SOLUTIONS FROM THE LAND

Voices of Florida Farmers:
Building a Circular Bioeconomy

SOLUTIONS FROM THE LAND

2026

TABLE OF CONTENTS

INTRODUCTION..... 2

STORIES FROM FLORIDA FARMERS

Cody Darling, Shenandoah Dairy, Crop Production..... 7

Beaver Yoder, Crooked Creek Farms..... 9

Mack Glass, Cherokee Ranch..... 11

John Dooner, Southern Forestry Consultants..... 12

Dr. Meghan Austin, Cindale Farms..... 14

David Hill, Southern Hill Farms..... 17

Steve Johnson, Treeair Cattle Company & Johnson Harvesting..... 19

Lance McNeill, Mineral Grow..... 21

Chuck Obern, C&B Farms..... 23

Dr. Lanette Sobel, Fertile Earth Worm Farm..... 26

Ed Chiles, Gamble Creek Farms..... 29

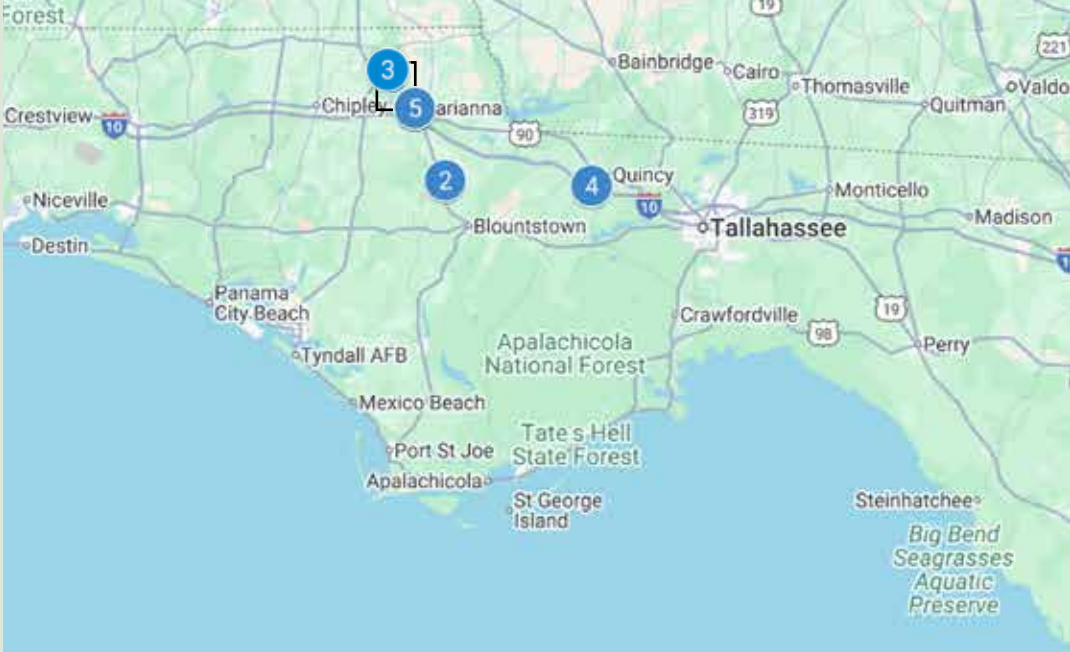
Timothy Solano, Cedar Key Aquaculture Farms..... 32

Discussion: What We Learn From Florida Farmers..... 34

Cover images. *Photos credits from top left to bottom right: Meghan Austin, Southern Hill Farms, Cody Darling, Gamble Creek Farms, Ed Chiles and Fertile Earth Worm Farm*

Citation: *C. Girgis, E. Shea, L. W. Morton, 2026. Voices of Florida Farmers: Building a Circular Bioeconomy. Solutions from the Land, Lutherville, MD.*

Funding Source: *Voices of Florida Farmers: Building a Circular Bioeconomy was funded by a grant from VoLo Foundation. VoLo Foundation is a private family organization whose mission is to accelerate change and global impact by supporting science-based climate solutions, enhancing education, and improving health.*



Voices of Florida:

The Voices of Florida Farmers report captures stories from farmers, ranchers, aquaculturists and allied industry who are experimenting with circular bioeconomy systems and practices. This map represents where in the state these voices come from.

FLORIDA AG STATISTICS

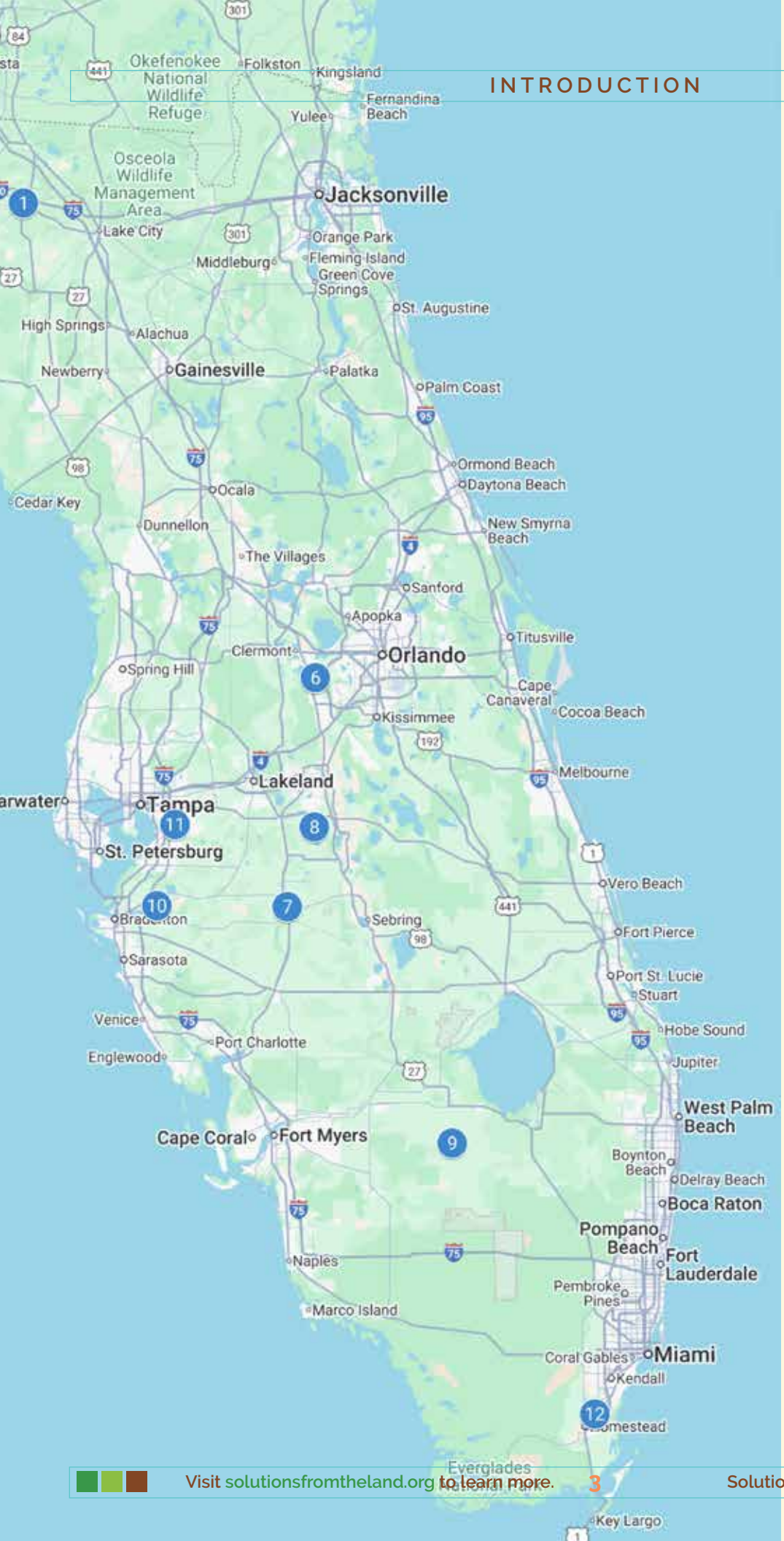
In 2023, Florida ranked high among states for various food and horticulture products by value, including:

- No. 1 for floriculture products, Valencia oranges, sugarcane, watermelon and sweet corn
- No. 2 for bell peppers, all oranges, strawberries and tomatoes grown in the open
- No. 3 for cabbage and grapefruit
- No. 4 for peanuts

Among Florida's top exports include:

- Dairy products ($619.8 million)
- Seafood products ($440.6 million)
- Beef and beef products ($378.8 million)
- Poultry meat and products (excluding eggs) ($302 million)
- Fresh fruit ($356.3 million)
- Forest products ($343.8 million)
- Fresh vegetables ($333.3 million)

Source: Florida Department of Agriculture and Consumer Services



Florida enjoys rich diversity in its agriculture and landscape.

Mild winters, with plenty of sunshine and rain make Florida one of the best places for fruit and vegetable production. Peanut, cotton and corn fields thrive in the Panhandle. Nursery greenhouses and sugarcane prosper in the rocky South. Beef cattle graze native grasses across the state. Aquaculture flourish in the rivers, lakes and estuaries.

FLORIDA MAP

1 Cody Darling, Shenandoah Dairy (Crop Production)

2 Beaver Yoder, Crooked Creek Farms

3 Mack Glass, Cherokee Ranch

4 John Dooner, Southern Forestry Consultants

5 Meghan Austin, Cindale Farms

6 David Hill, Southern Hill Farms

7 Steve Johnson, Treeair Cattle & Johnson Harvesting

8 Lance McNeill, Mineral Grow

9 Chuck Obern, C & B Farms

10 Ed Chiles, Gamble Creek Farms

11 Timothy Solano, Cedar Key Aquaculture Farms

12 Lanette Sobel, Fertile Earth Worm Farm

"Florida's 44,400 farms and ranches do so much more than just produce food and fiber."

Wetlands, prairies, forests, springs, rivers and beaches make up the beauty of Florida, which attracted more than 140 million visitors in 2024[1].

Tourism is a valuable part of Florida's economy, and much of that tourism depends on the state's scenic destinations. However, no one appreciates Florida's natural beauty more than those who live and work closest to the land and sea: farmers, ranchers, foresters and aquaculturists.

Florida's 44,400 farms and ranches[2] do so much more than just produce food and fiber. The lands and waters they manage coexist with and buffer, or protect, wild lands. They extend and provide more habitat for unique and, in many cases, threatened or endangered wildlife and birds. They filter and store water. They sequester carbon.

The pressure is on in Florida to preserve these green spaces. The Agriculture 2040/2070 report[3], produced by the University of Florida and 1000 Friends of Florida, projects about 120 acres per day, or almost 45,000 acres per year, could be lost to development between now and 2070.

That could mean less land available to provide the ecosystem services, and food and other everyday products, needed by society.

Farmers, ranchers, foresters, fisher people and their rural communities have seen the changes development brings to the land and the water. They recognize development is reality, and they realize the future begs them to

1. VISIT FLORIDA Research. Research FAQ. https://www.visitflorida.org/resources/research/research-faq/

2. Florida Department of Agriculture and Consumer Services. Florida Agriculture Overview and Statistics. https://www.fdacs.gov/Agriculture-Industry/Florida-Agriculture-Overview-and-Statistics

3. 1000 Friends of Florida. Agriculture 2040 2070. https://1000fof.org/ag2040-2070/

Photo courtesy of Southern Hill Farms

do things differently.

They must do more with less – less land, less water, less labor, and less fertilizer and other inputs. They must build resiliency amid the threats of more severe hurricane seasons. They must find new ways to capture value and remain viable as businesses in order to stay, and continue doing good, on the land.

To lead the conversation on how to move forward in Florida agriculture, a group of well respected and networked agricultural and forestry thought leaders and value chain partners came together in late 2018. They became the Florida Smart Agriculture Work Group.

They are farmers, ranchers, foresters, scientists, consultants, restaurateurs and aquaculturists.

They are innovators, risk takers, conservationists, water stewards, soil builders, learners and educators.

They are invested in ensuring the health and productivity of Florida land for future generations.

One of the opportunities they see is in the circular bioeconomy.

WHAT IS CIRCULARITY IN AGRICULTURE?

The circular bioeconomy at its core is all about making the best – and most – use of resources, particularly natural resources. Dr. Ana Martin-Ryals, assistant professor of agricultural and biological engineering with the University of Florida Institute of Food and Agricultural Sciences (UF IFAS), describes it as an "economy powered by nature and natural resources, including waste resources."

Photo courtesy of Mack Glass

Modern agriculture has achieved incredible success in producing an abundant supply of food and feedstuffs with the help of external inputs for plant nutrients, pesticides and energy. But for the most part, these systems have been linear: They take resources, make a product, and discard the products after they have been used.

A linear economy is based on the tangible products produced – food, feed, fiber, fuel, and other bio-based ingredients and materials. Producers receive compensation only for these tangible products. Efficiency is valued, but waste is often justified as cost-effective to both producers and consumers.

As time goes on, though, society has become more aware of the true, increasing, costs of waste. Landfills are filling up. Pollution is becoming a more widespread problem. Gone are the days of cheap inputs.

For farmers, every dollar must count The circular bioeconomy captures not just the value of physical products produced but also the value of the ecosystem services farms deliver as land-based businesses.

A DIFFERENT VIEW OF WASTE

Circular systems look at waste as opportunity. The goal is to extend the life of resources by reusing them over and over – creating new circles of life, as a similar farmer- and scientist-led group in Iowa describes it (see Iowa Smart Agriculture's Circles of Life report[4]). Resources might stay in service through maintenance or reuse. They might be recycled or upcycled for new purposes. Farmers make value out of so-called "waste," perhaps as fertilizer, feed, part of a new product or as bioenergy.

For example:

- Livestock manure, worm castings, and unmarketable crops or food/seafood products may be used to directly fertilize fields or be composted to build healthy soil.
- Food and drink manufacturing byproducts (such as distillers grains) can be used for animal feed.

4. SfL (Solutions from the Land) 2022. Iowa Smart Agriculture: Circles of Life. A Vision for the Future. Solutions from the Land, Lutherville, MD. https://www.solutionsfromtheland.org/wp-content/uploads/2022/11/Iowa-Smart-Agriculture-Circles-of-Life-Report.pdf

- Excess wastes and byproducts can be used to produce energy, such as through anaerobic biogas digesters on large dairy (and other livestock) farms. This energy can be sold into the grid for public use or used directly on-farm.

Regeneration of the land and natural resources is another key component of circular systems. This starts with the soil.

The five core principles of soil health are:

1. Minimize soil disturbances.
2. Maximize soil cover.
3. Maintain living roots year-round.
4. Boost biodiversity.
5. Integrate livestock.

Building up soil health supports the earth's natural cycles – how nutrients, water and energy are used and reused continuously in nature.

NOT A NEW CONCEPT

Farmers and ranchers are already moving toward circular systems. Though the term "circular bioeconomy" may not be commonplace in the agriculture community right now, the idea is inherent.

Nature naturally works in cycles, and farmers have tapped into those since the beginning of time. Farmers know to "take care of the land, and it will take care of you." Farmers find improving soil health enables the land to hold more water and be more productive and resilient in times of drought or extreme rain. Circular systems can reduce expensive inputs, such as synthetic fertilizers and pesticides by recycling on-farm and community resources and repurposing biological resources.

Increasingly, farmers recognize they are producing and enhancing ecosystem services needed by society. If farmers were compensated for protecting and improving their natural resource base, it could boost the farm economy and enable farmers to better compete with alternative land uses, like development, which diminishes the land's natural cycles.

These are the conversations that will guide the future of Florida agriculture, natural resources and quality of life. Those living on and working with the land must be at the center of these conversations.

"Farmers and ranchers are already moving toward circular systems."

Photo is courtesy of Gamble Creek Farms

THE FARMER VOICES

The heart of this report is stories from farmers, ranchers, foresters, fishers and partners in natural resources who share examples of circularity in agriculture. They represent different Florida geographies and agricultural sectors. They have access to different resources and are operating under different circumstances, but they share a desire to do good on the land and for their communities. They want to keep growing.

Cody Darling, Suwannee County, North Shenandoah Dairy, Crop Production

Cody Darling spent his childhood tending horses and making hay on family farms in Florida and Michigan. His first job as a teen was at a commercial dairy in Florida. After eight years there, and with an agronomy degree from the University of Florida, he ran a composting operation on a farm that grew potatoes, corn, carrots and green beans.

Darling describes himself as a homeopathic person, someone who believes nutrition can heal both humans and plants.

"I try to address disease through nutrition," Darling says.

Darling points to potassium in potatoes. A stress reducer, potassium can make a healthier potato plant that is less vulnerable to disease. Nutrition does not always result in yield gain, but it certainly can. Darling saw an increase of nearly 50% in potato yield while working for a potato farm over four years, in part due to attention on plant health and nutrition.

Plant nutrition is not just about adding in nutrients, Darling cautions. For optimum health, plants must grow in a healthy environment. This includes healthy soil biology – the bacteria, fungi and other microscopic creatures living and working quietly within and around all living things.

"Part of nutrition is soil biology," Darling says. "We have biology in our stomachs. That's why we take prebiotics and probiotics. It's the same for plant nutrition, you're just doing it for the soil."

Photo courtesy of Cody Darling

In July 2024, Darling joined Shenandoah Dairy to manage its crop production. He is applying what he has learned from both his agronomic studies and practical experience to grow a better crop and a better environment.

The Circular Approaches

Shenandoah Dairy grows all the sorghum, triticale and perennial grasses as well as about 80% of the corn silage it feeds to its 3,000 cows on about 1,800 acres of irrigated land. About 1,400 of those acres are under effluent water, or water from the lagoon storing manure and liquid wastes from the cows.

Darling applies the 4Rs of nutrient management (applying the right source of nutrients at the right rate at the right time in the right place) as precisely as possible in the present with a mind toward continual improvement. He uses several tools to deliver nutrients more efficiently and effectively, including a broadspectrum biological product with roughly 2,000 fungal and 2,000 bacterial species that help reduce soil disease and boost nitrogen fixation and nutrient

cycling. The biological boost helps make nutrients, like the nitrogen in the effluent water, more readily available to the plant to consume instead of being wasted and leaching into the soil. He also uses a nanotechnology-based product that helps plants uptake nutrients.

"Next year, I will likely use zero foliar fungicides," Darling says. "If we can cut our active ingredient impact on our environment, that's a pretty big deal."

Another tool used is the 360-YDROP, a sprayer attachment that applies nitrogen (and other nutrients) within a few inches of the plants' base, where about 70% of the plant roots grow. Historically, the farm would have applied nitrogen through an irrigation pivot six to nine times. With the YDROP, they only apply twice. In its first season using the YDROP, the farm reduced nitrogen use by more than half.

"We only applied 136 units of nitrogen to grow a 24-ton average corn crop, which is spectacular," Darling says. "So the YDROP really did help us."

Continuing to Improve

Darling has several goals for the farm. He wants to boost crop rotations and improve the overall soil, which suffers from poor drainage and compaction. Some areas have required occasional heavy, conventional tillage to break up rocks and "get back to where it needs to be so we can take care of it," Darling says. He no-tills cover crops and is working toward no-tilling sorghum into corn stubble.

He is also interested in adding another circular cropping enterprise that would match the soil's strengths: The farm would grow bahiagrass using only effluent water. The bahiagrass would be harvested for seed and sold to a cleaner. Revenue from selling seed would buy corn silage from local farmers to feed the Shenandoah Dairy cows.

Costly Barriers

Darling says one barrier to adopting more circular or regenerative practices is the time it takes to learn and adjust to doing something new. Another is the cost.

His goal to improve use of effluent water hinges on infrastructure investments. The YDROP is also costly. He was able to purchase it thanks to a cost-share program managed by the Suwannee River Water Management District.

"Cost is an absolute, massive part of it," Darling says.

A sprayer equipped with the YDROP system cost $450,000. The water district paid up to $300,000, and Darling was able to finance the rest from the bank after penciling out the cost savings of reducing fertilizer costs.

"If we didn't have that help, we probably still would have tried to do it but the revenue is just not there for dairies," Darling says. "It's hard because you want to do right by the environment, but it can be costly to do so. That's why these programs are helpful."

Next year, Darling plans to slightly increase nitrogen use compared to last season to optimize yield – and grow more food for the cows. The decision is based on what he saw in his highest yielding field (an outlier) last year. It received 150 units of nitrogen and yielded 28 tons.

He may use more nitrogen per square foot of ground, but nitrogen use per ton of corn will go down thanks in part to the YDROP's precise placement and attention to plant and soil health.

"If my plant is utilizing that nitrogen and creating yield with it, that nitrogen is not going into the groundwater," Darling says. "We're still being more efficient."

Photos courtesy of Cody Darling

Beaver Yoder, Jackson and Calhoun County, Panhandle Crooked Creek Farms

Beaver Yoder grew up on a dairy and row crop farm in the Panhandle. His family raised peanuts, corn, cotton and soybeans, but he found an interest in beef cattle early on.

Most of Florida's 15,000 beef producers[5] raise mama cows and their calves on grazing lands, which cover approximately 40% of the state's agricultural lands – close to 4.9 million acres[6].

Once weaned, these calves often go to farms beyond Florida as part of the beef value chain. They go to either backgrounding operations, which prepare them for the feedyard, or directly to feedyards, where they gain weight – including the intramuscular fat known as marbling – on a high energy diet comprising both grasses and grains, like corn.

While grass, especially bahiagrass, is abundant in Florida, it does not have the nutritional quality needed by these growing calves: Gap No. 1.

As a crop farmer, Yoder valued cover crops, or plant species sown between seasons of a main cash crop. Cover crops shield the soil from wind and water erosion when it otherwise would lie bare. Living roots feed soil microbes, and the diversity of species makes an even more robust buffet. As a result, cover crops help build soil health, including its ability to hold water and prevent nutrients from leaching into the watershed.

In the long-term, cover crops can provide a lot of benefits to the soil, society and the farmer. In the short-term, though, it adds a learning curve and costs for the farmer: Gap No. 2.

Photo courtesy of Beaver Yoder

Yoder began building his business to fill these gaps.

The Circular Approaches

Florida cattlemen sell their weaned calves at regional stockyards. Since there are many small cattle producers in the Southeast, the stockyards give them a market where they can sell their few calves alongside other small producers. For the next stage in beef production, most cattle buyers want larger groups of calves uniform in size, which for a smaller producer would mean selling non-uniform calves at a discount. However, Yoder is able to buy these single, non-uniform calves, graze them on cover crops through the winter (and, on a smaller scale,

"[Cows and calves are raised on] grazing lands, which cover approximately 40% of the state's agricultural lands — close to 4.9 million acres."

5. Florida Beef Council. Cattle in Florida. https://www.floridabeef.org/raising-beef/cattle-in-florida

6. UF Center for Landscape Conservation Planning and 1000 Friends of Florida, 2024. Agriculture 2040 2070. https://1000fof.org/wp-content/uploads/2024/01/FOF-1306-Ag-2040-2070-Report-v4-WEB.pdf

planted forages in the summer) then sell them through video sales in larger, uniform lots healthy and ready for the feedyard.

Yoder works with six to eight crop farmers each year. They are typically cotton or peanut farmers who plant cover crops for soil health purposes (from the cattle standpoint, Yoder's favorite cover crop is rye) and recognize the value cattle can add to their system. The cattle naturally fertilize the soil with their manure, which may help reduce the farmer's need for synthetic fertilizer, and grazing leases provide the farmer a new way to generate revenue short-term. Adding livestock also creates employment opportunities. Farm employees typically move on to find other work in the winter, but they may be able to stay on when livestock are around.

An Understanding Advocate

Yoder is proud to create value in his local agriculture industry and to raise his family in the agriculture environment. Three of his four daughters are pursuing or have graduated from college with agriculture degrees and are adding value to the community in their own ways. He's also proud to see all the cover crops growing in his area.

"I love to see something growing all the time, and we live in an area where we can see something growing green at all times," Yoder says. "I'm proud of the fact we're doing those things that are natural and healthy, that keep the soil healthy, and in turn make sure you have a healthy business."

Yoder is a big advocate for cover crops. He has seen what they can do to improve water quality. But he is quick to say planting cover crops and learning how to farm with them is not simple or one-size-fits-all. Adding cattle can further complicate matters. Watering systems and shade structures must be built. Cattle hooves can create damage. Strong partnerships between the farmer and cattle producer are a must.

"What one person finds value in another may not," says Yoder, emphasizing the importance of understanding the unique circumstances of individual farms and farmers and relying on principles not just practices that build sustainability – environmental, social and economic.

"Sustainability is like a three-legged stool," Yoder says. "You have to have the environmental, social and financial parts of a business. When one gets out of whack, the stool falls over."

Grazing stocker cattle on cover crops is providing new opportunities for both cattle and crop producers in Florida to improve their overall sustainability, regardless of the learning curve.

"We just keep plugging away at it, pushing at it," Yoder says. "We keep trying to find ways to make it work."

Photo courtesy of Beaver Yoder

Mack Glass, Jackson County, Panhandle Cherokee Ranch

Photo courtesy of Mack Glass

Not far from the Yoders is **Mack Glass** and his family, who operate Cherokee Ranch in Marianna, Florida. The ranch was started by the grandmother of Mack's wife, Mary Alicia Glass, who bought the nucleus of the farm back in 1916. Mary Alicia and her sister Berta Shumpert still primarily own the ranch today, and Mack started managing it in the 1970s.

Today, Mack and son Grant run a cow-calf operation, manage pine trees for timber, and grow satsumas, a type of mandarin orange. The Glasses, like Yoder, aim to add value to their calves through backgrounding, or preconditioning them for the feedlot. They do so by improving their bahiagrass pastures and providing supplemental feed.

The Circular Approaches

Cows are bred in February, March and April to align with grass at its nutritional peak. Calves are raised by their mothers on pasture until about 7 months, when they are weaned. Weaned calves continue to graze while receiving a higher energy supplemental feed, such as soybean hulls and corn gluten (a byproduct from making syrup for Coca Cola in Tennessee) for about 75 days prior to being marketed.

In 2002, the Glasses planted 6 acres of satsuma trees to diversify income. The mandarins are sold to various local markets, including school cafeterias, civic fundraising programs and Southern Craft Creamery (see Meghan Austin's story). Some mandarins go to support the Second Harvest Food Bank of Central Florida, and what is not suitable for those markets (satsumas with blemishes, for example) becomes a sweet calorie boost for the cattle.

Because of bahiagrass's low nutritional quality, Glass has experimented with planting different forages to support his growing calves, which have higher energy needs compared to cows. He plants annual legumes, like clovers, and millet. Most recently, in 2015, Glass began working with the University of Florida Institute of Food and Agricultural Sciences to introduce perennial peanuts.

As a legume, perennial peanuts (which don't produce "nuts") require little fertilizer because they fix their own nitrogen from the atmosphere thanks to special soil microbes that associate with their roots. Research from UF IFAS[7] has found that pastures of unfertilized bahiagrass and perennial peanuts produce just as good or even slightly better gain in calves as those on fertilized bahiagrass. The cattle like it, too. When cows are rotated through pastures planted with perennial peanuts, they head straight for them.

"We're just using good common sense," Glass says of adding legumes into bahiagrass pasture. "It lowers our natural input cost. It raises the nutrients of the grass."

Perennial peanuts are a good fit for Florida because they do well in san-

7. https://perennialpeanuthay.org/documents/2017_Perennial%20Peanut_does_fix_nitrogen.pdf

A CLOSER LOOK AT FLORIDA FORESTRY

John Dooner grew up helping on his family's tree farm since he was about 12 years old, or, in his words, old enough to carry a drip torch used in prescribed burns, an important forest management tool.

Dooner is from Gadsden County, Florida, which was a major shade tobacco farming area. His own maternal grandfather was a tobacco farmer. However, when the tobacco industry declined, farmers shifted to other land uses: ornamental nurseries, tomatoes and forestry.

Dooner's father, Michael, saw this transition. In the 1980s, after graduating from forestry school at the University of Florida, Michael Dooner started Southern Forestry Consultants, a forestry consulting business to help farmers and investors manage stands of forests, many of which were planted on old tobacco farms. John Dooner initially planned to pursue a career in environmental law but ultimately joined his father and other partners in the consulting business after earning degrees in business and forestry.

The Industry

While Florida has several large industrial (some publicly traded) forest owners, who contribute significantly to conservation efforts on forestland, much of the industry is fueled by nonindustrial landowners: families, individuals and small investment groups. These nonindustrial owners are typically interested in balancing or even conceding some return on investment with alternative conservation-driven goals. They want forested areas for wildlife habitat to support hunting, bird watching, and other forms of recreation or even just for aesthetics, anchored in a conservation ethic. Southern Forestry Consultants has a long history serving nonindustrial landowners by offering services that combine timber

production with habitat and ecological enhancements.

A variety of wildlife (birds, mammals, reptiles, etc.) benefit greatly from forest best management practices, which have been implemented industry-wide for decades, Dooner says. Many forest landowners in Florida choose to go above and beyond these minimum requirements by protecting extended riparian areas along waterways, intensively managing groundcover underneath established timber stands, and maintaining timber stand densities that promote healthy wildlife habitat.

"When you consider Florida's forestland at the landscape level, you begin to understand the mosaic of land cover types across the region," Dooner says. "This is a product of varying landowner objectives coupled with a commitment to stewardship, and it is good for biodiversity."

One Tree, Many Products

Mack Glass, from Jackson County, shared a typical example of how pine trees are harvested in Florida: When trees are about age 15 and then again at about age 20, a selective harvest removes weak or defective stems to obtain specific spacing. This reallocates resources to healthier trees, allowing them more space to continue growing. Simultaneously, the forest canopy opens up so that sunlight reaches the forest floor, promoting other beneficial vegetation, such as shrubs and grasses used by wildlife. A final, clear-cut harvest is conducted when trees are around age 30-35. The land is replanted, and the process begins again.

Some limbs and debris are left to return nutrients to the forest soil, but most of the tree is hauled to mills in North Florida, South Georgia or South Alabama.

"The industry in the tri-state area works well across state lines and is fortunate to have robust markets for timber," Dooner says.

Mature trees may be used to manufacture utility poles, lumber products, plywood, hardwood flooring, crates or beams used in building high-rises. Small trees and the top portions of larger trees, which have knots and crooks, go to a pulp facility that manufactures paper, pellets or oriented strand board (OSB) material. Saw dust and other low-quality parts of the tree are burned on-site or at another facility for energy to power the mills.

"Our markets are strong, yet most timber producers have other primary sources of income," Dooner says. "Revenue from timber may be used as a retirement account, college fund, supplemental revenue stream or to fund conservation activities on a forestland."

A Long-Term Investment That Must Hold Value

Dooner says most forest landowners would like to continue growing trees

Photo Courtesy of John Dooner

for years to come. However, investing in the establishment of a timber stand can be hard to justify as development and alternative land uses continue to grow in value and often outpace return from agricultural endeavors, including forestry. Further, fragmentation of forestland inherited by successive generations often leaves owners with parcels too small to feasibly manage as working forestland.

"It has to make sense financially," Dooner says. "They can't risk the livelihood of their family. If we can create opportunities that at least keep forest landowners close to remaining competitive with the value of development or other land uses, they'll keep growing trees."

Dooner offers solutions such as investment in new forest products and payment for ecosystem services, which he notes landowners have been providing for free for a long time. University of Florida and Oregon State University researchers, in a chapter on "Managing Florida's Plantation Forests in a Changing Climate," cited a 2012 Florida study by Escobedo et al. that estimated "the typical acre of nonindustrial private forestland annually provides $5,030 of ecosystem services (e.g., timber, carbon storage, water quality and wildlife habitat), with just 7% of that value from timber."[8]

"You could argue 'why pay for something you're already doing?'" he says. However, the value for these ecosystem services – clean water, clean air, for example – is increasing. A rapidly growing population equals increased pressure on limited resources.

"This elevated pressure on resources can be understood as increased demand for ecosystem services," Dooner says. "We need to be able to claim some of that value."

8. https://floridaclimateinstitute.org/docs/climatebook/Ch09-Martin.pdf

dy soil, are drought-tolerant, and are resistant to most pests and diseases. However they are a bit tricky to plant. Currently, perennial peanuts are planted materially, meaning their rhizomes, or special underground stems, are buried a couple inches deep into the soil. If you're not careful, you can create a rough pasture with the peanuts, Glass says.

University of Florida researchers are working on a seeded variety of perennial peanut to make planting easier and to create less soil disturbance. Glass appreciates the research and looks forward to improvements. Regardless, though, he is happy with the protein-rich forage for his cattle and for the soil and plans to keep adding perennial peanuts to his pastures. The yellow-flowered forage has done well to reduce erosion, reduce his need for synthetic nitrogen, and build soil health, which in turn helps create a cleaner watershed.

Glass spends a lot of time thinking about protecting the watershed.

"My grandkids drink this water here, so I have a real dedicated effort to keep this water clean," Glass says.

Building Resilience

The third component of the family ranching business is timber, which supports the family's goal to leave more marginal land in forest cover. Trees also help cycle clean water and provide wildlife habitat, and timber allows the family to further diversify their income.

In the 1980s, Glass planted a stand of pine trees: slash, shortleaf and loblolly. After about 10-12 years of growth, diseased or smaller trees were taken out to provide more space for the other trees. These trees were sent to a mill that turns them into pulp wood for paper or chips for energy. In 2018, the pine trees were big, about 30-inches around, perfect for larger logs used in the building industry. The family had just started the process of cutting those trees and replanting young ones when Hurricane Michael made landfall and blew all the trees down. Glass was left with 120 tons of debris, his 30-year investment decimated.

"It meant we had to tighten our belt for a few years," Glass says.

Some of the debris naturally decomposed while, over the last several years, some downed trees have been sold for wood pulp and chips. In the meantime, Glass replanted and hopes to begin marketing mature trees again in about 10 years.

"It's agriculture," Glass adds. "You try to be resilient and plan for the unknown then do the best you can with what happens."

Glass advocates for the continuation of agricultural research that helps develop technology and best practices that help farmers protect the environment and remain economically viable. It's important, too, that policy makers and the public understand how agriculture works and the implications of policy on agriculture. Something as simple as how far a guardrail is placed from the white line on a highway (18 inches is too short) can make a significant difference in safe transport of farm equipment, for example.

"We do the very best we can to protect this land and the water recharge," Glass says. "We need more education and less regulation. We honestly will do what we know to be the best."

Dr. Meghan Austin, Jackson County, Panhandle
Cindale Farms

"Getting bigger was not a good option, and neither was getting out."

Agriculture is a notoriously low-margin business. Dairy is especially so. It has gotten harder and harder for small dairy farms to survive. They are often faced with a choice: get bigger or get out.

Meghan and Brad Austin and Meghan's parents, Dale and Cindy Eade, began talking about the future of their family dairy shortly after the Austins returned home as co-managers in late 2009. They considered adding cows to the herd. A small operation, they milked 350-400 cows at the time. They felt comfortable expanding up to 800 cows; however, considering the average herd was 1,000, they decided that would not be financially feasible long-term.

Getting bigger was not a good option, and neither was getting out. So they took a third path: diversification.

The family agreed to make ice cream with their milk, and, led by Meghan's sister Lauren began building their brand, Southern Craft Creamery. Lauren, her husband and Cindy took courses at Penn State and University of Wisconsin to learn the chemistry of making ice cream. Then they spent more than a year perfecting their recipes for pasteurized but non-homogenized ice cream that has no additives or stabilizers but plenty of local ingredients – milk from the family's dairy and add-ins from other local farmers, including Mack Glass's satsumas. They wanted to keep their ice cream as minimally processed and locally sourced as possible, both to reduce start-up costs and to appeal to customers.

Southern Craft Creamery opened in 2012. Initially, the family focused on wholesale so they could operate under the Florida Department of Agriculture's dairy division and the same inspectors that already came to the dairy. They targeted marketing toward a nearby beach district and in the larger cities of Pensacola and Tallahassee.

"My sister jokingly says, 'You're not cool in a small town until you're cool somewhere else,'" Meghan says. "And a small town can only sustain a business so much. Our local community has been incredibly supportive, but there's only so many people within our footprint."

Their big break came in 2013 when Southern Craft Creamery was selected as Garden & Gun magazine's overall winner in the Made in the South Awards. They were on the map.

Today, the family sells ice cream and coffees at a retail location they opened in 2017 in Downtown Marianna. The building includes their processing facility so customers can

Photo courtesy of Meghan Austin

watch their ice cream being made in front of them. In 2020, they were granted a license from the state for bottling their own milk. They bottle and sell their milk in another, nearby renovated building downtown, which doubles as a farm-to-table market that sells beef, cheese and other local products in addition to milk.

Their operations all go back to where they started: the farm.

The Circular Approaches

Jersey cows graze the land rotationally, which boosts soil health. The Austins switched to the Jersey breed from Holstein and began rotational grazing when they started managing the farm. Meghan prefers working with Jerseys, a smaller but efficient breed known as good grazers. Cindale Farms is one of only a few dairies in the state that rotationally graze. Meghan explains this is largely because of their small size. Larger dairies, she says, are subject to waste management regulations that have pushed cows indoors.

Brad plants multi-species forage mixes, including ryegrass, triticale, oats and red clover, for the cattle to graze in the winter, and incorporates perennial forage crabgrass and Tifton 85 bermudagrass in the summer. An unexpected summer forage is a bracharia species native to South America. Meghan is not sure if it was brought in with a bag of seed or a hurricane, but it has taken over and been a surprisingly high quality summer forage. Maximizing plant diversity, keeping living roots in the ground and the soil covered, and integrating livestock are all principles that improve soil health. In addition to fresh forage, the cows receive supplemental feed, generally made from upcycled sources, for example, cotton seed, citrus pulp and distiller's grains. Hay is grown and harvested by local farmers.

Brad jokes that the only fertilizer they buy for the farm is in the form of feed. The cows produce all the fertilizer they need, both fresh while grazing and captured. Barns are washed, with wastes settling in a concrete-lined basin and liquids draining into a lagoon, both of which get used to fertilize fields. All wash water for barns and equipment is collected and reused as field irrigation.

Meghan, a veterinarian, and Brad, who holds a Ph.D. in ruminant nutrition and reproduction, say the dairy is unique in that it is managed more like a beef cattle operation. They use some artificial insemination for breeding but rely mostly on natural service. Calves are born during either fall or spring calving season as opposed to year-round as in most dairies, and the calves are raised by their moms until weaning at 3-3 1/2 months. Meghan says the reason behind specified calving seasons is purely personal. They like having seasons where they can focus on different parts of the operation. Not every dairy could have cows raise calves by their side. In fact, Cindale Farms participated in a study by the University of Vermont on the topic. The Florida dairy was one of only 10 dairies found doing so. Meghan credits, again, the operation's smaller size and their rotational grazing for helping them make it work.

About 80-90 acres of woodlands run through the middle of the property, adding more biodiversity to the farm and providing ecosystem services such as water filtration and wildlife habitat. A diverse array of birds and other wildlife – black-bellied whistling ducks, egrets, ibises, Mississippi kites, eagles, osprey, fox squirrels, gray and red foxes, bobcats, alligators, deer, turkey – take refuge among the hardwoods at different times in the year.

As members of a dairy cooperative, the family sells their milk to the cooperative then purchases back what they need to make ice cream and bottled milk. They source ice cream flavor ingredients and products sold in their market as locally as possible, within food safety regulations. A local beekeeper produces both a Tupelo and a wildflower honey. Meghan's mom grows figs and sources additional figs, lemons and kumquats from other growers. Satsumas come from Mack Glass (see Mack Glass's story).

They also sell their beef at the market, made from bull-calves-turned-steers born on the farm.

Photo courtesy of Meghan Austin

"I don't care what size farm you are but especially small farms, the financial ability to do some of these things is a struggle."
—Meghan Austin

Thinking Ahead

Looking to the future, the Austins want to improve access to water and electricity for electric fencing so they can better rotationally graze dry cows and young cattle like they do their milk cows.

"We would love to be able to do more rotational grazing on those pastures and build up soil organic matter," Meghan says. Soil organic matter is the foundation of the soil's fertility and ability to hold and filter water.

The family has partnered with their local Natural Resources Conservation Service (NRCS) office on Environmental Quality Incentives Program (EQIP) projects to prepare pastures for rotational grazing in the past and would like to lean into NRCS funding and technical assistance again in the future.

"I don't care what size farm you are but especially small farms, the financial ability to do some of those things is a struggle," Meghan says. "It's really important for us to have resources where we can receive either cost-share or grant funding for things like that."

Rising costs make providing high-quality, nutritious products for the community harder every day, she says. But it's important to keep growing.

"If you are able to support local farms within your region, do, because you are their backbone," she says. "That's what keeps farms in the family or even just farms as farms. It's keeping that green space green, not just in houses and concrete."

Photo courtesy of Meghan Austin

David Hill, Lake County, Central Southern Hill Farms

Photo courtesy of Southern Hill Farms

Many of Central Florida's orange groves have been lost to diseases, like citrus canker and citrus greening. The freeze of the 1980s brought a final blow to the orange grove in Clermont, Florida, that **David and Lisa Hill** bought in the early 2000s. Previously, the Hills farmed with Lisa's father. They grew vegetables on the drained marshlands of Lake of Apopka until June 1998, when the Lake of Apopka Restoration Act passed. The vegetable farm was returned to wetland, and the Hills started over by planting landscaping trees on 80 of the 120-acre dead orange grove.

Then the recession of 2008 hit.

"Florida stopped," Hill recalls.

With development at a standstill, demand for landscaping trees dwindled. The Hills decided to make a return to food crops. With their remaining 40 acres, they planted commercial blueberries in 2011. Then they ventured into agritourism to further diversify. They invited the public to "u-pick" some of their blueberries for the first time in 2014, and have since replaced landscaping trees with a number of crops, including strawberries, blackberries and peaches.

Today, they grow blueberries and strawberries commercially but largely focus on providing the public with fresh fruit and fun as a family-friendly destination with a market and events.

The Circular Approaches

Pine bark, a byproduct of pine milling, is brought in to add organic matter and lower the soil acidity as needed by the blueberry plants. As perennial crops, berries don't need to be replanted every year. However, they do get trimmed in the summer. Those trimmings are left to build the soil up.

Commercial berries are picked and packed on-farm. Visitors pick berries, other fruits and seasonal vegetables in u-pick patches. Overripe, cull berries are used to make blueberry lemonade, blueberry muffins, jams, jellies and other sweet treats sold in the farm market alongside additional local products, including candles and soaps.

Moisture and temperature sensors across the farm inform the Hills of environmental conditions so they can make decisions on when and how much to irrigate. At least two-thirds of the farm's irrigation comes from reclaimed gray water. The rest is from wells and is used primarily for freeze protection when necessary. Hill sets the sensors to alert him when temperatures get down to about a half degree warmer than would concern him. He then watches the weather and turns the irrigation on himself, even if it means staying up all night.

Reclaiming Water

The ability to use reclaimed water is one of the reasons the Hills were attracted to this particular piece of property.

A joint venture between the city of Orlando and Orange County started collecting and cleaning up gray water. They needed a place to disperse the reclaimed gray water and landed on the sandy soils of the old orange groves outside the city, including the one that has become Southern Hill Farms. The sand acts as a natural water filter.

Reclaimed water is piped to the edge of the farm, where the Hills tap into it. The water is tested monthly for safety, and it never touches the fruit. Instead, drip irrigation is placed beneath the plastic or mulch of beds so that it delivers moisture to the roots.

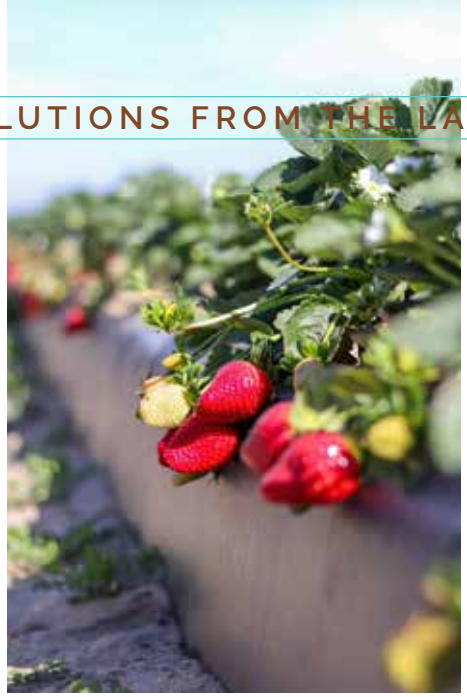
"We are trying to do right by the environment," Hill says. "We are taking the least desirable water in our community, cleaning it up, then using it in the most responsible way by irrigating our crops and replenishing the aquifer."

He goes on to say he sees all farmers as environmentalists, each in their own way.

"Farmers approach environmental stewardship differently because they have access to different things," he says. "We have access to reclaimed gray water."

Public Connections

Initially, Hill was not excited about opening the farm up to the public. Every time he read a news story or opened up a popular magazine, it seemed like agriculture, especially "big ag," was getting bashed. He personally saw farmers as the hero, but it seemed the public saw the farmer as the anti-hero, or "the guy with the black hat," he says.



It's a new day now, though.

"The millennials and younger people, they want to know where their food comes from," Hill says. "Parents want their kids to see what a farm looks like, so they come out here and they get to pick a crop, and they get to talk to me. They get to trust the farmer, whereas before they didn't."

He says relationship building has been one of the best things to come from agritourism. He gladly answers his customers' questions about his farm and about agriculture in general. He helps people understand that "big ag" is nothing to fear. They're under a microscope, he tells them, with high stakes in ensuring food safety and compliance.

"We get to educate people in Central Florida, and they're hungry for it," Hill says.

Keeping Ag Land

Hill says he faces the same challenges as other farmers: labor, markets and weather. As a small-scale berry producer, it's tough to compete against other countries with less regulation and cheap labor, he says. He is always considering different crops and ideas to remain viable.

"Sustainability to me is making common sense decisions to leave the land better than you found it, but as a farmer, first and foremost, is profitability," Hill says. "Without profitability, you're not going to be around to do the right thing."

Agritourism has offered a solution, but it has its limitations. It would be easy to sell the land just 25 minutes from downtown Orlando. Hill gets offers every week, but that's not what he wants to do. One of his sons manages the blueberry farm, the other manages the packing house, and his daughter helps from home while raising her children. He wants to see the farm remain profitable for future generations.

"There are so many ways a farm can help the world – water drainage, wildlife habitat, carbon sequestration," he says. "Once you put the land in concrete, you're not helping the world anymore. I hope this property stays in agriculture as long as possible."

Photo courtesy of Southern Hill Farms

Steve Johnson, Hardee and Manatee Counties, Central Treeair Cattle Company & Johnson Harvesting

When **Steve Johnson** graduated from the University of Florida in 1998 and returned to work full-time on the family citrus and cattle farm, he made $25,000 per year. He had already taken over much of the day-to-day operations two years prior, after his dad's heart attack. He wanted to be there. But for the farm to support another family, he needed to find ways to make more income.

He began looking at the books — and around the farm. He noticed most of the farm's equipment went unused all but two months of the year.

"The rest of the year, they cost us money," Johnson recalls thinking. "So why aren't we utilizing them somewhere else?"

He approached his dad with the idea to expand further into harvesting. His dad hesitated but agreed to sell him the equipment, and Johnson Harvesting was born. The custom harvesting company started with 20 employees and now employs close to 400, though it has employed as many as 1,200. Crews harvest crops like watermelons, strawberries, blueberries and citrus for local growers and fill other labor needs.

Supplying labor, brokering fruit, growing hay and sod – these are all enterprises that have diversified the farm that for four generations had primarily grown oranges and cattle. This diversification became especially important as citrus greening and other citrus diseases began moving in and weakening orange production in 2005.

"I saw if we wanted to evolve and continue to make money, we had to diversify," Johnson says. "If we stayed

Photo courtesy of Steve Johnson

status quo, there was no way for us to survive."

The Circular Approaches

At one time, the Johnsons managed almost 1,000 acres of orange groves and kept a few cows. Now, because of citrus greening and other diseases, the family is down to 300 acres of orange trees but up to a 1,000-head cow herd.

With more cows, Johnson is conscientious of good grazing management and plant nutrition. Much of the grazing land he leases is reclaimed phosphate mining lands, which tend to have lower pH levels and are susceptible to cogan grass, a nonnative invasive species. Johnson uses rotational grazing and, for the last two years, has experimented with added fertilization. He takes wastewater from a local fertilizer plant and spreads it across the pastures, guided by soil tests to ensure he does not overfertilize and stays within best management practices. This has helped bring back native bahiagrass on these pastures.

In the orange groves, subterranean tiles drain excess rainwater into a holding area. When the groves are dry, this water is pumped back out onto them through an iirrigation system. Compost is brought in to add organic matter in the orange grove and improve the soil microbiome. If a load of oranges is rejected at market, those oranges are brought back to the farm and fed to the cattle.

Circular Exploration in Citrus

Johnson says the citrus industry has a hard time adopting circular systems and reusing materials for multiple reasons. For one, there is the nature of how trees grow. Cover crops can be planted between rows of trees, but the shade hinders growth and reduces the benefit. There is also economic factors and the risk of investing time and money in new systems, especially with citrus greening making returns tighter than ever.

It takes three to four years to get a good crop off a young tree, but because of citrus greening, most trees only live about 10 years. The industry estimates about 30% of a tree's roots are lost in the first of year of the infection, which is spread by a

"... the industry recognizes the health of the soil microbiome is crucial to tree health ..."

gnat-or-smaller-sized insect called a psyllid. Most orange growers are not planting new trees because of the disease, which has cut yields by as much as 75%. Production used to be 300-400 boxes per acre. Now it is 75-100, Johnson says, and he will be surprised if 10 million boxes are picked across the state (compared to 250 million when he graduated from college).

Johnson says he and others are waiting for resistant tree varieties, at least one of which is now available but yet to be proven.

There are few examples of circular experimentation Johnson points to, such as:

- A dairy farmer used the waste slurries from his dairy as fertilizer in his orange groves. This practice ended once the farmer sold the dairy.
- A few people tried to turn old citrus wood into barbecue pellets, but the business only broke-even.
- Groups, such as Biotech Applied Research (BAR), are making biochar from citrus wood. Johnson says this is a newer, and especially intriguing, area of experimentation.

As his next step in circularity, Johnson has been working with Vanguard Renewables to build an anaerobic biogas digester on his farm. He will bring in expired and otherwise rejected foods from distribution centers to feed the digester. The digester will turn those feedstuffs into natural gas and a slurry that can be put back onto the orange groves through irrigation as fertilizer.

Other Barriers

Johnson says the industry recognizes the health of the soil microbiome is crucial to tree health, which is why the use of compost is on the rise. However, it takes at least one to two years to see a difference. That difference is mostly in tree health, not in fruit quality, he says. Fruit quality is key for the Florida market, he adds.

Then there is labor.

"Labor is always an issue, and labor is always a hot topic," Johnson says. "It has been for fifty years, and it will continue to be."

Citrus is especially labor intensive, Johnson says. It is not as mechanized as other industries in part because citrus greening has made the trees too fragile to withstand mechanical harvesting, which Johnson used prior to the disease takeover.

Johnson relies on the H-2A program to bring in employees seasonally. He says it is his "only good source of labor," but it is subject to policy changes and, at times, uncertainty. Typically, workers come in at the end of September or beginning of October, depending on when visa petitions are approved. In 2025, however, the government shut down on Oct. 1, just as work would normally be ramping up. Only 60 of his 400 employees had arrived as of mid-November, and he did not expect the rest until first week of December. This created a nearly two-month delay of work and loss of income.

Johnson says it's determination to figure out how to make citrus work that keeps him going. That and hard-headedness, he adds with a laugh.

"I also have kids that I hope will come back and take over," Johnson says. "I'm just trying to keep everything going so they have something to come back to within the citrus industry."

Lance McNeill, Polk County, Central Mineral Grow

Millions of years ago, the sea covered Florida. As land emerged, rivers and streams flowed into the sea carrying materials washed from the land. The remains of ancient land animals came to rest with those of the coastal sea creatures.

Time passed. Bones and other fossils settled. Marine biochemistry and geology did its work to form phosphate-rich sediment. Then, in 1881, Captain J. Francis LeBaron, an engineer with the U.S. Army Corps of Engineers, found it in Polk County, east of Tampa. Florida's phosphate mining industry would soon begin. With it, agriculture would also rise with access to phosphate fertilizer. Presently, Florida produces about 80% of phosphate used in the U.S. and 25% used around the world.

Lance McNeill lives in Polk County not far from where LeBaron stumbled upon the phosphate-rich rocks of Bone Valley. He is the third generation of his family involved in mineral ventures, and his focus brings that legacy full circle.

McNeill goes to lands disturbed by past decades of phosphate mining, recovers leftover phosphate from previously mined areas called tailings, and returns the land to its more natural state with native vegetation and better water quality.

"It's a feel-good deal," McNeill says. "You're providing a good product to make fertilizer, which the world needs to feed the population, and you're cleaning up the lands."

Photo courtesy of Lance McNeill

In recent years, McNeill has found another opportunity for turning mining waste into value for farmers and society. Mining operations left behind huge pits of clay, holding ponds of about 640-700 acres each. These holding ponds are called Clay Settling Areas (CSAs) in Florida, McNeill says, in which clay was pumped and has now been sitting for 50-plus years.

McNeill's product Mineral Grow, commonly referred to as "soft rock," takes that clay and turns it into an Organic Materials Review Institute (OMRI)-certified soil amendment that holds water and, combined with chicken litter or biochar, boosts fertility. The product is rich in phosphorus and calcium along with many other valuable minor elements.

The Circular Approaches

Clay from old mining sites is dug up

"Florida produces about 80% of phosphate used in the U.S. and 25% used around the world."

9. Davis, Ennis. "15 Things You Didn't Know About Polk County." https://www.thejaxsonmag.com/article/15-things-you-didnt-know-about-polk-county/

10. Ask IFAS. "Florida's Geological History." https://edis.ifas.ufl.edu/publication/UW208

and allowed to dry with sun and wind before going through a milling process then screened for size. The clay is then bagged and sold mostly in bulk to farmers across the country, including Amish communities in Pennsylvania and Gamble Creek Farms in Parrish, Florida (see Ed Chiles' story). It's also bagged and sold in retail outlets for home and garden use.

Lab testing has shown Mineral Grow can save 40-60% of irrigation needs thanks to clay's ability to retain water. The colloidal nature of the clay also has been proven to keep the product at root level, meaning no runoff or leaching into the soil. Thus Mineral Grow is an all-natural phosphorus source that will not end up in water ways.

McNeill has been working with Andrew Bass of Live Oak, Florida, who makes the organic fertilizer Everlizer using chicken litter from Florida and Georgia farms, to make a combination product that would help farmers both retain water in and fertilize their sandy soils. They are testing the product in a controlled experiment, which will be reviewed by University of Florida Institute of Food and Agricultural Sciences researchers, as well as at Gamble Creek Farms. A third element, biochar, is incorporated alongside the clay and chicken litter to add a carbon sequestration component for farmers interested in participating in carbon markets.

Reinfusing Life Into the Soil

McNeill believes the upcycled clay is perfect for Florida farmers.

"It's a real exciting time for us because we want to do the right thing for the water and the land," McNeill says. "With Mineral Grow, we can save water. It helps with nutrient runoff. And perhaps most importantly for the farmer, we have demonstrated 40-50% yield increases."

McNeill has already seen the product do good things for the soil. He uses it in his own front, but not back, yard to demonstrate the difference. He once grew potted tomatoes, one with Mineral Grow and one without. The one grown without was infested with pests. The one grown with Mineral Grow grew healthy.

"This just shows that with healthy soils nature can take care of itself." McNeill says.

On a larger scale, he points to a 35-acre orange grove within a larger, dead grove. The owner had been spending $2,800 an acre for four or five years trying to keep the trees alive and productive, but he had given up. He was preparing to bulldoze them and so gave a group permission to try the Mineral Grow product on it. They spent $290 per acre on the grove using all organic products, including soft rock. They focused on getting the soil healthy again by adding organic matter. Earthworms, butterflies and birds began to reappear, and, in about three years, the grove was producing 350 boxes of oranges an acre.

McNeill is investigating how he could incorporate composting as another way to add biology to his clay. He sees great opportunity for the reuse of clay left behind by past generations in their hunt for phosphate. While Mineral Grow is a small company for now, McNeill is ready to scale up as the market allows. He sees potential for farmers and for homeowners wanting green grass without risking loss of nutrients into waterways.

"There is phosphorus in all of Florida's soils," McNeill says. "It's just bound up, unusable by the plant. What we're doing is increasing the microbes, and they start making that phosphorus available. It's getting back to basics."

Photo Courtesy of Lance McNeill

Chuck Obern, Hendry County, South C & B Farms

Chuck Obern started his farming career in the greenhouse. Duda farms hired him to grow vegetable transplants in 1979, shortly after he graduated from the University of Florida. Then he learned to graft and grow citrus trees – more than 1.5 million of them – while working for another farmer in Immokalee, Florida.

In Immokalee, Obern's boss allowed him to start growing what he calls a big garden. First it was 10 acres, then 20, then 40. By the late 1990s, Obern was working full-time and farming 60 acres. That's when the owner of Pace called asking if he could grow 3 million pounds of jalapenos for the Texas company's salsas and picante sauces. Obern did, with Pace providing him a blanket line of credit to buy anything he needed to bring in the crop.

"He had a lot of confidence in me," Obern recalls. "That made me a big-time farmer."

Today, Obern grows more than 60 different vegetable and culinary herb crops on 2,700 acres in South Florida, in the C-139 drainage district, adjacent to the Everglades National Park. His produce is sold to retail supermarkets, restaurants and other distributors as far west as Texas and Chicago.

Some of his produce is certified organic and some is conventional. However, both receive similar treatment with a large focus on biodiversity and promoting a healthy ecosystem.

The Circular Approaches

Farming near the Everglades requires Obern to pay great attention to water running off his farm. Obern adheres to best management practices and legal requirements to capture rainwater in above-ground impoundments (AGIs). He reuses some of the water captured for irrigation rather than pulling from wells and works with Dr. Sanjay Shukla and other UF IFAS researchers, the Southwest Florida Water Management District, and private engineers to further improve systems for the benefit of the farm and watershed.

Photo Courtesy of C&B Farms

Some of the phosphorus-mitigation projects on the farm have included development of:

- A methodology that allows water coming off the farm to be reused by the farm or treated with aluminum sulfate (commonly called alum) before leaving the farm. A UF IFAS study on the farm found that aluminum sulfate brought phosphorus levels from 175 parts per billion to 8-10 parts per billion for a few dollars compared to the $350-700 it costs per pound of phosphorus removed by storm treatment areas (STAs). This is clean enough to

"To attract beneficial insects, Obern plants flowers and other plants"

"Promoting biodiversity is not just good for the environment ... It makes dollar sense."

run straight into the Everglades, which has a threshold of 10 ppb.

- A canal system in which water cascades down levels. A study showed at least 60% reduction in phosphorus from beginning to end.
- A methodology of growing high-phosphorus-absorbing crops (like grass or cattails). Harvesting these crops during the dry season removes phosphorus, and the crops can be composted and returned to the land. This is important because another downfall of STAs is that they can and are reaching phosphorus saturation levels.

Composting is a regular activity on the farm. Horse bedding used by the polo ponies of Wellington, Florida, is brought to the farm to be composted. About 8-10 tons of compost per acre is spread across the land. Compost does not yield a quick return on investment, Obern says, but it creates a more uniform soil after about five years. He rarely sees, for example, streaks of yellow plants within a field, and some of his soils test at 1.5% organic matter compared to the standard 0.5% on native South Florida soils.

Other circular practices tap into natural predator-prey relationships of the ecosystem to address pests and diseases.

To combat damage-causing insects, Obern relies on beneficial insects. To attract beneficial insects, Obern plants flowers and other plants that support the flowers or the overall ecosystem.

For example:·

Sweet alyssum flowers provide nectar and pollen (food) to many beneficial insects, including aphid wasps.

- Mexican sunflowers planted in ditches and intercropped among vegetable crops feed the minute pirate bug, which eats thrips and, to a lesser degree, white fly eggs.
- Buckwheat supports flowers.
- Oats, a type of grass, targets aphids that eat only grasses.
- Flowering basil attracts serpent flies, another predator to aphids.

To prevent soilborne diseases, especially fungi-driven, the farm

Photo Courtesy of C&B Farms

grows its own microbes using a purchased mother culture. Instead of using soil fungicides to kill fungi, the farm sprays microbes onto fields to strengthen the soil microbiome and prevent damping off and fungal growth.

Native wetlands are reserved on the farm to provide habitat for the roseate spoonbill and other threatened or endangered bird species.

Eucalyptus trees have been planted around all the fields as wind breaks and to slow cold weather. Between every block within a field, sugarcane provides an added wind break. The sugarcane also hosts sugarcane aphid, which provides more food for beneficial insects.

Sunn hemp and sorghum are planted as cover crops to reduce weeds and increase soil organic matter. Tactical flooding helps control nematodes.

Financial Necessity

Promoting biodiversity is not just good for the environment, Obern says. It makes dollar sense.

"I'm a realist," Obern says. "I'm an economic man with a slant toward using ideas and technology to my benefit."

Before using beneficial insects as biological pest control, he could not control aphids and other pests on his organic kale, collard greens, cabbages and all other brassicas. He lost several hundred thousands of dollars in crop losses to diamondback moths. Supermarkets rejected his crops because there were too many bugs on them.

"I had to do something different," he says.

The greatest barrier to a circular bioeconomy in agriculture, he says, is money. He has been able to use federal programs to help fund his tailwater recovery systems and some other projects through the Natural Resources Conservation Service (NRCS). He says for farmers to move toward circular bioeconomy systems, it is essential for the government to offer programs that encourage circular ideas because most farmers are living to survive one more year.

"[Vegetable farmers] are never sure of our future because it's so tentative with our competition with Central and South America," Obern says. "Every year, we're on pins and needles wondering whether we're going to be able to pay our bills and go on to the next season. That's a real fact and why most vegetable land around here is on year-to-year leases."

Obern sells about $46 million of produce per year, but it takes an $8 million investment at the start of every season. Labor is a challenge. With few local applicants interested in field work, he brings in employees from Mexico via H-2A visas. He pays workers at least minimum wage plus provides housing and covers the visa costs, which brings his real cost of labor to about $22/hour, much more than his competitors in places like Mexico, the Dominican Republic and Guatemala.

Focus On Efficiency

Recently, the farm enrolled in the USDA's Whole-Farm Revenue Protection program. Unlike traditional crop insurance, which covers individual crops, this program protects revenue and offers the best price to farmers like Obern who produce a diverse mix of crops, which naturally reduces risk. It's a smart program, Obern says, and one that helped him face two hurricanes in 2024.

Thoughtful programs can help farmers, but Obern says efficiency underlies his business strategy. Building up the soil and ecosystem – transforming unproductive soils into productive vegetable lands – makes his farm more efficient. So does technology.

GPS-equipped tools plants in straight rows; spray and fertilize at precise rates; and trace each box of produce back to when, where and by whom it was picked as part of USDA's larger traceability initiative.

Two software engineers on Obern's team evaluate and integrate technology into the farm's operations. Obern experiments with robotics for activities like weeding and spraying.

Obern also experiments with extending the growing season. Traditionally, the season ends in late May and does not start back until November. Now, he is pushing cold-weather crops through June and harvested cucumbers and squash through October.

He is always looking into new management tools that will add efficiency and solve problems on the farm. Lately, Obern has been experimenting with different trap crops targeting the yellow margin leaf beetle, and he plans to place pots of mullein near areas with white fly problems. A particular beetle that eats white flies makes their home on mullein plants, so he will inoculate these potted plants with the beetle as a biological pest control for white flies. He is also continuing trials of using cataulacus, a type of ant, to control pepper weevils.

Always Learning

Obern is quick to say the ideas he has tried are not his own. He makes friends and learns from them. He tries their ideas for himself, tailoring them to his farm. And he shares what he has learned from others.

"We continuously learn," he says. "Don't think there's an endpoint

Dr. Lanette Sobel, Miami-Dade County, South Fertile Earth Worm Farm

"Sobel's goal is to divert as much food from the landfill and incinerator as possible and instead feed people ..., animals ... and create soil."

As a consultant to hotels wanting to achieve green certifications, **Lanette Sobel** discovered massive amounts of organic materials going to waste. There were only two places at the time for it to go: the landfill or the incinerator. Sobel set out to create a third option, one that would send the food scraps to "the highest, best use," she says.

Sobel founded Fertile Earth Worm Farm, which has become the largest commercial composting operation in South Florida.

"That doesn't say much," she says. "We are 10 times bigger than the next guy, but currently we only handle a fraction of 1% of South Florida's waste stream; and since about 50% of that waste stream is organic matter that can be rescued, that means we are just getting started. If we have a chance to work with the county, there is space for us to grow exponentially."

The worm farm is more than just a worm farm. Sobel's goal is to divert as much food from the landfill and incinerator as possible and send it instead to feed people first, if possible, animals next, then to create soil.

The Circular Approaches

Sobel works with a wide network of companies and farmers across the food value chain to maximize the use of food for humans, animals and soil. Food distributors call her, for example, to say they have tons of fruit sitting at port due to a market hiccup and won't be able to truck it to farther destinations. Sobel contacts Feeding

Photo courtesy of Fertile Earth Worm Farm

South Florida, Farm Share, local food pantries and anyone who might be interested in what they have, and people come in droves to take it away.

Food scraps are picked up from commercial establishments, such as supermarkets and restaurants that pay for the pickup service. Material is loaded in specialized dump trunks modified to handle food then brought back to either the worm farm or another partnering farm. Food fit for animals feeds about 700 chickens per week. Scraps that will be turned into soil undergo a pre-composting process, which kills pathogens and weed seeds. Some is fed to earthworms, which produce fertilizer in the form of castings and worm tea, or is otherwise composted and turned into organic soil mixes.

The high-quality soil does not require fertilizer or other amendments, says Sobel, who holds a doctorate in plant medicine, a combination of soil and water science, plant pathology, entomology and horticulture studies.

Community Outreach

Compost fills multiple needs in the community:

- It diverts waste from the landfill and incinerator. According to Sobel, the county generates 5 million tons of trash annually, and organic matter, which could be composted, makes up more than half of it. The county's only incinerator burned down in 2023, so trash has been shipped outside the county at the expense of taxpayers, Sobel adds. It's time for a cleaner, healthier solution, she says, pointing out that people living near incinerators are known to have more health issues aside from environmental concerns for air and water pollution.

Photo courtesy of Fertile Earth Worm Farm

- It creates high quality soil for South Florida, which is naturally rocky. Any agricultural enterprise in the region has had to bring in soil in some capacity. Miami-Dade County is one of the top counties in the country for nursery plant production. This industry heavily relies on peat moss brought in from peat bogs as close as central Florida and as far away as Lithuania and Canada. Peat moss is a limited resource, and the industry struggles with pest and diseases due to resistance to current measures.

"If you have a healthy soil, you generally have a healthy plant, a plant that creates its own plant defenses," Sobel says. "Peat isn't really a soil. It has no biology, meaning it is devoid of life. The microbes that make nutrients and other compounds available to plants aren't there. Thus it's that much harder for plants to create the secondary metabolites to protect themselves."

She knows of nurseries spending thousands of dollars weekly to control pests.

"I can grow a much better plant with a lot less money by making a living soil where the plant takes care of itself," she says.

Fertile Earth also leads programs that directly benefit the community. The farm donates up to two yards of soil, valued at $400, to any public community garden and powers the Everglades Earth Cycle program.

Through the Everglades Earth Cycle program, residents of the Village of Pinecrest drop their food scraps off at a central location. Compost made from those scraps goes to the Miccosukee Tribe in the Everglades to be used in their community gardens. A grant from the U.S. Department of Agriculture will add seven drop-off locations in 2025, four in Pinecrest and three in the broader District 7 area. Sobel sees potential for some of the compost to be used to build up the Miccosukee's islands, where water levels are rising and the land is eroding.

"Soil cleans, so part of the thought process behind it is that by supporting the Miccosukee and their food sovereignty and improving the quality

"We need to see food as a resources … [and] use that resource to the fullest extent possible …" —Lanette Sobel

of their soil, we will be contributing to cleaner water for the entire watershed and everyone living in South Florida," Sobel says.

Policy Challenges

In March 2025, Miami-Dade County's Department of Environmental Resource Management (DERM) informed Fertile Earth that sales and even donations of soil mixes were not allowed. Around the same time, a new county code was drafted to require almost all composting operations, including those on farmland, to be managed the same as solid waste management facilities. Conversations were ongoing, and Sobel was hopeful for a positive resolution, but if the regulation were to be put in place as written, it would put her out of business and strongly discourage composting throughout the county.

Sobel says the natural biological process of composting was being blocked because of perceived liabilities and a perceived threat to the bond ordinance that protects the now-defunct incinerator. It's a shame, she says, because composting is neither difficult nor a nuisance if done correctly, and it's highly beneficial.

"Nature has been composting since the beginning of time on Earth," she says. "It works."

Instead of being afraid of composting and discouraging it, she would rather see any bad actors weeded out with best management practices and education requirements.

She sees additional solutions to problems surrounding the misuse of food. Depackaging equipment can extract food out of packaging, like boxes of cereal, jugs of milk or cans of beans. That food could be sent to feed pigs or dairy cattle or it could be composted. Other technology is helpful in addressing concerns about odor and groundwater contamination. Food scraps could feed anaerobic digesters that deliver energy to homes and businesses.

"We need to see food as a resource," she says. "We should use that resource to the fullest extent possible, and that's what we try to do at Fertile Earth."

Photo courtesy of Fertile Earth Worm Farm

IN PURSUIT OF CIRCULAR AGRICULTURAL SYSTEMS: ED CHILES' JOURNEY

Photo courtesy of Gamble Creek Farms

Ed Chiles, longtime restaurateur and environmental advocate, built his career at the intersection of hospitality, sustainability and stewardship of Florida's fragile coastal ecosystems. For more than four decades, he has worked to demonstrate how business, science and community can align to protect water quality, foster resiliency, and create circular systems that nourish both people and planet.

From Restaurants to Red Tide

Chiles' journey began in 1979, when he and his father purchased their first restaurant, the Sandbar, on Anna Maria Island, just south of Tampa. In 1988, he added Mar Vista on Sarasota Bay, and in 1993, the Beach House on the Gulf of Mexico. Each property offered direct exposure to Florida's iconic coastlines – along with the environmental risks tied to those waters.

Less than a year after opening his second restaurant, Chiles faced a devastating crisis. A harmful algal bloom, commonly known as red tide, struck the area. Caused by a dinoflagellate that attacks the nervous systems of fish and marine life, red tide leaves behind massive fish kills, a harsh odor and an aerosol that triggers respiratory distress. That particular bloom lasted nearly a full year – 11 months and 21 days – and nearly drove Chiles out of business, costing him employees and customers alike.

In response, Chiles joined with local officials, business leaders and concerned citizens to establish Solutions to Avoid Red Tide (START), a nonprofit dedicated to understanding and mitigating harmful algal blooms.

Discovering the Role of Bivalves

This experience led Chiles to a profound realization: The health of Florida's estuaries and coastal waters is inseparable from the health of its communities and economy. He began studying how clams, oysters and other bivalves could help restore balance. As filter feeders, bivalves consume plankton, bacteria and algae, improving water quality and reducing conditions that fuel red tide. Their waste, in turn, fertilizes the seafloor, promoting seagrass growth – the foundation of marine biodiversity and the primary food source for Florida's endangered manatees.

Chiles later partnered with Curt Hemmel, owner of the largest bivalve hatchery in the southeastern United States, to co-found the Gulf Shellfish Institute. Their mission: To advance research on how bivalves and seagrasses support marine ecosystems and coastal resiliency.

Closing Loops Through Recycling

Inspired by this science, Chiles expanded his efforts within his restaurants. Under the leadership of Chief Operating Officer Robert Baugh, his group launched a shell recycling program, collaborating with START, the Manatee County Department of Natural Resources, the Gulf Shellfish Institute and the University of Florida IFAS/Sea Grant program. Oyster and clam shells from his restaurants were dried, bagged and repurposed for shoreline restoration and as substrate beds for new bivalve growth.

This circular practice demonstrated how restaurant waste could be transformed into an asset for coastal ecosystems, creating a model for community-driven sustainability.

All Clams on Deck

The urgency of this work was reinforced in 2021, when a breach at a gypsum stack near the Port of Manatee released 200 million gallons of nutrient-laden wastewater into Tampa Bay. The discharge coincided with an ongoing red tide bloom, intensifying the event and

causing massive fish kills across Tampa Bay, Hillsborough and Pinellas counties.

Rather than simply lament the disaster, Chiles responded with action. He launched the All Clams on Deck campaign, successfully raising $5.5 million to support the Gulf Shellfish Institute. The initiative underscored the role of clams and seagrasses as natural, biological mitigation tools and called attention to the economic and ecological importance of resilient coasts.

As Chiles has often said: "Florida's economy is built on its coast. Our restaurants sit on the edge of the largest gulf in the world and the only place in the country bordered by three national estuaries – Tampa Bay, Sarasota Bay, and Charlotte Harbor. Protecting those waters is protecting our future."

Farming for the Future – A Circular Economy

Chiles' vision of circularity expanded inland in 2013, when he began leasing Gamble Creek Farm in Manatee County. Located on the historic Gamble Creek, part of the watershed that feeds directly into coastal estuaries, the farm was designed to grow produce for his restaurants while modeling regenerative practices. He subsequently purchased the farm, further cementing his commitment to using the land as a long-term model of circular agriculture.

Chiles' restaurants initiated a program to transport all food waste from the three properties to Gamble Creek Farm, where it was combined with wood chips sourced from surrounding rural land being cleared for residential development. Instead of rotting in landfills and producing methane, the scraps were transformed into compost that built healthy, nutrient-rich soil. These soils retained more water, sequestered more carbon, and grew nutrient-dense produce that was cycled back into the restaurants.

Reflecting on this effort, Chiles noted: "I believe every business tells a story. Over time, our restaurant story grew deeper and showed that the most important dynamic was the culture it created among our employees – and the way it differentiated our restaurants."

The farm transitioned from 50% to 100% Real Organic, one of the only six certified Real Organic farms in the state of Florida, adopting regenerative practices such as Korean Natural Farming (KNF), vermiculture, garums and microbial amendments.

The farm completed the circle, linking coastal protection with inland stewardship. What happens 26 miles east of Anna Maria Island on the edge of Gamble Creek directly influences the estuaries where 40% of Florida's commercial seafood spends part of its life cycle.

As Chiles puts it: "What we grew on the farm and how we grew it mattered. Featuring bivalves and sustainable seafood in our restaurants told a story of quality and resilience. It inspired our staff, attracted employees who cared, and gave our customers a deeper connection to sustainability."

Tackling Invasive Species – From Iberia to Florida

Another key chapter in the circular story is Chiles' partnership with Shogun Farms, which addresses Florida's invasive feral pig crisis. Wild pigs, present in 34 states, cause widespread environmental destruction – but their history is deeply intertwined with Florida's own.

The first pigs to ever arrive in North America came in 1539, landing in what is now Manatee County with the expedition of Hernando de Soto, sent by Queen Isabella of Spain. These were Iberian pigs from northeastern Spain – today recognized as the finest heritage pigs in the world. Over time, additional European breeds were introduced, and Russian pigs crossed into North America over the land bridge. The interbreeding of these lineages produced the feral pigs that roam Florida and much of the United States today, now classified as one of the most destructive invasive species in the country.

Shogun Farms takes a circular approach to this challenge. Pigs are trapped humanely and brought to their farm in Southeast Tampa, where they are fed surplus produce, dairy and spent grains

Photo courtesy of Gamble Creek Farms

that would otherwise go to landfills. After several months of finishing, they are processed into what Chiles and his team believe is among the finest pork in North America, yielding artisanal products such as sausages, guanciale, hams, bacon and coppa. For Chiles, this was another example of "taking lemons and making limoncello" – turning an environmental crisis into a regenerative, value-added solution.

Looking Ahead – The Case for Restoration Clams

A lifelong outdoorsman, Chiles grew up fishing on Anna Maria Island and hunting in Florida's woods. His work reflects a deep desire to preserve the state's natural beauty for future generations. Today, he champions expanded clam farming, recognizing both its economic potential and its ecological importance.

Although harmful algal blooms continue to threaten Florida's waters, clams survive red tide events and continue filtering water year-round. Mature clams too large for the commercial market can live up to 35 years, spawning multiple times annually and providing long-term ecosystem services.

Currently, Florida clam farmers are paid about 11 cents per clam for little neck, middle neck and top neck sizes, which reach market maturity in 18–24 months. But when blooms force long closures, farmers lose crops because clams "age out" of the market. Chiles argues for a solution: creating a system where farmers can be paid 25 cents of market value for oversized, sexually mature clams. These clams, predator-proof and capable of spawning for decades, are worth far more to Florida and its citizens as restoration clams than as food. Supporting farmers in this way would keep them in business, strengthen the industry and help restore Florida's clam populations to the sustainable levels enjoyed just a few generations ago.

Through his restaurants, nonprofit collaborations, farm and advocacy, Ed Chiles has demonstrated the power of circular agricultural systems to strengthen communities, restore ecosystems and build a more sustainable future. His story is proof that food, when connected to its environment, can serve as both sustenance and solution.

Photo courtesy of Gamble Creek Farms

Timothy Solano, Levy County, North Central Cedar Key Aquaculture Farms

Timothy and Alyssa Solano recently took their three young children out on the water, close to where the Suwanee River meets the Gulf of Mexico near Cedar Key. A pod of dolphins emerged, so Timothy slowed the boat to a putter. The dolphins brought their calves to the surface and swam, bellies exposed, alongside the Solano family.

"It was just the coolest thing," says Timothy Solano, a fourteenth-generation Floridian. "I could tell they were happy. We were happy, too."

While other parts of Florida have lost wildlife, Solano sees strong populations in Cedar Key. Thick flocks of roseate spoonbills wade its waters. Blue crabs bring in crabbers from Jacksonville and across the East Coast. Dolphins once swam in to mate and birth their offspring. Now they don't leave.

"This area's got such a pristine estuary from being cleaned up," Solano says. "The wildlife get back up in these areas that are protected, quiet and calm, and there's so much food for them."

Solano credits the clean water, in part, to the region's young clam industry. Clams, as bivalves, filter feed up to 20 gallons of water per day. They consume nutrients, like nitrogen, which otherwise, when left unchecked, create a toxic environment unfit for wildlife and humans.

In 1993, Solano's father, Daniel Solano, whose roots were in citrus, started clam farming. He began the wholesale operation, Cedar Key Aquaculture Farms, in 1996. Today, Timothy Solano, with his sister, two brothers, and 23 other employees they consider like family, carry on the business. They grow more than 35 million clams every year, which are sold in Costco stores across Florida and up the East Coast as well as to Whole Foods in Florida.

The Circular Approaches

To produce a crop of clams, bags of "clam seeds," or baby clams, each 4 millimeters in diameter, are planted at the bottom of Gulf bay water leases. The public leases are 2 acres each, and the family follows strict regulations from the state on when and where to plant the clams based on water quality testing. The clams bury themselves in the mud and begin filter feeding. Their entire diet is nitrogen, carbon and other nutrients in the water. After about three months, they are brought to the farm's certified plant and broken down into groups of about 1,300 per bag and replanted to reduce competition for food. Another 15 months later, the clams are harvested then processed in the plant.

Clams go to Costco stores from Miami to Massachusetts as well as Whole Foods in Florida, and any leftover shells are crushed and used for landscaping (both for aesthetic purposes and to hold moisture), to fill in potholes, and for other uses. For example, the Solano's farm road is made mostly from recycled clam shells, and they maintain, at no charge, their local school's parking lot using shells. Clams too small to be marketed are replanted in the bags, which are washed and reused, and the process begins again.

New Ideas

Solano sees several opportunities for the 30-year-old industry to expand its circular bioeconomy, overall efficiency and profitability, which is essential for keeping clam farmers in business.

"We're a positive industry for the ecosystem," Solano says. "With everything that's been going on in Florida with red tides, it's important to make sure we have those clams and oysters on the front line."

One idea came from his own back-

Photo courtesy of Timothy Solano

yard. His family raises chickens for eggs, and, after noticing oyster shells were listed as an ingredient in their chicken feed, Solano wondered if clam shells, too, might be effective as a poultry feed supplement. He tried it, and it seemed to work, so now he is pursuing opportunities to study more formally the calcium content of clam shell. Perhaps clam shells could one day be reused as animal or even human nutritional supplements.

Other ideas come from groups of fellow clam farmers and scientists. He has been closely watching a research project funded by the state Aquaculture Review Council Board, on which he sits, looking for genetic markers for strong heat tolerance. The Virginia Institute of Marine Science, University of Florida and a couple private Florida research groups have been working together on the project since 2019. They have bred a clam expected to be more heat tolerant, and seed from the second generation will be sold to farmers beginning in 2026. The genetics will be improved, but, thanks to the grant, the seed will be sold at the same price as unimproved clam seed.

Facing Future Storms

Solano purchases his clam seed from a hatchery 2 ½ hours south of Cedar Key. It is important to buy from someone in similar waters so that the young clams planted on his leases are acclimated to similar water temperatures and food supply. He says the waters get hotter every year, earlier in the year, so he is looking forward to planting more heat-tolerant clam seed.

Clam seed is a limited commodity for the young industry, he says. Hatcheries generally don't have the luxury to ask how many clams he would like to buy. They tell him, "This is how much I can give you this year." Solano says if farmers had access to more hatcheries, they could perhaps self-insure themselves by growing an additional percentage of clams.

Photo courtesy of Timothy Solano

Insurance for clam farmers against hurricanes has been lacking, and recent hurricanes have been devastating.

Hurricane Idalia in 2023 took 6,200 bags of his clams, each worth $10 in material plus the potential for $100 in sales. Hurricane Helene in 2024 took 8,800 bags. That's on top of the damage the 16-foot storm surges brought to the broader island community. One of multiple clean-up events the Solano family joined rounded up nearly 30,000 pounds of debris. At one point, Solano's boat carried enough wood plucked from the waters to build a tiny home – cabinets, siding and all.

The fourteenth-generation Floridian plans to weather any storm that may come, but he is thinking about how to build resiliency. One step the family is taking is building a new processing facility off the island of Cedar Key.

"We can't change Mother Nature," Solano says. "I like to say she's our business partner, and we have to work with her and adapt to what she throws. I don't see the hurricanes just deciding to get weaker anymore."

Policy can help, he adds. He notes the Florida farm bill for the first is allowing clam farmers to apply for loans to help with purchasing clam seed and material. Previously, they could only use the loans to rebuild facilities.

"That's big for the small guys," Solano says. "There's a lot of them that just couldn't get back in the game after Hurricane Helene, with all the bills piling up from Hurricane Idalia. They are the backbone of this industry. We have to have them if we're going to be able to compete with foreign competition or just be able to supply America with enough food."

WHAT WE LEARN FROM FLORIDA FARMERS

These are just a few of the voices of farmers and partners in Florida agriculture who are building toward a more resilient future for themselves and the broader community by adopting circular systems. There are so many other examples that could be brought to the surface.

A few more include:

- Large dairy and sugarcane farms produce biogas from wastes using anaerobic digesters.
- Biotech Applied Research (BAR) leads the way in giving citrus growers an alternative to open-air burning of retired groves by converting wood waste into biochar. This biochar not only returns to the land as a soil amendment, improving fertility and water retention, but also locks carbon in the ground to help fight climate change, while unlocking the potential of carbon credit cost share. The nonprofit is headquartered in Avon Park, Florida, and works with growers and partners across the state to build a circular bioeconomy from agricultural waste. More information is available at www.biotechappliedresearch.org.
- The Brain Health Initiative (BHI), established in 2020 and headquartered in Lakewood Ranch, Florida, was launched as a collaborative effort in partnership with Massachusetts General Hospital, a Harvard Medical School Teaching Hospital. BHI is now a fully independent global nonprofit organization. BHI is advancing the Brain Health Circular Bioeconomy as a pathway to improving brain health and connecting agriculture, nutrition, neuroscience and sustainability — from molecules to metabolism, from soil to synapse. Through its Brain Health Certification Program, BHI recognizes foods grown to support cognition, mood, memory, and resilience — including the Gamble Creek Pumpkin, a hybrid of two heirloom varieties: the Dutch Fork Pumpkin of South Carolina and the Seminole Pumpkin of Florida (see Ed Chiles' story). The Gamble Creek Pumpkin blends the flavor and silkiness of Dutch Fork with the hardiness and longevity of Seminole. It is rich in beta-carotene, vitamin C, potassium, fiber, and polyphenols — compounds known to protect the brain against oxidative stress and inflammation.

From these farmers, ranchers, foresters and aquaculturists, we learn that to become more circular, there is risk involved. One must be brave to try something new, and, for many, that moment comes with necessity. It might be a storm, a flood of pests or the looming reality that a family cannot keep up the scale of production needed to compete in today's linear, product-centric economy. Change comes when it must, or when the potential benefits outweigh the risks.

Building up soil health and a circular bioeconomy is, in a way, a proactive measure. It is a good idea long-term, most farmers realize, but it is challenging to do when there are bills due today. The circular bioeconomy places value on both products produced and ecosystem services (clean water, clean air, biodiversity, etc.). The latter is harder to define and quantify, but figuring out how to do so is an important area of study in Florida that has the potential to fill the gap.

If farmers were to be paid for the ecosystem services they already provide, they may be able to invest more into improving those services. Furthermore, when the market recognizes the land's innate environmental value, farming can better compete with development as a viable land use. Green spaces can stay green.

Beyond the need to be compensated for ecosystem services, farmers need:

- **Access to markets.** Wholesale buyers typically want large, uniform lots, which is not easy to deliver as a

Courtesy of Timothy Solano

Courtesy of Meghan Austin

small-scale producer. However, smaller producers can cooperate to sell their products together or they find niche markets, such as Cindale Farms' Southern Craft Creamery ice cream brand or Southern Hill Farms' public-facing u-pick operation. Niche and direct-to-consumer markets require advanced marketing and customer service skills as well as access to a population interested in and able to purchase premium products.

- **Access to labor.** Labor is a concern in Florida agriculture. Agriculture is hard work, and it's not lucrative. The domestic job market is limited, and other countries can produce food cheaper in part because of lower standards for employees. Technology will continue to replace field hands and increase efficiency.
- **Financial grants and incentives.** Finances remain one of the top barriers to making change on the farm. Programs that cost-share and/or help alleviate risk on the farmer encourage movement toward new, circular practices.
- **Research and collaboration.** Several of the farmers participate in research studies because they value knowledge and testing new ideas. Research funding must be protected to allow for thorough investigations of new tools, technologies and systems to work out issues before farmers start adopting them with their own investments. Research collaborations with farmers are essential to keeping them grounded on the farm.
- **Thoughtful regulation.** As Mack Glass says, "We need education and less regulation." Regulation has its place, but it is important that policies take into consideration farmers' needs and the complexity, and circularity, of nature.

Above all, it must be recognized that farms are made of unique individuals with unique sets of resources and circumstances. Some farmers will be able to complete a circle on their own farm – such as making and using compost on farm – while others will partner with neighbors and others to exchange and make the most of the resource. There are no one-size-fits-all solutions, and policy and programs should be built to promote principles, not necessarily practices.

JOIN US

In collaboration with agriculture, forestry and conservation organizations along with our academic and value chain partners, Florida Smart Agriculture is building and facilitating a circular bioeconomy alliance to advocate for enabling policies, programs, investments and markets that will help scale the delivery of ecosystem services to achieve quality livelihoods, improve food and nutrition security, protect/enhance soil-water resources, improve the environment and enhance the biodiversity of natural systems. Join us in an uncommon partnership that will collaborate to achieve outcomes that benefit producers, Floridians and the planet. You can learn more about this expanding initiative by contacting Solutions from the Land at **info@solutionsfromtheland.org.**

SOLUTIONS FROM THE LAND

SOLUTIONS
FROM THE LAND

1430 Front Avenue
Lutherville, MD 21093

ph: 410-252-7079
solutionsfromtheland.org