah grow soybean, corn, chickpeas and hay; maintain a 30,000 custom wean-to-finish hog operation; and raise sheep, poultry and beef cattle. All of their croplands are planted to cover crops which offer grazing alternatives, reduce erosion and compaction, improve water infiltration, and increase yields of crops that follow. Fields with nematodes are planted with mustard (a brassica) which produces a chemical when it decomposes that fumigates the soil. Annual soil tests by zone help Jason to track and site-specifically adjust phosphorus, potassium and other nutrient balances to improve microbial life, soil structure, reduce excess off-field nutrient losses, and meet crop growth needs. Jason's most highly erodible lands (HEL) are in the Conservation Reserve Program with riparian stream areas seeded to perennial prairie grasses and windbreaks placed to manage wind erosion and control snow drift. The bonus from these strategies are more beneficial wildlife and insects. Jason says, "Alfalfa fields near pollinator plots and woodlands seem to rarely need insecticides; and hawks and eagles eat the small rodents that make farming with cover crops and no-till a challenge."

Wind mills and solar panels power the hog operation making it cost- efficient to operate barn fans and augers while eliminating electric bills. These savings are used to purchase more efficient equipment like a well pump with a variable pressure system that uses less electricity. Jason has also switched to LED lights to cut electricity use and moved wet/dry feeders inside the hog barns to conserve water and energy resources. He is currently diversifying his crop mix with edible food grains, chickpeas and flax.

Adapted from AgWeb Conservation March 3, 2021

<https://www.agweb.com/news/business/conservation/never-status-quo>

Story 2. RESEARCH AND ADAPTATION: A TEAM EFFORT

Ray and Elaine Gaesser story

Ray and Elaine Gaesser, soybean farmers from Corning, Iowa are known locally and globally for their pioneering conservation stewardship and innovative agricultural leadership in water quality, managing for biodiversity, and encouragement of farmer-to-farmer learning. They farm about 5400 acres, half corn and half soybeans with hay and cover crops integrated into their conservation and production system. They began no-till in 1975 and fully implemented it in their corn- soybean rotations by 1991. In

2010, they started using cover crops in rotation with about 70% of their corn-soy crops. They have partnered with the Iowa Soybean Association on a number of field trials such as the minimum amount of N on corn that would produce the maximum profit, as well as testing new practices, herbicides, fungicides and cover crops. Long term cover crop trials are another research project the farm has participated in as part of the Soil Health Partnership

The next generation of Gaesser farmers are deeply involved in agricultural research and adaptation and are carrying on a long history of crop research, testing, seed varieties and technologies. Ray says, “The farm has always been a team effort. First, just Elaine and me, then our children Jenny and Chris helped out a lot. Now Chris and his wife Shannon are 50% partners in our farm. We share decision making and each has responsibilities.”

Each spring and fall the Gaesser family gather water samples from field tiles to test for N and P in the water. N & P results are consistently lower than the Iowa Nutrient Reduction Standards. No-till and cover crop practices have helped keep these nutrients in place in the field for crop growth. According to Ray, “Comparisons between 30 years of no-till and 10 years of cover crop field versus only two years no-till and cover crop reveal major differences in soil structure and especially water infiltration. Long term no-till plus cover crop has much faster water infiltration; one inch rain almost instantly (2-3 seconds) absorbs the water compared to short-term no-till and cover crop fields which can take several minutes to absorb the same amount of water.”

The Gaesser Farm is currently cooperating with Iowa Soybean Association, Corteva and Iowa State University on-farm experiments with permanent cover crops and testing more diverse crop mixes. The Gaesser “can do” attitude is contagious and Ray generously shares what they are learning on the farm with other farmers and policy leaders. Nationally he recently led an initiative with Solutions from the Land farmers to develop Climate Smart Agriculture public policy recommendations for the US Senate Select and House committees on the Climate Crisis.

Picture caption. NRCS staff comparing no till and cover crop water infiltration rates on the Gaesser Farm 2021 April 15.

Story 3. YOUNG FARMERS TRANSITIONING TO NEW SYSTEMS

Blair Farm story

Farmer-neighbor partnerships enabled Kellie and AJ Blair to expand their farm acres, experiment with different crop-livestock systems, and transition over time to new ways of managing their land and making a living. What began 15 years ago as a corn-corn, full-tillage system with custom-finished pigs has transitioned to no-till soybeans, minimum tillage corn, cover crops, oats and alfalfa-hay, and cattle with a goal to be completely no-till on all crops in the next year or two. Their livestock-cropping system recycles waste from their cattle into fertilizer for crops and improves the soil structure and fertility of their fields. Cover crops also contribute to healthier soil and water quality. Routine tile line water samples give them feedback on their nutrient management and potential losses off of the farm. On-farm research helps to drive decision making as well as provide benchmarks for the future. Oats and alfalfa offer flexibility when weather and markets change unexpectedly—with options of off-farm premium

prices as well as on-farm feed, hay and straw for cattle. Getting to where they are today wasn't easy. Off-farm jobs and Kellie's CCA (Certified Crop Advisor) training and certification have provided new knowledge, income and valuable networking with other farmers.

Farmer-neighbor partnerships have provided mutually beneficial resources: equipment sharing (no-till planter), more acres, and farm experience in exchange for labor, keeping the land in agriculture, and opportunity for a young local couple to succeed in farming. As their farm partners transitioned out of farming, Blair Farm acreage tripled, Kellie moved to farming full time and they have hired two employees. Currently they finish pigs, have a cow/calf operation and beef feedlot and over the last year started to sell beef directly through local lockers. This gives them a new opportunity for profit through a different "world" than traditional corn-soy commodity farming. Production planning and efficiency are essential. The Blairs have a limited amount of time to get things done in the field and manage the animals. Kellie says, "Our goals are to continue to improve and learn, pay down debt, make time for family, and create new partnerships/relationships."

Story 4. A PASSION FOR COVER CROPS AND SOIL HEALTH DATA

Mitch Hora story

"Soil health data are critical in helping farmers make practical decisions about which practices and cropping systems will help them better manage their land, increase productivity and protect the environment," says Mitchell Hora, Ainsworth, Iowa. In 1986 Mitch started no-till drilled soybean; and by 2014 he and his Dad no longer used a chisel plow or tilled their corn or soybeans. He planted his first rye cover crop following soybean on 15 acres in October 2013 after heavy rains, severe erosion and major soil clean out around one year old inlet pipes. In 2016 he seeded his first cover crop blend of oats and hairy vetch. That same year he set up side-by-side soil health testing experiments to track nitrogen deficiency, growth and yield variances to better understand how his practices and planting rates affected the soil and subsequent crop.

Intra-seasonal weather variability has been a challenge for growing corn, soybean, and cover crops while managing for extreme wetness and drought. Cover crops have reduced weed pressure, soil erosion, and improved his soil structure. By 2018, 95% of his farm was seeded to cover crops. That was a tough winter, late planted fall wheat cover crop got a slow start and ice and cold caused a lot of winter kill. Wheat seed can be expensive. In the last couple of years he has used a variety of cover crops blends: purchased wheat seed-radish-clover ahead of corn; his own wheat seed-crimson clover and hairy vetch ahead of corn; and cereal rye ahead of soybean.

Mitch is an innovator, always exploring new technologies to find those that improve soil health, improve yields and give him flexibility to respond to changing conditions. In 2016 he upgraded his planter to 1255 with Precision units, Delta down force, V drive and pneumatic row cleaners. He's been using a nitrogen stabilizer to protect fall applied nitrogen and in 2019 put a liquid in

furrow starter system on the corn planter. He's used drones to aerial-seed cover crops. He continuously gathers data on his soil, rates-placement-source-form of fertilizer applications, the performance of a variety of equipment, and practices to measure and evaluate impacts on soil health, water quality, crop growth, yields, and profitability. Mitch reminds farmers, **"We're in a really unique space, but to quantify the gains we're creating, farmers have to have data and learn how to use it on their farms."**

Story 5. BRINGING A LEGACY CONSERVATION FARM INTO THE FUTURE

Brian Sievers story

Environmental stewardship of the land, water, and air has been a family ethic and practice for generations of the Sievers family. Descendants of German and Norwegian immigrants that settled Iowa in the late 1800s, Bryan and his wife Lisa own and operate a 2,300 acre farm operation, 2,400 head beef cattle feedlot, and renewable energy facility in western Scott County, Iowa near Stockton. Generations of Sievers have installed field borders, grass waterways, and terraces; routinely use contour farming, no-till, strip-tillage, and site-specific farming practices along with cover crops; and participates in the Conservation Reserve Program (CRP) and Conservation Stewardship Program (CSP).

In 2009 they wanted to dramatically expand the farm's beef cattle feedlot but had concerns about the expansion's effects on their carbon footprint, water quality, soil health, and the environment. **The solution was a circular economy strategy to remake their farm system by reusing and recycling their cattle manure and biomass from cover crops into methane gas with two 970,000 gallon anaerobic digesters.** The Sievers and their partners, Dr. William and Judy Davidson, created a new company AgriReNew, to build and operate the digesters and a 1 MW CHP power plant which was commissioned in 2013. Today, the digesters process over 60,000 gallons per day of cattle manure, neighboring agricultural waste streams and other off-site co-feeds. The electricity that's generated, 24 hours per day 7 days per week, is sold to their local service provider, Interstate Power and Light (Alliant Energy). In 2014, AgriReNew received the Agricultural Biogas Project of the Year Award from the American Biogas Council and the 2014 Iowa Environmental Excellence Award for their anaerobic digester project. Bryan has been using his experiences to participate in national, state and local enabling policy decisions.

Kellie Blair (Co-Chair)

Kellie Blair is a graduate of Iowa State University with a BS in Forestry and Agronomy. Kellie, her husband, AJ, operate AKR Farm, a diversified crop and livestock farm, in north central Iowa near Dayton. Her focus has been in soil conservation and water quality on our own farm, locally, statewide and nationally.

Sarah Carlson

Sarah is the Strategic Initiatives Director with Practical Farmers of Iowa. She co-majored in Biology and Geography from Augustana College in the Quad Cities graduating in 2001 with a BA degree, following graduation Sarah joined the Peace Corps as an Ag-business and Ag Extension volunteer. She returned to the Midwest in 2004 and began her Masters program co-majoring in Sustainable Agriculture and Crop Production/Physiology in Iowa State's Agronomy Department, graduating with an MS degree in 2008.

Senator Chris Cournoyer

Senator Chris Cournoyer was elected in November 2018 to the Iowa Senate, representing the northern part of Scott County and all of Clinton County. Prior to serving in the Senate, Chris served as President of the Pleasant Valley Community School Board. Chris is a self-employed website designer, a Reserve Sheriff's Deputy and member of the North Scott Rotary Club. She lives north of LeClaire with her husband Kurt and four children.

Bill Couser

Bill is a cattle and grain farmer in central Iowa. Bill is a past winner of the NCBA's National Environmental Stewardship Award and National winner of Beef Quality Assurance Award. He is Co-Founder and President of Lincolnway Energy Ethanol Plant; Past President Iowa Renewable Fuel, Bill has served on the on Environmental Defense Fund advisory board, Washington EPA Animal AG Discussion Group and many other state and national entities.

Jeremy Davis

Jeremy Davis is Regional Coordinator for the Northern Cornbelt (Farm Production and Conservation Mission Area) at USDA and in the past worked for over four years as Director of Grassroots at National Pork Producers Council, strengthening NPPC's network of pork producers willing to weigh in on important federal legislative and regulatory issues. He earned a bachelor's degree and a master's degree in agricultural education and an M.Ed. in educational leadership and policy studies from Iowa State University, and his organizational affiliations include ISU Greek Alumni Alliance, the Story County Republican Central Committee, and the Iowa FFA. Jeremy grew up on a family farm in eastern Iowa.

Krystal Doolittle

Corn and soybean producer; Doolittle lives and works on a multi-generational family farm alongside her husband, Eric, in central Iowa where they are raising three children. In addition to working on the farm, Doolittle is an active voice for farming in legislative conversations and is passionate about agricultural education. She dedicates time to work nationally with American Agri-Women, and various agriculture groups at the state level. She has served locally through various roles in her community, including working to coordinate women's ministry efforts and volunteering at a local horseback riding camp, and has served as a board member on the Hamilton County Conservation Board.

Chris Doud

Chris is a corn and soybean farmer in Guthrie & Adair County. He has been an Agronomist for the past 20 years with Pioneer Field Sales and has been a certified crop advisor for 22 years. He is a cover crop

user and advocate who graduated from Northwest Missouri State University with a B.S. in Ag Business & Agronomy in 1997 and from Iowa State University with an M.S. in Agronomy in 2004.

Jeff Frank

Frank is a 4th generation soybean and corn farmer on our century farm. He is presently 4th District Iowa Soybean Association Director Research Advisory Council Chairman Supply Committee and Information and Education Committee Vice Chair. Sac County Farm Bureau Director. Past County USDA FSA President for 8 years.

Ray Gaesser (Co-Chair)

Corn and soybean producer; Gaesser is past Chairman and President, *American Soybean Association*, an active leader in the North America Climate Smart Agriculture Alliance (*NACSAA*); serves as Co-Chair, *Iowa Conservation Infrastructure Initiative*; and is an active leader in numerous Iowa agriculture and economic development boards.

Anna Gray

Public Policy Director, Iowa Natural Heritage Foundation; As a southern Iowa farm girl, Anna found her love for nature while picking wildflowers from the cow pastures, tromping through Shoal Creek and spotting wildlife in the timber. Using her education from Iowa State University's College of Agriculture and Drake University Law School, she hopes to shape policy that promotes sustainable agriculture, preserves natural resources and connects people with the outdoors — providing all Iowans an opportunity to enjoy the state's natural wonders.

Neil Hamilton

Neil is the Director of the Drake Agricultural Law Center, Dwight D. Opperman Chair of Law, Professor of Law; he has been Drake Law School Professor since 1983. He is a member of the Board of Directors for the Iowa National Heritage Foundation, past president of the American Agricultural Law Association, past chair of the Iowa Food Policy Council (2000-2007), past chair of the Agriculture Law Section of the Association of American Law Schools, and past vice chair of the USDA Small Farms Advisory Committee (1997-2000).

Jerry Hatfield

Dr. Jerry Hatfield, recently retired director for the USDA-ARS National Laboratory for Agriculture and The Environment; He graduated from Kansas State University in 1971 with a B.S., University of Kentucky in 1972 with a M.S., and in 1975 with a Ph.D. from Iowa State University in Agricultural Climatology. His focus is on the role of management practices that enhance soil health to increase the efficiency of agricultural systems in the use of natural resources and positively impact ecosystem services. He is working directly with producers and agribusiness to show how the genetics x environment x management concept can be utilized to increase food security. He is the recipient of numerous awards and was elected to the ARS Hall of Fame in 2014 for his research on improving agriculture and environmental quality and the Hugh Hammond Bennett award for his national and international work on conservation and a Presidential Rank Award in 2017 for meritorious service to agriculture on environmental quality. He is the author or co-author of 493 refereed publications and the editor of 18 monographs.

Mitchell Hora

Mitchell is a 7th generation Washington County farmer and the Founder/CEO of Continuum Ag. The Hora's have been using no-till on their 700ac row crop operation since 1978 and cover crops since 2013. Today, Continuum Ag is a soil health data company and is on a mission to help 1 Million farmers profit from soil health. The company launched the first soil health software, TopSoil, and has amassed a business footprint of over 40 states and 12 countries. Mitchell's personal mission is to be a catalyst for regenerative relationships and a shepherd of God's creation.

Kendall Lamkey

Professor and Chair, Department of Agronomy, Iowa State University; provides long-term vision for the research, teaching, and extension mission of the department impacting Iowa and the world. Fellow of the American Society of Agronomy and Crop Science Society of America; a lifelong corn breeder and agronomist who loves agriculture.

Sara Lira

Sara has a BS in ecology and a MS & PhD in plant breeding from ISU, and has worked in corn breeding at Corteva (formerly DuPont Pioneer) for 15 years. Sara and her husband also manage a cow-calf herd on his family farm in Appanoose County, and Sara serves on the board of Susan G. Komen of IA where she hopes to help decrease breast cancer deaths in underserved areas of rural IA. She is committed to bettering the lives of farmers and rural Iowans and improving the health of the lands in Iowa, and is excited to have a chance to represent Corteva's renewed commitment to sustainable agricultural research, products and service.

Sean McMahon

Sean is the Executive Director of the Iowa Agriculture Water Alliance (IAWA), an organization that is dedicated to increasing the pace and scale of farmer-led efforts to improve water quality in Iowa. Sean has created over \$150M in public-private partnership projects to implement the Iowa Nutrient Reduction Strategy. Prior to leading IAWA, Sean launched the agriculture program at The Nature Conservancy (TNC) as the North America Agriculture Program Director and led TNC's work on the Farm Bill. Sean also served as State Director of the Iowa Chapter of TNC, the Director of National Land Stewardship Campaigns at the National Wildlife Federation, and various senior positions at the U.S. Department of the Interior in his three-decade career in conservation. Sean has a master's degree in Natural Resource Science from Virginia Tech, an Executive MBA from Iowa State and lives with his wife Rebecca and four children in Cumming, IA.

Lisa Schulte Moore

Dr. Lisa Schulte Moore is a professor in the Department of Natural Resource Ecology and Management and associate director of the Bioeconomy Institute at Iowa State University. She conducts research and teaches in the areas of agriculture, ecology, forestry and human-landscape interactions. Her research addresses the strategic integration of perennials into agricultural landscapes to support new agricultural markets and to meet societal goals for clean water, healthy soils, abundant wildlife and inspiring recreational opportunities. She works to return more of the value from agricultural supply chains to rural communities and the land, and develops relationships and institutional capacity so diverse groups of people can more effectively work together. Dr. Schulte Moore is co-founder of the [Science-based Trials of Rowcrops Integrated with Prairie Strips \(STRIPS\) project](#), which pioneered the prairie strips conservation practice. She is also lead developer of [People in Ecosystems/ Watershed Integration \(PEWI\)](#), a simple web-based educational game designed to help people understand human impacts on the environment and improve the management of natural resources. She directs [C-CHANGE](#), an Iowa

State University Presidential Interdisciplinary Research Initiative and USDA-NIFA Sustainable Agricultural Systems Coordinated Agricultural Project.

Lois Wright Morton

A former professor of rural sociology at Iowa State University, Dr. Lois Wright Morton spent much of her career investigating why and how farmers make decisions. Now, she's in the field as a 7th generation farmer in NE Ohio making those decisions for herself. A board member of SfL and member of NACSAA, Morton grows mainly specialty crops like blueberries, asparagus, and red raspberries on 50 acres. She has her own weather station and soil sensors, and her blueberries sit under half an acre of netting, allowing her to avoid insecticide use. While the netting keeps out the main assailant, Spotted Wing Drosophila, she is repairing damage caused by larger creatures almost daily. As a smaller grower, Morton can afford to use the net, but would like to see the technology improved to increase its scalability. "It's not enough for industry to partner with us, we've got to listen to farmers and what their real experiences are so that we've got an effective feedback loop," she urges.

David Oman

David is a public policy and political strategist. He spent two decades as an executive in the cable television industry in Des Moines, IA and Denver, CO. David served as Chief of Staff for two Republican Iowa Governors, Robert Ray and Terry Branstad and chaired the Iowa 2010 Strategic Planning Council for Democratic Gov. Tom Vilsack. He is a past Chair and long-time board member of the Iowa Natural Heritage Foundation and was a founding board member of the Iowa Environmental Council. Several generations of David's family farmed in Ohio and Iowa.

Dean Daniel Robison

Daniel Robison began his tenure as the Endowed Dean's Chair of the College of Agriculture and Life Sciences at Iowa State University in January 2019. He also serves as director of the Iowa Agriculture and Home Economics Experiment Station. Following a national search, he was announced as the 11th dean in the history of Iowa State's agricultural college in October 2018.

Jason Russell

Jason Russell is a sixth generation Linn county, IA livestock and grain farmer. He graduated from Kirkwood Community College in 1999. Jason, his wife Sarah and 3 children custom feed hogs, raise direct to market beef and lamb, Grow corn, soybeans, hay and now chickpeas. Jason's efforts in conservation and cover crop outreach have resulted in accolades in environmental stewardship from IA pork producers, national pork board, IDALS and American Soybean Assoc. Jason is active with several commodity groups to help influence ag policy.

Jason currently serves on the energy policy committee's for IFBF and AFBF as well as participating in several on farm trials with NRCS and ISA. Jason also continues to learn and share his experiences with regenerative ag by speaking and hosting visitors to his farm.

Matt Russell

Fifth generation Iowa farmer, Russell farms with Patrick Standley in Marion County producing beef and growing specialty crops. He served 8 years on the Farm Service Agency state committee, worked for 12 years at the Drake University Agricultural Law Center, earned an MS in Rural Sociology at ISU, and

currently is the executive director of Iowa Interfaith Power & Light where he leads their Faith Farms and Climate project.

Brent Schwenneker

Brent grew up on a row crop and cow/calf operation in southwest Iowa. He attended Iowa State University where he obtained a Bachelor of Science degree in Agriculture Business, and Kansas State University where he earned his Masters of Ag Business.

In 1995, Brent began his career with Monsanto in the soybean breeding organization. Since then he has held positions with technology development, integrated farming systems and currently, as the manager at The Huxley Learning Center for Bayer Crop Science.

Brent currently serves on the INREC board, Chairman of Dallas County Extension Council, Iowa Corn Grassroots Network Membership & Checkoff committee and recently finished the Iowa Corn Growers Leadership program.

Brent is a fifth-generation farmer in partnership with his brother and enjoys deer hunting, cyclone sports, and dabbling in a new agronomy podcast, Iowa Agronomy Update.

He lives in Adel with his wife, Samantha, and their 3 boys Bryce, Nolan and CJ.

Ernie Shea

President, Solutions from the Land; President and CEO, *Natural Resource Solutions, LLC.*; Formerly CEO, *National Association of Conservation Districts*; Assistant Secretary of Agriculture for Agricultural Development and Resource Conservation, *State of Maryland*.

Bryan Sievers (Co-Chair)

Bryan operates a cattle feedlot in Stockton, Iowa. Bryan and his wife, Lisa, are enthusiastic environmental stewards of the land as such have been actively involved in implementing combined heat and power (CHP) anaerobic digester projects on their property. Bryan received his degree in Agricultural Business in 1982 from Iowa State University. His past experiences include being a 3-year letterman on the Iowa State University baseball team, leadership roles in the Iowa Farm Bureau, serving two terms in the Iowa Legislature (one term in the Iowa House and one term in the Iowa Senate), and current service as Chair of the Iowa Economic Development Authority's Biomass Conversion committee. Bryan and Lisa have two children and five grandchildren.

Bert Strayer

Bert graduated from Iowa State in 1986 with a degree in Ag Business with an emphasis in Agronomy. He was an active member of the Alpha Gamma Rho fraternity. As an FFA member, he was awarded the American Farmer degree and received a regional Agricultural Processing Proficiency Award. Upon graduation he served as the sales and marketing manager for Strayer Seed Farms, his family's seed business in Hudson which specialized in food grade soybeans and wholesale soybean and oat seed. He soon added wholesale grass seed to their portfolio. Bert sold his first winter rye for use as a cover crop 30 years ago. For the past 20 years, he has been with La Crosse Seed serving in such capacities as Regional Sales Manager, Location Manager, Forage Lead, and most recently serving as a Cover Crop Lead. In addition to providing forage, turf, and conservation seeds, La Crosse Seed is the nation's largest cover crops seed company. Bert has served in numerous leadership roles within the seed industry and the community of Hudson, where he and his family call home.

Dennis Todey

Director of the USDA Midwest Climate Hub in Ames, IA. The hub delivers actionable climate information for agriculture in an eight-state region over most of the Corn Belt. He has worked on regional climate

DRAFT

2021 August 13 IA Smart Ag Vision paper

services in the Missouri River Basin and Midwest for over a decade partnering with NOAA, Regional Climate Centers, state climatologists and state extension. He also worked on issues of climate change impacts on all types of Midwest/Plains agriculture.