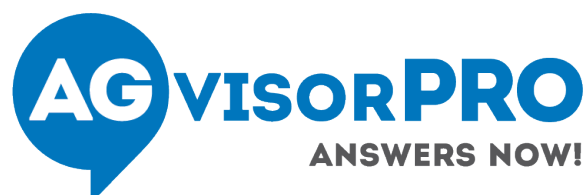


3 TENETS OF MODERN SUSTAINABLE AGRICULTURE APPLIED IN 2022

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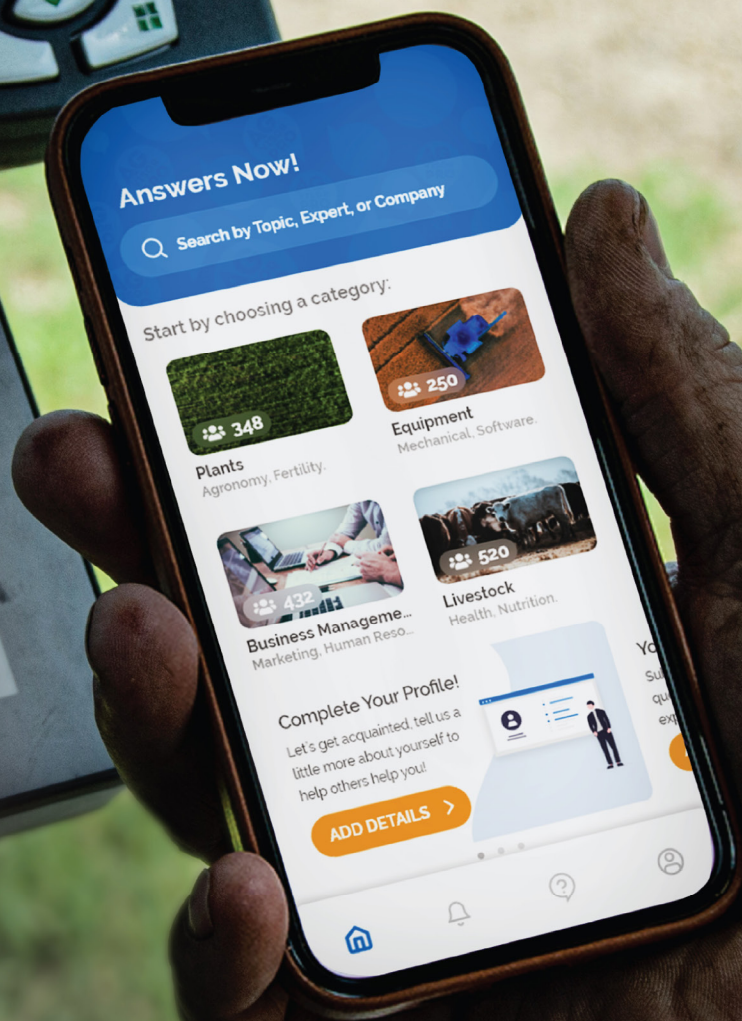
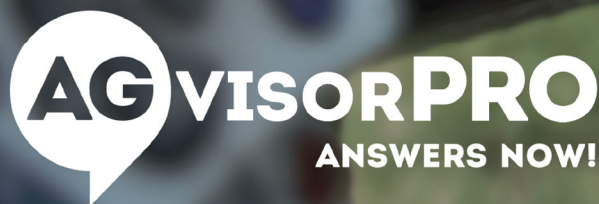
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3 TENETS OF MODERN SUSTAINABLE AG APPLIED IN 2022

UPDATING ECOLOGICAL, ECONOMICAL AND GENERATIONAL SUSTAINABILITY FOR A QUICKLY ADAPTING AGRICULTURE INDUSTRY

BY ACRES U.S.A. / PREPARED FOR AGVISORPRO

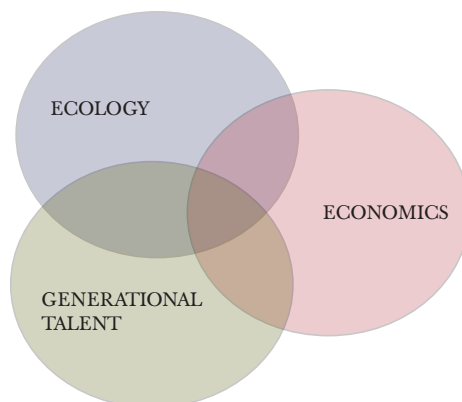
SHORT SUMMARY

The goal of this white paper is to help farmers, ranchers and agriculture industry professionals better understand the core principles of modern sustainable agriculture, which includes three key tenets:

1) Ecological systems. A farmer and rancher in a sustainable system uses more natural techniques to reach their soil fertility and crop protection goals. Techniques like cover cropping, livestock integration and inter-cropping are discussed, along with key data on how they build resilience in a system.

2) Economic improvements. A farmer and rancher must be profitable with their system in order to invest back into it. This return is crucial. Decreasing costs by building a more resilient local ecosystem is one return on the investment into ecology.

3) Generational talent. A farmer and rancher must have a transition plan for ownership should they become sick or retired. The average age of farmers and ranchers in the United States is nearing the retirement age for most Americans; yet, the number of new farmers is growing, and they are taking a different approach than



the previous generation.

In this white paper, we will walk through some key ecological growing tactics and show how they are improving the land and the farm owners' bottom lines. These tactics discussed are designed to decrease risk and offset current economic trends, and the results are specific to the farm and ranch where they are applied.

We will also show why some tactics may not work in every region, and why connecting with other like-minded professionals and practitioners with experience in your region is most important to implementing

accurately and effectively.

The evidence in this white paper will also illustrate why ecological growing tactics are becoming more and more economically important. In 2022, as disrupted supply lines caused dramatic rises in inorganic fertilizer costs, they also created a new line of customers searching for more natural products not dependent on global manufacturing lines. Fertilizer costs are increasing as much as 80-100% across industries¹, affecting rice growers the most but all cash crops on some level. You will learn in this white paper the details on how costs are increasing, and how natural solutions are helping farmers offset those costs.

This white paper will also illustrate how an aging population of farm owners is creating a huge opportunity for generational change, while congruently creating a challenge of how to transition the immense volume of ownership and information needed. An increase in new farmers in 2017 is just starting to offset the trend of an aging farm ownership demographic in the United States. This white paper will demonstrate how these new farmers are changing their operations, and how the second and third generations are leading in different ways.

INTRODUCTION

Increasing fertilizer costs, intensifying weather patterns, aging labor forces and the advancements of natural growing systems are big components of a rapidly changing agriculture industry in 2022.

More than ever, ideas like sustainability farming and ranching are moving beyond meaningless marketing jargon and into tactics with real, measurable goals. Today, the sustainability practitioner must consider all the factors that truly make any business or operation sustainable, resilient, and free of unnecessary risk. Modern sustainable farming systems are being designed much more broadly than they have historically when they were defined purely in environmental terms.

We will first look at the ecological lens, before connecting the dots to our economic realities today, and then to show how aging demographic trends will be leading to a major shift in generational talent.

PART 1: ECOLOGY

"It's the foundation of the system."

The ecological leg of the three-part sustainability equation is rooted in a truth: as our ecosystem balances, it will start to defend and feed itself.

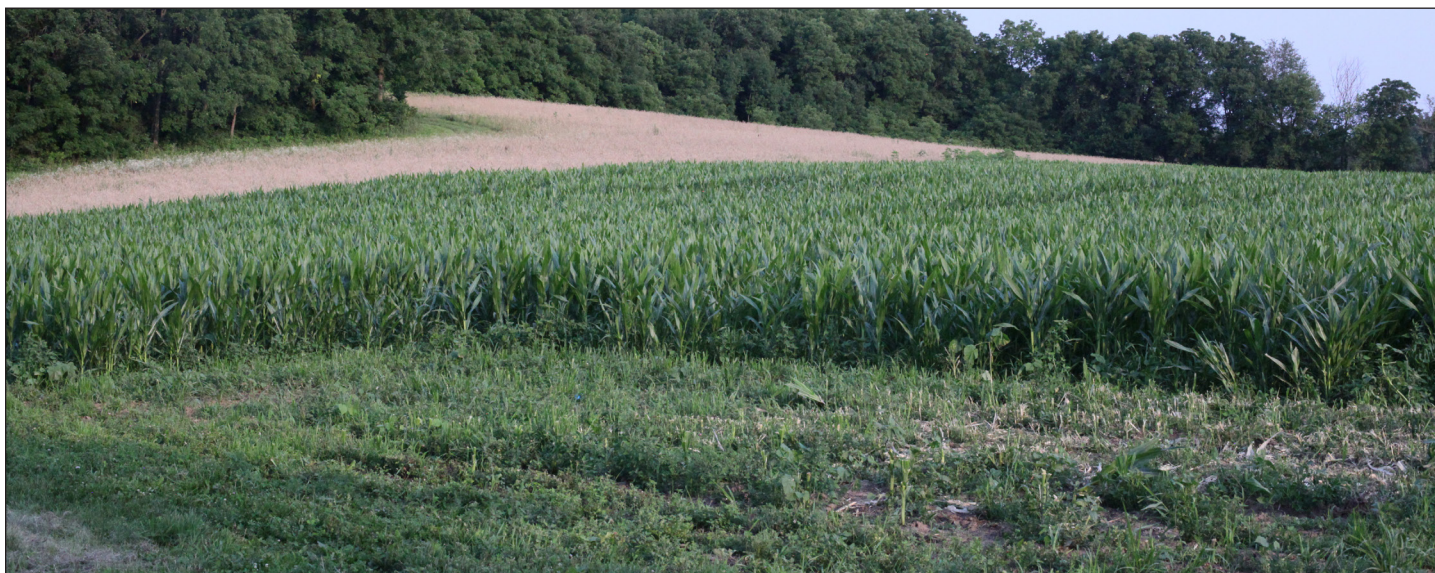
At a higher altitude, a move to a more ecological system means removing the linear mindset involved when designing synthetic systems – use N-P-K, refill N-P-K. Instead, ecological farmers



Wisconsin farmers gather in 2021 to look at inter-cropping and cover cropping systems. Connecting with others is one of the big accelerators of sustainable practices. Photo by Acres U.S.A.

and ranchers are taking a more nuanced approach and looking more holistically at the broad array of elements and biology at work in the soil, plant, air, and water.

These components create a cycle of flowing nutrients between the plant and its local ecosystem. While soil management tactics and their effects on an operation will change depending on soil types, climate, weather and a multitude of variables, including whether the soil was glaciated or not, certain truths are independent of the local differences.



An example of cover crops being used as grown cover with some inter-cropping. *Photo by Acres U.S.A.*

One ecological principle found around the world in sustainable systems is a focus on soil mineral balancing. Yet even this can be controversial. While some agronomists will put soil mineral balancing as the leading indicator of an ecosystem, other agronomists with the same educational background will look at the plant itself, or at soil biology first. Each one of those approaches is measurable.

“Soil health is one thing we can quantitatively measure with soil sampling,” said Marcia Cripps, a farmer and agronomist based in Michigan. Cripps has spent most of the past few years observing change in agriculture, including at the elemental level in soil. “It’s the foundation of your system. If you have a bad foundation of a house, it’s going to be horrible to live in.”

Research dating back to University of Missouri researcher William A. Albrecht in the 1940s and 1950s connected the dots between mineral balancing and pH (Albrecht looked at calcium-to-magnesium ratios), and his research updated work done centuries before by guys like Ehrenfried Pfeiffer². Updated research by groups like Rodale Institute, Rattan Lal at Ohio State University³ and many land grant universities are proving how soil biological life – from dung beetles to microbes – and soil chemistry work together and feed off each other, and how costly synthetic systems can often replace free, natural solutions in nature. Differences aside, no matter how you look at the soil-plant relationship, the goals are similar – growing nutrient-dense food at the highest yield the ecosystem will support.

Why is this only now becoming common knowledge? “One of the problems in this industry is our disconnect between sci-

entists and farmers,” said Cripps. Agronomists are part of that solution, she said, as are our social media discussion boards, agriculture community-building applications and the traditional conference circuit.

Our knowledge of natural, organic systems began to accelerate in 2000 as the organic standards in the United States were passed and a multi-billion-dollar market suddenly attached price to the way it was grown. Now, farmers and ranchers – as well as investors – had a reason to find new ways to grow our food without toxic chemicals. And that surge of opportunity continues more than two decades later. The global organic fertilizer market size is reacting to the surge in demand, and is projected to reach \$13.8 billion by 2026, exactly double from the market size 2019⁴.

So, what are these ecological components fueling the rapid increase in production and adaptation that farmers and ranchers need to really understand? They are focused in areas like biology, chemistry and in-field experimentation. Since many farmers will not have the budget or bandwidth to staff a laboratory, they are dependent on others who do – mainly soil testing labs, land grant universities and independent researchers around the country. These organizations measure for dozens of different elements, soil organic matter, cation exchange capacity, and help a farmer know what and how much of a type of input to apply. Yet, they still need translation from someone who understands how to put them into action.

“It’s like a doctor explaining a blood test,” Cripps said, explaining the soil testing process. “They aren’t giving you the data. They are giving you the story behind the data. If you aren’t testing, you are

working blind.”

“I don’t need a farmer to understand (biology and chemistry),” Cripps went on. “That’s where agronomists need to come in. I’d challenge researchers too to be able to speak to Joe Grower. Don’t expect a customer to know what a soil test is.”

For those seeking a chemistry primer, Cripps has a way to gently approach the subject, and go back to the “building a house” metaphor she used earlier. While memorizing the periodic table isn’t mandatory, some common understanding of the elements can help you ask good questions to fertilizer companies when they stop by, at the very least, she said.

According to Cripps, here are a few common elements and how to remember them:

- Potassium (K) is your pick-up truck, and it moves calcium (Ca). How much potassium you have determines how much calcium you can move.
- Calcium are the bricks of your house.
- Boron (B) is the cement that hold them together.
- Zinc (Zn) is the surface paint that keeps it safe from the weather.
- pH is a credit score. If your pH isn’t right, you won’t get far from the start.

Beyond soil testing, other management tactics can vary depending on the region. In many areas, planting cover crops – the practice of planting short rotation crops to keep biological life in the ground between cash crop seasons – is a common practice to build soil life, structure, and erosion prevention. It’s a common practice and the results are becoming easier to measure. Because of those two factors, the Biden administration has announced a number of steps to encourage adoption of

cover crops, most recently signing a partnership with three farm groups to double the use of cover crops on corn and soybean land to 30 million acres.

The volume of data and study of cover crops is now leading to more confidence in adoption, according to the 2020 National Cover Crop Survey Annual Report⁵, which also shared this finding of the more than 1,400 producers they surveyed:

“Besides the slight revenue boost from modest yield increases, cover crops can help pay for themselves in other ways, such as reduced input costs. In terms of fertilizer savings, 49% of corn producers reported reduced fertilizer costs, as did 41% of soybean producers, 43% of wheat farmers, and 53% of cotton producers. A similar pattern emerged with herbicide savings, with reduced herbicide costs in soybeans (38.7% of producers), corn (39%), wheat (31.9% of producers) and cotton (70.6%). Among the farmers who did not report a cut in herbicide applications or costs, a majority still reported improved weed control from cover crops.”

Scott Gillespie, a Canadian agronomist, teaches an online course on cover crop strategies and has worked for years to tie them back to common economic and ecological measuring sticks.

“There’s a lot of medium-term or long-term benefits, by having a root growing as much as possible, we’re building a few more aggregates every year, supporting water filtration so we can take in big storms when they come, and then we hold the soil in place and we hold water in place,” Gillespie said. “There’s no sense in doing it if there’s no payback.”

Another commonly adopted practice when improving an operation’s sustainability equation is livestock integration. Chicken, hogs, and cattle can help recycle nutrients through the ecosystem by eating plant materials, processing them internally and returning the nutrients to the soil through manure and urea. Obviously, the animals can also be sold for meat, dairy, and eggs, among other commercial uses like dog treats and manure.

Joelle Faulkner, an entrepreneurial investor who founded Area One Farms in Canada, has been tracking the benefits of livestock integration – 4 use livestock within the 25 farms her company co-owns.

“The biggest success we are seeing is around cattle integration. We are seeing quite a bit of success in rotational grazing and high-intensity grazing,” she said.

Gillespie helped explain the positive results economically and ecologically but didn’t want anyone to become too discouraged if livestock does not seem feasible.



Cattle integrated into a pasture field at different levels of growth. *Stock photo.*

“The animal integration can be a way to pay for some of the costs of their farm, and increase the cycling of elements,” he said, before cautioning, “but many in reality don’t have access to animals and processors. Most farmers either know animals or don’t know animals. You can make deals with neighbors, but there’s a lot that goes into it.”

Other opportunities to move a farm or ranch in a more ecological direction include more simple tools like using humate supplements, composting waste and keeping fields covered with organic material any way you can.

“While I’m big on compost, every program I write is never like the last one I wrote,” said Cripps, the agronomist. “They are rarely identical.” Instead of encouraging her customers to spend time searching for the perfect solution, she focuses on encouraging them to take small steps that have positive results they can measure and see with their own eyes.

“Right now, the big challenge of fertilizer is price,” Cripps said. “Price is going up, and that’s going to force change and creativity.”

PART 2: ECONOMICS

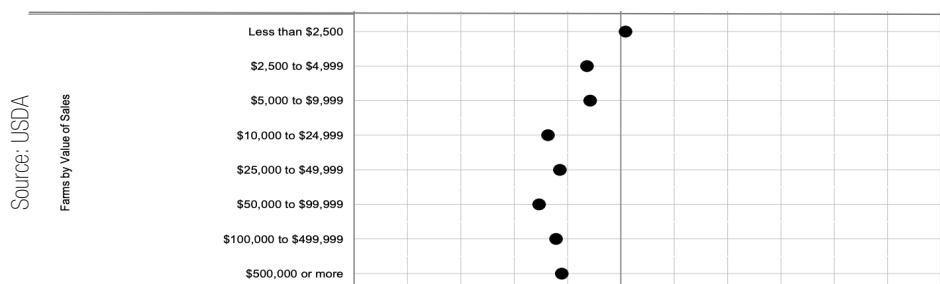
“Find people to actually make it work.”

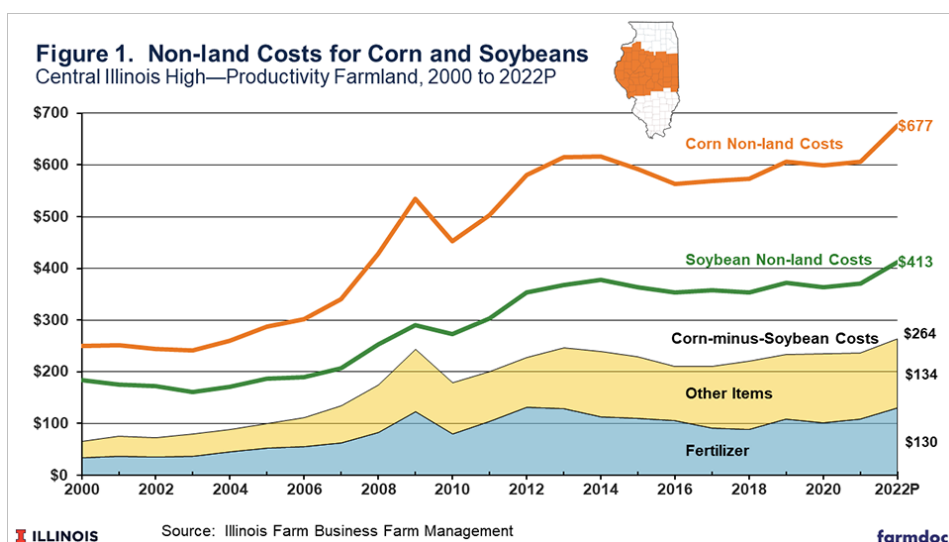
Long-term economic data in the United States shows clear trends: rising expenses and lowering sales. Economics 101 would tell us this trend is not sustainable.

The chart below (courtesy U.S.D.A. 2017 Census), with each vertical line representing 5% +/- and the center line being no change at all, illustrates the decrease in farm valuations in the United States between 2012 and 2017. The only growth came in very small boutique farms, and even that was less than 1%.

During the same time period, United States farms shrank in value, its farmers paid more for livestock, labor, interest, and chemicals, and are now seeing historical increases in fertilizer, gasoline⁶, and feed costs.

Complications created by a global pandemic have created massive disruptions and pricing increases in the fertilizer industry in 2022. China, for example, supplies about a third of the world’s phosphate and banned exports through the calendar year. Similar shortages in ammonia-based synthetic nitrogen and even microproces-





sors are disrupting supply lines across the globe.

To look at a sample in a specific region in central Illinois, the trends are clear about more than just fertilizer. Non-land costs per acre are increasing at a faster rate than the revenue, illustrated in Figure 1⁷ (above).

Business models that benefited from the cheap cost of synthetic fertilizers are now feeling the opposite effects, which is triggering a change in fertilizer manufacturing across the globe. The global Biological Organic Fertilizers market was valued at \$1.6 billion (USD) in 2020 and it is expected to reach \$2.8 billion by the end of 2027, growing at rate of 7.5% during 2021-2027⁸. Faulkner sees the paradigm shifting, which has changed the way she approaches the 25 farms in her portfolio. Her company operates on a co-ownership model, which while complicating the equation, keeps overall ownership on the land.

Faulkner said that in her experience, most farmers like to tinker, but for them to commit to real change, the pieces have to connect back to bottom line performance. A good example with her investments is the practice of cover cropping. While in most regions cover cropping is profitable and a best practice, she is finding difficulty building soil health due to the very short growing seasons in her Canadian region.

The time between harvest and freeze is too short to plant and winterize the operation, so the additional seed cost goes to waste. Instead, they are seeing more success incorporating pasture and livestock into cash crop systems like canola. Even more impressive is the yield data they've amassed attached to moving away from mono-cropping and toward inter-cropping.

The bottom line? The biodiversity discussed in the Ecology section of this white paper reflects the yield gains shown below.

Others might describe the results in a different way: the individual tactic of inter-cropping is truly sustainable because it checks all three boxes discussed in this paper: it builds positive and measurable results across economics and ecosystems and can be replicated into the future across multiple generations.

Of course, everything has a cost, and any discussion of new systems without expenses would be incomplete. There are no free paths forward, and while ecological systems will allow land managers to save money on inputs like herbicides and pesticides and need less fertilizer, the ecological techniques like inter-cropping and livestock management are not without initial expenses. For example, even if you lease your field to a cattle operation to graze on your land, you may still need to add fencing, or repair fencing, to support the lease.

COVER CROP YIELD GROWTH VS. NO COVER CROPS

Cover Crop/No Cover Crop	2012	2014	2016
Corn	9.6%	2.1%	1.3%
Soybeans	11.6%	4.2%	3.8%

Source: SARE/CTIC National Cover Crop Surveys conducted annually for crop years 2012–2016 in similarly managed fields.

For inter-cropping or cover cropping, new orders of seed can challenge a farmer's first experience, as writing a check without seeing the immediate cash gain is never comfortable.

National Cover Crop data⁹ below shows these practices can result in immediate ROIs that extend over several years. Added to that are the complications of insurance. A common practice by insurance companies is to measure productivity of a system as yield per acre of a single crop, not the total crop. Changing to a multi-crop system then skews the math. In fact, the more diverse your field, the worse the numbers can look. If you take a corn crop grown across an acre and suddenly divide in half by mixing in a few rows of soybeans, you've intentionally decreased your yield per acre by 50 percent. That trend is changing however, with a recent ruling in February 2022 by the U.S.D.A. to "allow soybeans relay cropped into an established small grain crop to be insurable via written agreement."¹⁰

Fair or not, the early adopters in sustainable agriculture are not so different than disruptors in other industries who choose to change from the norm; they bear the brunt of proving the concepts – in this case, cover crops or livestock integration – are good business.

"We should be decreasing expense through it, but with increasing complexity," Faulkner said. "It will take a little bit of time to get over that."

For those wondering where to start, Gillespie offered an idea.

"Find the problem to solve on your particular farm, and start simple," he said. "Learn how it works and find people to actually make it work."

PART 3: GENERATIONAL

"The mindset can be one limiting factor."

Perhaps the least discussed aspect in the sustainability equation is the human capital side. Long-time sustainable farming advocates have been advocating for "three paid generations," and while that's possible for some, for many today it is not. This isn't always due to economics, but also the availability of interest and talent, which are discouraged by the lack of ownership opportunities in the industry.

"Talent is a challenge this industry faces a lot, and we don't talk it about it enough," Cripps said. "We talk about it as a sustainable and an environmental aspect."

In the United State, the aging farmer

Beginning Producers

Beginning farmers have ten or fewer years of farming experience. They were 27 percent of U.S. producers in 2017. Their average age was 46.3, and their farms were smaller than average in both acres and sales.

	Top States	%
<i>As a percent of producers in the state, Alaska ranks first in beginning farmers.</i>	Alaska	46
	Georgia	33
	Maine	33
	Hawaii	32
	Florida	31
	Rhode Island	31
	West Virginia	31
	New Hampshire	31
	Colorado	31

Source: USDA

demographic is one of the biggest challenges weighing on the long-term and global viability of the industry. According to the 2017 U.S. Census of Agriculture¹¹, the average age of all U.S. farm producers in 2017 was 57.5 years, up 1.2 years from 2012, continuing a long-term trend of aging in the U.S. producer population.

There is a good/bad side to this. While there has never been a time when our farm and landowners have more knowledge of their operations, conversely, the country has also never experienced such a challenge to transition that volume of operational experience and knowledge to our future industry leaders. To prove that point, U.S. farm owners today have been on their current farm an average of 21.3 years. Trends are starting to shift, however slowly. Beginning farmers, defined as those within their first 10 years

of commercial production, are increasing, and made up 27 percent of all U.S. farmers in 2017. This was 5 percent more than in 2012.

Gillespie, who works with new farmers and legacy farm owners, said often younger farmers are more likely to change or try new things.

“Either the elder farmer tried it many years ago and it didn’t work, and they are still running the farm, so the idea doesn’t go,” Gillespie said. “The mindset can be one limiting factor.”

“A lot of times, it starts with going to a lot of conferences, or going into YouTube and just wanting to try things,” he continued. “They see something new, and they want to try something better. At the core of it they know the existing system isn’t exactly working or is faltering with the amounts of inputs they have to put in, and they are trying to find some better ways to do some things. That’s probably how most people come to us.”

Connecting with other farmers and ranchers, while not a new practice, is getting easier with applications designed just for that purpose, the growth of social media and the explosion of soil-health events around the country and world. There are a variety of places where information is changing hands, and generations are building the knowledge they need. A 2021 Acres U.S.A. readership survey showed farmers and ranchers preferred direct communication, in-field applications and in-person events far more than a USDA website or social media channels.

For Faulkner, she can see the need for increased communication and collaboration and uses that as a real metric in determining her investments. Combining a good transitional network with solid government policy checks two major boxes

for her. As she earlier stated, generational culture and government policy are big pieces to the sustainability equation.

“The Canadian farms tend to be multi-generational,” she said. “We have an advantage in there’s no estate payable tax. It’s not avoidance; it’s deferral. Whoever eventually sells it will pay the taxes for everyone. It’s effective in maintaining ownerships of families.”

For her business, learning which generation tends to make the economic and ecological decisions has also become somewhat important when asking farms to invest in their own sustainability.

“We try to partner with two generations,” Faulkner added. “The senior generation, whether that’s 80, 70, 60, or 45, is usually in control of the money. The sticker shock is more felt by the older generation. ... Depending on the age gap, the younger generation tend to work on the crop and not the operation. ... Crop treatment falls more junior, along with operations like machinery and maintenance.”

Faulkner’s challenge is to reach a positive ROI in that investment in a new type of inter-cropping or an integration of livestock and help build a complete system that returns high-quality yields, bigger deposits in the bank account, and more multi-generational control. “We tend to partner with at least two (generations), as those farms have decent cost control and better risk management. Better cycles mean better risk management.”

This paper was authored by Ryan Slabaugh, the publisher of Acres U.S.A., on behalf of a partnership with AGvisorPRO. All sources were identified as experts and were not compensated for their ideas and information. You can learn more about Acres U.S.A. at www.AcresUSA.com and AGvisorPRO at <https://agvisorpro.com>

FOOTNOTES

¹ <https://afpc.tamu.edu/research/publications/files/711/BP-22-01-Fertilizer.pdf>

² <https://cafnr.missouri.edu/2013/08/healthy-soil-and-people/>

³ <https://research.osu.edu/rattan-lal>

⁴ <https://reports.valuates.com/market-reports/QYRE-Auto-25G2940/global-organic-fertilizer>

⁵ <https://ctic.org/files/CoverCropSurvey%202020%2024mb.pdf>

⁶ <https://www.consumeraffairs.com/news/gas-prices-start-2022-more-than-a-dollar-a-gallon-higher-than-in-2021-010722.html>

⁷ <https://farmdocdaily.illinois.edu/2021/10/2022-planting-decisions-nitrogen-fertilizer-prices-and-corn-and-soybean-prices.html>

⁸ <https://www.marketwatch.com/press-release/biological-organic-fertilizers-market-size-share-2022---global-business-review-key-findings-company-profiles-growth-strategy-developing-technologies-trends-and-forecast-by-regions-2022-01-03>

⁹ <https://www.sare.org/wp-content/uploads/Cover-Crop-Economics.pdf>

¹⁰ <https://rma.usda.gov/Policy-and-Procedure/Bulletins-and-Memos/2022/MGR-22-002>

¹¹ https://www.nass.usda.gov/Publications/Highlights/2019/2017Census_Farm_Producers.pdf

