USDA

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Enhancing Rural Economies Through Agroforestry: Assessing Emerging Opportunities

USDA National Agroforestry Center June 2019

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Executive Summary

Accelerating the adoption of agroforestry will require a better understanding of the economic opportunities and financial benefits to society, says a recent assessment of U.S. agroforestry.[1] Providing this understanding is critical for agroforestry to reach its full potential, whereby it enhances rural economies and provides ecological services that people need, such as clean drinking water. To assess emerging opportunities, the U.S. Department of Agriculture (USDA) convened more than 60 people in March 2018 to learn, network, and, above all, generate ideas for raising the economic profile and viability of agroforestry in the United States.

The effort was led by USDA's National Agroforestry Center, which serves as a hub to advance the health, diversity, and productivity of working lands, waters, and communities through agroforestry. The National Agroforestry Center collaborated with other USDA agencies (the Agricultural Marketing Service, Agricultural Research Service, Economic Research Service, Farm Service Agency, National Institute of Food and Agriculture, Natural Resources Conservation Service (NRCS), and Rural Development) and additional partners to convene the workshop. This report provides a narrative summary of the workshop and includes next steps developed by participants.

Key findings include:

1. **Intermediaries are critical.** Whether they are farmer cooperatives, local NRCS offices, or cooperative extension staff, organizations and individuals who collect information and aggregate resources to fill technical gaps are critical.
2. **Information must be accessible.** One of the biggest challenges to expanding agroforestry is the producers' ability to access information. They need information on the value of crops and products, resources for grants and loans, and details on how to develop and access markets.
3. **Education and outreach are needed.** Many producers, individuals at USDA, and members of the banking and investment community remain unaware of the benefits of agroforestry, including its ability to increase resilience of businesses and the natural environment. To increase agroforestry adoption, an awareness about its benefits must be raised.
4. **Government entities, universities, intermediaries, and producers must collaborate.** Increasing collaboration among producers, program delivery staff, scientists, and others will help improve the delivery of programs that support agroforestry, from production to consumption.
5. **Research is required to provide direction.** Additional information is needed on financial and economic valuation, risk analysis, and market access and development to identify ripe opportunities for agroforestry in the United States.

[1] Mercer, D. Evan; Li, Xiaoshu; Stainback, Andrew; Alavalapati, Janaki. 2017. Chapter 4: Valuation of agroforestry services. In: Schoeneberger, Michele M.; Bentrup, Gary; Patel-Weynand, Toral, eds. 2017. Agroforestry: Enhancing resiliency in U.S. agricultural landscapes under changing conditions. Gen. Tech. Report WO-96. Washington, DC: U.S. Department of Agriculture, Forest Service. 63-72.

Setting the Stage

What Is Agroforestry?

Agroforestry—defined as the intentional integration of trees or shrubs with crop and animal production to create environmental, economic, and social benefits[2]—helps build farms, ranches, and forests that are resilient to changes in market and environmental conditions. The five most common agroforestry practices are alley cropping, windbreaks, riparian forest buffers, silvopasture, and forest farming. They are associated with different types of benefits and uses, ranging from energy conservation to erosion reduction (see Table 1).

While agroforestry practices are diverse, a common thread is the positive economic outcomes that can be generated when businesses: (1) diversify to manage risk and (2) reduce costs to more efficiently use resources. Agroforestry systems also are a way to make marginal and degraded agricultural lands more productive. Finally, agroforestry provides access to unique markets for products that capture premium prices, from pawpaws to organic herbs to hazelnuts.

> *"We use agroforestry on our farm to create infrastructure for future generations."*
> —Ridge to Reef Farm

Looking beyond the economic benefits, there are other trends in agriculture that provide an impetus for practicing agroforestry. One of these is the rise of organic agriculture to address citizens' concerns about water quality, soil health, and human well-being. Local and regional food movements also have intersected with increased attention to agroforestry. These food movements are partly motivated by people who want to reduce the impacts of agricultural production, reduce the energy required to transport food, and grow local economies that are connected to local food systems. Products grown in agroforestry or other perennial systems are common in local food systems.

There is a growing interest in and excitement around investing in sustainable agricultural systems, including agroforestry. According to a recent survey by Global Impact Investing Network, 63 percent of impact investors said they were putting their dollars into food and agriculture, and impact investment in the sector has grown at an annual rate of 32.5 percent since 2013.[3]

[2] Schoeneberger, Michele M.; Bentrup, Gary; Patel-Weynand, Toral, eds. 2017. Agroforestry: Enhancing resiliency in U.S. agricultural landscapes under changing conditions. Gen. Tech. Report WO-96. Washington, DC: U.S. Department of Agriculture, Forest Service. pp. 212.

[3] Global Impact Investing Network. 2016. Impact Investing Trends: Evidence of a Growing Industry. Visit Global Impact Investing Network for more information

Table 1. Benefits of Agroforestry Practices[4]

Practice	Description	Primary benefits and uses
Alley cropping (also called tree-based intercropping)	Trees or shrubs planted in sets of single or multiple rows with agronomic crops, horticultural crops or forages produced in the alleys between the trees that also can produce additional products.	• Produce annual and higher-value, but longer-term crops. • Enhance microclimate conditions to improve crop or forage quality and quantity. • Reduce surface water runoff and erosion. • Improve soil quality by increasing utilization and cycling of nutrients. • Enhance habitat for wildlife and beneficial insects. • Decrease offsite movement of nutrients or chemicals.
Windbreaks (also includes shelterbelts)	Single or multiple rows of trees or shrubs that are established for environmental purposes; depending on the primary use, may be referred to as crop or field windbreak, livestock windbreak, living snow fence, farmstead windbreak, or hedgerow.	• Control wind erosion. • Protect wind-sensitive crops. • Enhance crop yields. • Reduce animal stress and mortality. • Serve as a barrier to dust, odor, and pesticide drift. • Conserve energy. • Manage snow dispersal to keep roads open or to harvest moisture.
Riparian forest buffers	An area of trees, shrubs, and herbaceous vegetation established and managed adjacent to streams, lakes, ponds, and wetlands.	• Reduce nonpoint source pollution from adjacent land uses. • Stabilize streambanks. • Enhance aquatic and terrestrial habitats. • Increase carbon storage in plant biomass and soils. • Diversify income either through added plant production or recreational fees.
Silvopasture	Trees combined with pasture and livestock production.	• Produce diversification of livestock and plant products in time and space. • Produce annual and higher-value, but longer-term products. • Reduce nutrient loss.
Forest farming (also called multistorycropping)	Existing or planted stands of trees and/or shrubs that are managed as an overstory with an understory of plants that are grown for a variety of products	• Improve crop diversity by growing mixed, but compatible, crops having different heights on the same area. • Improve soil quality by increasing utilization and cycling of nutrients. • Increase carbon storage in plant biomass and soil.
Additional applications	Use of agroforestry technologies to help solve special concerns, such as disposal of animal wastes or filtering irrigation tailwater, while producing a short- or long-rotation woody crop.	• Treat municipal and agricultural wastes • Manage stormwater. • Produce biofeedstock.

[4] Schoeneberger, Michele M.; Bentrup, Gary; Patel-Weynand, Toral, eds. 2017. Agroforestry: Enhancing resiliency in U.S. agricultural landscapes under changing conditions. Gen. Tech. Report WO-96. Washington, DC: U.S. Department of Agriculture, Forest Service. pp. 212.

Who Practices Agroforestry?

The workshop kicked off with presentations and a panel discussion by four producers who use agroforestry; see Appendixes I and II for the agenda as well as the biographies of speakers and planning committee members. They showcased creative ways agroforestry can meet multiple goals—from education and agrotourism in the U.S. Virgin Islands to creating regional food systems in Minnesota.

Green Fire Farm in Wisconsin, led by father and son team Jim and Jacob Marty, adopted agroforestry out of a desire to (1) bring economic vitality to residents of its rural Wisconsin community and (2) restore native wildlife and plant communities. Its silvopasture system integrates livestock production with fruit and nut production. Apples, chestnuts, mulberries, pecans, mushrooms, and other fruits and nuts are providing food for people and forage for livestock.

> *"The goal is a regenerative system that de-risks the farm operation, allowing farmers to relax and move into a different lifestyle."*
>
> —Main Street Project

Nearby in Minnesota, Reginaldo Haslett-Marroquin described how the Main Street Project is testing a prototype agroforestry system for producing free-range poultry as part of a sustainable regional food system that will be accessible to aspiring immigrants and other limited-resource farmers.

Shelton Roberts Properties in Mississippi, a minority-owned farm, creates "meaningful economic sustainable development on fourth-generation ancestral property," according to Vickie Roberts-Ratliff. The farm includes a fruit-based alley cropping demonstration site, which helps address local needs in a county where poverty is high and food security is relatively low.

Ridge to Reef Farm in the U.S. Virgin Islands also is creating food security in an area where food production is scarce. Nate Olive described how the farm sells its products, which include moringa[5] and fruit trees, through community-supported agriculture and farm-to-school programs. Although the Category 5 Hurricanes Irma and Maria killed half of the farm's fruit trees in 2017, the moringa have bounced back to the point of harvest.

Following the producer panel, Marca Weinberg and Jay Variyam of the U.S. Department of Agriculture (USDA), Economic Research Service provided an overview of economic factors that affect today's agricultural producers, including:

- Food is the third-largest consumer expenditure.
- About 15 cents per dollar spent on food goes to farm operations. The rest goes to off-farm supply chains.
- Access to land is the Number 1 concern of young farmers.
- Farms with direct sales are more likely to still be in existence 5 years later.
- From 2014–2017, slightly more than half of farm households have lost money on their farming operations each year.
- Sixty percent of U.S. farmland is operated by owners, while lessees operate 32 percent of U.S. farmland.
- Small farms make up about 22.7 percent of the market share.
- Sales in organic products have been growing since 2002, have doubled since 2006, and account for 5 percent of overall sales.
- During a 5-year period, 10 percent of U.S. farmland changes hands; 25 percent of this is expected to be sold to nonrelatives.

[5] Moringa is a tropical plant grown for its food and medicinal uses. The most common species is *Moringa oleifera,* which originated in India.

Getting Started in Agroforestry—Access to Land and Capital

Access to land and capital is a key concern in agricultural enterprises. Larry Godsey from Missouri Valley College discussed barriers to agroforestry (both perceived and real), including issues with collateral lending, risk analysis, land tenure, and financial feasibility.

Godsey identified four lending barriers often confronted by agroforestry producers.

1. With **collateral lending**, a bank can take land or equipment to hedge against risk. In the 1970s, when farming was booming and land values were increasing 7 to 8 percent a year, banks did not care much about how farmland was managed. Today, farm profitability and land values are more volatile, and securing loans based on land and equipment assets is more challenging, especially for less common practices, such as agroforestry.
2. The absence of reliable time series data on the market value of most agroforestry products inherently makes it difficult for a financial institution to conduct meaningful **risk analyses**, which discourages lending to this sector.
3. Markets are based on **exchange value** rather than value in use (e.g., the value of land may be higher for housing than for farming). It is thus more challenging to make the case for agroforestry.
4. When considering loan decisions, lenders tend to rely on "what they know" and are more likely to provide loans for land uses with which they are most familiar. Most lenders are unfamiliar with agroforestry.

Keefe Keeley, co-executive director of the Savanna Institute, highlighted land tenure challenges, especially those opportunities associated with leasing. Typical lease arrangements are not conducive to long-term investments, such as agroforestry. Producers who launch an agroforestry system often need to make substantial upfront investments and dramatic changes in how their land is being managed (usually eschewing annual cropping). The fact that trees can take years to produce the desired benefits means that returns on investment are delayed relative to those for annual crops. Each of these factors must be considered and addressed up front in a lease.

According to the Economic Research Service, 32 percent of U.S. farmland is leased, and leased land is especially important for beginning farmers, who rarely have full title to their land. There is, however, opportunity on the horizon. About 40 percent of U.S. farmland, or 400 million acres, is expected to transition to new owners in the next 20 years. Succession planning from generation to generation can enhance the conditions for long-term investments and can improve the opportunity for support (e.g., transition incentive programs, land trusts, and partnerships).

More information on long-term lease benefits, sample questions for building a lease, and a long-term lease workbook can be found in Forest Service publications and at the Savanna Institute.

While there are challenges to accessing land and capital, there also are opportunities—from private and public investment. Kevin Egoff of Iroquois Valley Farms, a real estate investment trust, spoke about the trust's approach to connecting investors to organic farmers and farmland. Investments are designed to maximize profit and be socially conscious. Founded in 2007, the trust has about 300 investors, works with 30 farm families that collectively manage nearly 9,000 acres, and represents a $43 million asset base. It currently invests in two agroforestry opportunities involving aronia berries and hazelnuts. Egoff indicated there are opportunities to work with producers on a broader range of agroforestry systems. Identifying partners with whom to collaborate is key.

On the public side, Sarah Campbell of USDA Farm Service Agency (FSA) reviewed resources that farmers can use. These include capital and investor services. However, financing options for agroforestry can be complex because of the need for long-term access to land, land prices, and the lack of familiarity of many lenders with agroforestry. The focus of FSA programs is on risky borrowers, such as beginning farmers, with whom a typical lender may not work.

Moving Forward With Agroforestry–Access to Markets

Market Products

During the Access to Markets panel, producers and cooperative members shared approaches to creating and accessing markets for products from agroforestry systems. Continuing the theme of creativity and persistence, panel members illustrated that a range of marketing approaches can work. For example, 20 years ago, Chris Chmiel noticed pawpaw fruits local to Ohio were rotting on the ground. He set about to raise awareness of the fruit and, today, the pawpaw is Ohio's official State fruit. In addition, the annual pawpaw festival he hosts brings in thousands of people who buy and enjoy fresh pawpaws. Internet sales of shelf-stable products, such as pawpaw pulp and jams, sustain his business all year long.

> *"Use your stories – those stories are what are going to get you access to markets."*
> — Forest Agriculture Enterprises LLC

The Abington, VA, nonprofit Appalachian Sustainable Development (ASD) operates a food hub for forest botanicals. It creates markets for diverse products, which are aggregated from growers and connected to larger markets. Emily Lachniet described how this helps make producers' businesses viable. On an even larger scale, Mark Shepard of Forest Agriculture Enterprises, LLC, shared the origins of Organic Valley Cooperative, which now aggregates products from hundreds of farmers across the United States.

Panelists agreed a big boost to the agroforestry sector has come from mentoring and education offered by other members of the farming community. They also credited programs that support and influence farmers' success. For example, Chmiel used USDA's Sustainable Agricultural Research and Education grants to integrate silvopasture into native pawpaw production. Likewise, ASD used an Appalachian Regional Commission Power+ grant to establish its forest botanical hub.

Furthermore, in a sector where consumer and buyer demand has not yet been fully realized, they noted that agroforestry producers need to be very familiar with, and responsive to, current market outlets if they hope to be economically viable. They warned growers against introducing and growing new crops without having a ready market for their product.

Ecosystem Service Markets

During the plenary on ecosystem service markets, Jonas Epstein of the USDA Forest Service explained how these markets can create incentives for better managing resources. Ecosystem services markets work best where there is a strong driver to address a particular need (such as water quality) and there is a sound verification system in place.

David Primozich of Freshwater Trust provided an example of an emerging ecosystem services market for water quality in Oregon based on National Pollutant Discharge Elimination System permitting. In the example provided, Freshwater Trust paid landowners to improve water quality by maintaining riparian buffers for 20 years.

Kelley Hamrick of Forest Trends presented another ecosystem services example relevant to agroforestry through carbon offsets. The most active areas for carbon markets are where compliance is required; at this time, there are no compliance markets that explicitly recognize agroforestry.

John Munsell of Virginia Tech spoke about Virginia's market for point and nonpoint nutrient credit trading. Work by Virginia Tech indicates that agroforestry systems may provide an important future mechanism for farmers to participate in this market.

Emerging Themes

Five needs emerged during the panel presentations. People need:

1. Opportunities to share information and learn;
2. Long-term leases or clear title to the land;
3. Access to markets for agroforestry products;
4. Market data to inform enterprise choices, as well as to help encourage investment; and
5. Regulatory certainty and pilot transactions to enhance markets for ecosystem services.

> *"When you are passionate about something, you can sell it".*
> — Chris Chmiel

Challenges, Bold Steps, and Opportunities

Accessing Resources–Overcoming Challenges and Bold Ideas

The first set of breakout discussions focused on challenges to and opportunities for accessing resources for agroforestry practices. Access to land, labor, and capital can be a limiting factor in landowner efforts to adopt new practices, particularly for long-term practices like agroforestry systems. The discussions on resources fell into three broad categories: accessing land, using USDA resources, and building financial and human capital.

Accessing Land

To establish an agroforestry practice, a producer needs time, land, capital, and markets. Numerous participants discussed challenges with accessing land. At least one participant, however, countered that land access is not necessarily as much of a problem as it is thought to be. This participant discussed the availability of "junk" land (i.e., small parcels and marginal land that can be well-suited to agroforestry practices). To overcome land access challenges, participants suggested that it is important to illustrate the economic potential of small parcels. For example, various enterprises can be "stacked" through agroforestry, making the land more productive both spatially and temporally. These approaches can also reduce risk by diversifying the enterprise.

There was consensus in the groups that long-term leases can substantially increase land access, but that establishing such leases can be challenging. Providing examples of successful leases and demonstrating successes to landowners can increase interest in long-term leases. One participant told the story of a farmer in Missouri, managing leased land for intensive grazing, who required a 7-year lease to guarantee a long rotation. By bringing the landowners out to see his operation and demonstrating how his approach had increased the value of the land, he was able to obtain a 10-year lease.

ASD provided another example of overcoming issues with absentee landowners, specific to forest farming. Currently, ASD is working with The Nature Conservancy to create a lease that would allow forest farmers to grow nontimber forest products on forest lands owned by others.

Another thread of discussion was on engaging absentee landowners through education and trust-building, both of which are challenges.

Research Questions Related to Accessing Resources

The group also discussed research needs, which included:

- How do intermediaries help with land access and accessing markets?
- How much does it cost to convert to agroforestry?
- What are the social, ecological, and health benefits of agroforestry practices?
- What specialty crop machinery is needed, especially as systems scale up (e.g., elderberry)? What kinds of mechanical harvesters and management systems will support larger scales of production?
- What are the general economic benefits of converting to agroforestry? How can we get beyond the current case study/anecdotal evidence approach?
- Is a comprehensive study of successful and long-standing co-ops needed to determine the reasons for their success, particularly related to their governance structures and operations?

Using USDA Resources

Many farmers use USDA programs to change or improve their practices. Programs such as the Environmental Quality Incentives Program and the Conservation Stewardship Program play an important role and have been valuable in helping diversify business models. A range of ideas was suggested for increasing awareness of USDA resources. These included a database of USDA programs that can be used to support agroforestry, as well as training on this topic for field staff at USDA, conservation districts, extension agents, practitioners, and other interested individuals.

It was also suggested that agroforestry practitioners, both within USDA and external to the agency, reach out to cooperative extension offices, nonprofit organizations, and citizen-led efforts to increase awareness on agroforestry benefits and resources. Such efforts could be most effective if combined with information on the economic, social, and environmental benefits of agroforestry. It was also suggested that listening sessions, such as those being held by USDA National Institute of Food and Agriculture (NIFA), could increase understanding of USDA stakeholders' research and outreach needs.

Building Financial and Human Capital

It can be difficult for producers to access capital from lenders. That is because establishing an agroforestry practice takes time, which means it takes longer to show returns on capital investments. It also is hard to qualify for traditional loans because economic and noneconomic values are difficult to quantify. One solution is to develop data, best practices, financial statements, and pro formas to educate investors on loans for agroforestry.

> *"For agroforestry practices to grow, we need to either create our own infrastructure or embed ourselves into the current system. Not only for financing, but other things — for seeds, processing, and more."*
>
> — Main Street Project

Building financial capital was also discussed. This discussion included the use of agroforestry for stacking enterprises. The marketing of products grown within agroforestry systems could be assisted by intermediaries, such as cooperatives, through technical assistance, shared equipment, and space or assistance in aggregating goods to increase profitability. Blockchain technology was also suggested as a potential way to increase resources for producers. Originally developed for bitcoin, blockchain is used to democratize and decentralize commerce in a wide variety of services. Some participants suggested it could potentially be used to track agroforestry products and help build tracking mechanisms for regional food markets or certification schemes. Mechanisms are not yet developed for exchanging information on the values of many products from agroforestry systems. Practitioners need to continue developing markets for financing to become viable. Ideally, the agroforestry industry eventually will be robust enough to support farmers and provide such information.

Building human capital is as important as building financial capital. Participants expressed the need to build capacity and increase understanding of agroforestry practices. A handful of participants talked about the overarching culture of agriculture, suggesting the need to get people to buy into the values of agroforestry, such as protecting ecosystem and human health, rather than focusing on buying into the practice of agroforestry. Suggestions for educating others about agroforestry and associated values included: incubator farms, agroforestry academies, and farmer-to-farmer mentoring programs. One example of an incubator farm is the Lincoln, NE, Community Crops' Growing Farmers Training Program, where a demonstration alley cropping system is used as a training tool. Another training example comes from the University of Missouri, which has an online agroforestry certificate program and hosts

Agroforestry Academy trainings for producers and professionals that advise producers. Information about the Agroforestry Academy is available at the Center for Agroforestry.

*T*rainings should convey the many ways people can support or practice agroforestry. One participant described an individual who started a private consulting and management company to provide turnkey solutions for productive riparian buffers. The owner prepares the design, payment program paperwork if applicable, and plans to manage and maintain the buffer, including harvesting commercial products.

Drawing a connection between human and financial capital, it was also suggested that training and assistance be developed to help practitioners create compelling business plans and models that appeal to lenders. One example of this is the Appalachian Beginning Forest Farmer Coalition, supported by NIFA's Beginning Farmer and Rancher Development Program. Through this effort, nonprofits, including Appalachian Sustainable Development and Rural Action, provide training in business plan development for forest farmers.

Finally, farmer-to-farmer mentoring programs have great promise. Appalachian Sustainable Development has a mentoring program that pays farmers to mentor other farmers; learn more about this program at its website. These programs can be very important for agroforestry, especially when the mentor has experience with the land and with the business side of agroforestry.

Accessing Markets

Access to markets is critical for a viable agriculture production system. Agroforestry systems offer numerous ways to enhance access to markets, including diversification of products and markets, consumer awareness about production methods, branding, certifications, and verifications. Many producers with agroforestry systems use cooperatives, aggregation, and food hub models to provide infrastructure, add value, and support access to larger volume markets. Discussions on access to markets fell into two categories: markets for tangible products from agroforestry systems—such as edible, herbal, or medicinal products—and ecosystem services.

Marketing and Market Access for Agroforestry Crops and Products

A reoccurring theme throughout the discussions at the workshop was the relatively small amount of information available on agroforestry as compared to conventional farming. This was particularly discussed as a challenge for accessing markets. Conventional farming has robust promotion by commodity and business interests that do not exist for agroforestry. This information imbalance makes it difficult to know what to grow and where to sell it. Many farmers do not have the time or know-how to seek out this information. Where market data exists, it tends not to be widely or easily accessible.

The diverse nature of agroforestry practices presents marketing challenges. Not only do different producers have different needs related to markets; there also is the challenge of having an accepted definition of agroforestry.

Labeling and certification programs are of interest. There was general agreement that existing programs, such as organic certification, are insufficient for promoting agroforestry. There was less consensus on how to meet the needs of agroforestry producers or whether developing certifications and labeling are worth the effort. Such programs can help to ensure the sustainable harvest and sale of agroforestry products, as well as raise consumer awareness. The downside is that that for some crops, sustainable harvesting is not quantifiable or well-defined, and there often is a considerable amount of paperwork associated with such systems. If certification is used as a marketing tool, it will be important

to understand market (consumer and retailer) requirements and the types of labels that may be important in the future (e.g., organic, regenerative agriculture, small farm, local, etc.). Some suggested that certifications unique to agroforestry be developed and used to promote agroforestry products. In contrast, others suggested that a new label would not be productive and instead suggested that existing standards, such as organic, should be improved. Finally, some farmers may not be interested in marketing or may not have the skills required to sell products to consumers.

Finally, a number of participants discussed the need to tell producer stories as part of marketing efforts, but they recognized the difficulty of: (1) doing so without over-burdening producers or (2) diluting individual stories as they are aggregated for marketing purposes.

Another market-related challenge is access to harvesting and processing infrastructure. For example, producers may struggle with having enough product to support mechanization or accessing certified meat processors. Some of the mechanization and processing problems can be solved by aggregating through cooperatives. Governance and administration issues associated with cooperatives, however, can cause them to fail.

Farmer cooperatives or other similar intermediaries were discussed as a mechanism to overcome many of the aforementioned challenges. One participant noted that co-ops are under-used and that USDA Rural Development could be a possible source of support. Forms of support needed include technical assistance to cooperatives in the development of their structure and administration, as well as information on how to access resources from USDA or elsewhere. The USDA Technical Service Provider program possibly could play a role. Because cooperatives can help create the volume and uniformity of products, they may be a solution to many of the challenges discussed at the workshop, especially on smaller farms. It was discussed that people working in cooperatives should have technical expertise relevant to agroforestry but could also benefit from training/information in business skills (e.g., to help sell products and bring people together). Such skills will help cooperative managers direct market products and build consumer relationships to increase both exposure to the value of agroforestry and market share.

Related to the issues of access to markets, certifications, and labeling, there was discussion of the need for trusted intermediaries that can verify sustainability and provide education. Intermediaries are needed at the local, regional, and national levels. It was suggested that on a local level, cooperatives make good intermediaries. On a national level, the National Agroforestry Center serves this role by helping to connect USDA agencies that have programs that can support agroforestry (e.g., Natural Resources Conservation Service, Rural Development, Agricultural Marketing Service, Risk Management Agency, Agricultural Research Service, and National Agricultural Statistics Service). Strategies also are needed that promote agroforestry production and marketing at regional and State levels.

Research Questions Related to Producer Access to Traditional Markets

The group also discussed research questions and ideas related to how producers access traditional markets, including:

- What is the market for nontimber forest products? Are some products more marketable than others? Does this vary by region?
- What is consumer awareness of certifications? Would consumers pay a price premium for an agroforestry-related label or is there a better label to use?

- Does the difference in carbon footprint between food produced using agroforestry practices and food produced through other methods for use in marketing purposes need to be identified?
- What information should be gathered on different aspects of agroforestry for different regions and at different scales of enterprise (i.e., information on regional prices and value-added prices, certified kitchen costs)?
- What are the best tree crops for each region, as well as the markets for these tree crops in different regions.

Thinking Outside the Box To Market Agroforestry Products

The group developed ideas about how to market products from agroforestry systems, including:

- Market agroforestry for health and wellness aspects and charge a premium for those aspects.
- Sell experiences as a product: agrotourism, festivals, and heritage tourism.
- Work with utilities to capitalize on the clean water aspects of agroforestry—utilities pay for installation and maintenance of riparian buffers, for example.
- Use Quick Response codes to connect a product with a specific farm. Scanning the code unlocks the farm's story, thereby connecting people with the land. Agroforestry producers and co-ops could use this technique to market their products. Geo-tag foods to build awareness of regional food systems and develop markets.

Building and Accessing Markets for Ecosystem Service Benefits

Challenges noted during discussions of this topic focused on uncertainties in building and accessing ecosystem services markets. For example, the carbon market was discussed as having potential, but navigating the process for how to accrue and market credits appears challenging. This is in part because there are no regulatory bodies to enforce national standards for ecosystem services. Other challenges discussed were the high levels of monitoring needed for compliance markets and that performance is often measured in acres, not in actual outcomes. To participate in ecosystem services markets, producers with agroforestry systems would likely need more flexibility than existing markets seem to offer. In particular, existing markets often require permanent retirement or easements on land, and they limit additional income that can be made on the land. This can be difficult to fit into a "productive conservation" approach. Finally, public perception of ecosystem services markets and lack of trust in their effectiveness are barriers to implementation and growth of these markets among all landowners. The "chicken or the egg" scenario was also discussed in terms of trades themselves. As trades occur, outcome data are gathered; however, outcome data are necessary in the first place to have a trade. The lack of coefficients prevents trade, but the lack of trade limits data on coefficients.

While there are certainly challenges to accessing and building ecosystem services markets, there were also many ideas of how to advance opportunities related to these markets. Many ideas suggested were more broadly applicable to these markets and not specific to agroforestry. They included the need for greater regulatory certainty and consistency. Another was the idea of mechanisms, such as insurance, to reduce the financial risks to producers. The importance of intermediaries in verifying credits and brokering trades was also discussed.

Participants also discussed the idea of taking a regional approach to strengthen capacities to measure and quantify benefits from agroforestry practices and to connect such information to efforts to establish or implement ecosystem services markets. Related to this was the idea of sharing information and examples of creative ways of funding such research. An example is the work Virginia Tech performed on multifunctional riparian forest buffers. It was also suggested that efforts be made to understand the role that policies and regulations play in efforts to establish and implement ecosystem services markets.

Additionally, participants discussed specific topics—including credit stacking, water-credit eligibilities, and mitigation banks—as another potential route for agroforestry practices to enter the credit-trading market. Given that riparian forest buffers are virtually the only agroforestry practice supported by current ecosystem services markets, participants suggested that educational materials on the use of buffers in markets be made available to entities engaged in water-quality credit trading.

Research Questions About How Producers Access Ecosystem Service Markets

- What practices, issues, and challenges are most common for ongoing water-quality-related credit schemes that use agroforestry?
- What level of specificity is required for the measurement and quantification of ecosystem services related to agroforestry? What level will be good enough for the markets, and how can we make it not cost prohibitive?
- What models specific to riparian management, carbon sequestration, etc., need to be developed?
- How can we enhance understanding of scavenging crops that take excess phosphorus out of the soils?
- Does more robust research on above-ground and below-ground carbon for agroforestry systems, including simpler, but valid, protocols to validate the carbon need to be developed?

Next Steps

Steps for the Next Year

Members of the agroforestry community could pursue the following opportunities in the next year:

1. Review the ideas presented here, identify those of highest priority to their missions, and form teams to refine, describe, and advance ideas.
2. Plan an effort to assess and synthesize existing research that can help to meet the needs of interested parties regarding agroforestry economics. Interested parties can include natural resource/ag professionals, landowners, research professionals, and managers. Incorporate the research needs identified at this workshop into this effort.
3. Submit a thematic grouping of articles related to agroforestry economics to *Choices Magazine* or another similar open-source journal. Managed by the Agricultural and Applied Economics Association, *Choices Magazine*"… provides coverage on economic implications of food, farm, or rural community issues directed toward a broad audience."
4. Coordinate with others in the agroforestry community to include information sessions on agroforestry at annual meetings of landowner organizations.
5. Coordinate a deeper discussion on implementing agreements between impact investors and farmers to capitalize on ecosystem services opportunities.
6. Explore the establishment of a coordinating body or other mechanism(s) to network State departments of forestry, environmental quality, agriculture, and universities to share agroforestry resources, research needs, and ideas.
7. Explore the creation of a central location to provide information on USDA programs that support agroforestry and provide a database of financial assistance programs.
8. Buy certain key words for Google searches so that agroforestry options show up on the first page of search results.

In addition to actions that could be taken by the larger agroforestry community, a handful of workshop participants provided thoughts on the actions they would personally take in the near term as a result of the workshop. On the production side, numerous participants indicated they would share information on agroforestry programs and techniques with other farmers and with local agency and consultant personnel. Two participants noted specifically that they plan to share this information through a local or regional workshop. One participant noted that work would be expanded to include research questions that producers need to have answered, with particular focus on improving financial analyses of agroforestry systems. Another indicated that s/he is already connecting producer participants with academic researchers.

Steps for the Next 5 Years

Participants in the meeting or the broader agroforestry community could pursue the following opportunities in the next 5 years:

1. Provide training to technical service providers, USDA staff, extension, and others who work with producers to increase awareness of opportunities for financial assistance for agroforestry systems, as well as economic tools and information that support decision making on adoption, design, and management of agroforestry systems.
2. Prioritize and plan for demonstration sites and related efforts to provide on-the-ground educational opportunities for practitioners and communities. As participants stated, most producers want to see what works for their neighbors.
3. Develop economic case studies of businesses for use in outreach efforts.

4. Aggregate existing market research and economic data on growing and selling agroforestry crops/products. Assess and connect existing efforts to develop more research and data on crops often used in agroforestry systems.
5. Provide outreach to producers and other interested parties on potential benefits of long-term leases, as well as examples of such leases for agroforestry.

Summary and Conclusions

Agroforestry can make businesses and nature more resilient to change, and that potential excited the 60 leaders who convened during this workshop. They delved into the agroforestry challenges, uncovered economic opportunities, and charted ways the agroforestry community can collaborate.

Leaders agreed that intermediaries often provide technical know-how to those that need it most; producers, bankers, and others need easy access to information to grow and strengthen businesses. They also need support from others to showcase the benefits of agroforestry, such as through education, outreach, and marketing. New research is required to provide direction on financial and economic valuation, risk analysis, market access and development, and how to influence opportunities for agroforestry in the United States. Lastly, we must collaborate for agroforestry to grow in America.

Appendix I. Agenda

"Enhancing Rural Economies Through Agroforestry: Assessing Emerging Opportunities"

Hosted by the USDA National Agroforestry Center, USDA Interagency Agroforestry Team, and USDA Economic Research Service

March 19, 20, and 21, 2018

USDA, Patriots Plaza III, 355 E St. SW, Washington D.C. 20024

Please arrive at or before 12:30 to ensure time to go through security.

DAY 1 Monday, March 19

12:30 **Meet and Greet**

1:00 **Welcome and introductions - Toral Patel-Weynand**

1:30 **Setting the stage - Susan Stein**

1:50 **Agenda review**

2:00 **Producer perspectives - Victor Harris, Moderator**

- **Reginaldo Haslett-Marroquin**, Main Street Project, Minnesota
- **Vickie Roberts-Ratliff**, Shelton Roberts Properties, LLC, Mississippi
- **Nate Olive**, Ridge to Reef Farm, Virgin Islands
- **Jacob Marty**, Green Fire Farm, Wisconsin

3:00 **Open discussion**

3:30 **Break**

3:45 **Economic factors affecting producer access and decision-making - David Smith, Moderator**

- **Marca Weinberg**, USDA Economic Research Service
- **Jay Variyam**, USDA Economic Research Service

4:15 **Open discussion**

4:45 **Closing remarks, reflections**

5:00 **Adjourn**

DAY 2 **Tuesday, March 20**

8:00 **Meet and greet**

8:30 **Welcome and review**

8:45 **Theme 1: Accessing resources - Harry Greene, Moderator**

- **Considerations for accessing land and capital**, Larry Godsey, Missouri Valley College
- **Land access and tenure**, Keefe Keeley, Savanna Institute
- **Private investment**, Kevin Egolf, Iroquois Valley Farms, LLC
- **Public investment**, Sarah Campbell, USDA Farm Service Agency

9:45 **Open discussion**

10:15 **Break**

10:30 **Pulling it all together - Small group discussions**

11:30 **Lunch**

12:45 **Theme 2: Accessing markets - Tricia Kovacs, Moderator**

- **Chris Chmiel,** Integration Acres
- **Mark Shepard**, Forest Agriculture Enterprises, LLC
- **Emily Lachniet**, Appalachian Sustainable Development

1:45 **Open discussion**

2:15 **Break**

2:30 **Pulling it all together - Small group discussions**

3:30 **Regroup and report-out on today's two panels**

4:30 **Closing remarks, reflections**

4:45 **Adjourn**

Day 3 **Wednesday, March 21**

8:00 **Meet and greet**

8:30 **Welcome and review**

8:45 **Theme 3: Incentives and markets for ecosystem service benefits - Jonas Epstein, Moderator**

- **Incentives & markets for ecosystem service benefits**, Jonas Epstein, USDA Forest Service
- **Ecosystem service credits & markets**, David Primozich, Freshwater Trust
- **Payments for ecosystems services**, Kelley Hamrick, Forest Trends
- **Agroforestry and Virginia's Nutrient Trading Program**, John Munsell, Virginia Tech

9:45 **Open discussion**

10:15 **Break**

10:30 **Pulling it all together - Small group discussions**

11:30 **Regroup and report-out on today's panel**

12:00 **Closing remarks, reflections**

12:15 **Adjourn**

Appendix II. Speaker Biographies

Sarah Campbell, USDA Farm Service Agency

Sarah Campbell is a part of the U.S. Department of Agriculture's (USDA) Farm Service Agency Outreach Office. She supports the Farm Service Agency's strategic outreach and stakeholder engagement around organic farming, local and regional foods, urban agriculture, and women in agriculture. Her work includes developing tools and resources that help field employees engage new audiences and building partnerships across Federal, State, and community partners to ensure equal access to USDA programs. She also works on several cross-agency initiatives, including the Local and Regional Foods Working Group, the Urban Agriculture Working Group, Farmers.gov, and the USDA Women in Ag Initiative. She is a graduate of Guilford College and has a master's degree in community development from University of California-Davis. She resides in Maryland where she operates a diversified livestock operation and sells pasture-based meats and hay.

Chris Chmiel, Integration Acres, Ltd.

Chris Chmiel graduated from Ohio University in "Wholistic Transition to Sustainability." After graduation in 1992, he started Integration Acres, Ltd., a specialty food company, which now is the world's largest pawpaw processor. He also started the Ohio Pawpaw Festival in 1999 and helped make the pawpaw the official State native fruit of Ohio, signed into law in 2009. Chmiel now is in his second term as a county commissioner and lives with his wife and two children in Athens, Ohio.

Kevin Egolf, Iroquois Valley Farms, LLC

Kevin Egolf is an impact investing professional focused on socially responsible farmland investing. His passion for sustainable agriculture and extensive finance background naturally led him toward impact investing. As the Chief Financial Officer of Iroquois Valley Farms, Egolf focuses his efforts on raising money and managing the money spent. He leads the company's private offerings, keeps the books and records, and administers the investor registers. Additionally, given his East Coast location, he often is the company representative for East Coast farm activity.

Prior to his work with Iroquois Valley Farms, Egolf spent several years in investment banking and private equity, developing extensive experience in corporate valuation, transaction management, and fundraising. Egolf is a graduate of Wesleyan University with bachelor's degrees in both economics and computer science. Outside of farmland finance, he coaches wrestling at Nathan Bishop, a local public middle school. Egolf lives in Providence, Rhode Island, with his wife, Amy, and daughter, Aurora.

Jonas Epstein, USDA Forest Service

A recent graduate of the University of Michigan School of Natural Resources and Environment with a master's degree in environmental policy, Jonas Epstein is an Oak Ridge Institute for Science Economic Research Fellow with the Forest Service, serving as the National Forest System Office of Watershed, Fish, Wildlife, Air & Rare Plants ecosystem services point of contact. He also works on a cross-deputy strategy team tasked with providing national direction in integrating ecosystem services into agency decision making, performance metrics, communications, and partnership engagement. He primarily is interested in helping connect people to healthy landscapes through environmental stewardship and making the economic justification for land conservation. His past research has delved into assessing the economic impacts resulting from Federal and State agricultural conservation programs, making the business case for investing in natural infrastructure, and the nexus of natural resource valuation and land planning.

Larry Godsey, Missouri Valley College

Larry Godsey earned his Ph.D. in forestry and his master's degree in agricultural economics from the University of Missouri-Columbia and a bachelor's degree in mathematics from Missouri Valley College. He served as the University of Missouri Center for Agroforestry's economist for more than 13 years and is a certified general real estate appraiser, providing consulting and appraisal services to the University of Missouri Forestry Department, Missouri Consulting Foresters Association, USDA Farm Service Agency, and numerous private institutions. Currently, Godsey is an assistant professor at Missouri Valley College and leads the Agribusiness program. He also has served in the Army National Guard for 30 years, just recently returning from a year-long deployment to the Middle East. Godsey and his wife, Lori, own several business ventures and enjoy the challenges of entrepreneurship.

Kelley Hamrick, Forest Trends

Kelley Hamrick is a senior associate at Forest Trends' Ecosystem Marketplace initiative. She has authored flagship annual reports on voluntary and forest carbon markets, clean cookstove markets, and, most recently, on conservation impact investing.

Reginaldo Haslett-Marroquin, Main Street Project/Regeneration International

Reginaldo Haslett-Marroquin, a native Guatemalan, began working on economic development projects with indigenous communities in 1988. He served as a consultant for the United Nations Development Programme Bureau for Latin America and as an advisor to the World Council of Indigenous Peoples. He migrated to the United States in 1992; served as a founding member of the Fair Trade Federation in 1994; served as director of the Fair Trade Program at the Institute for Agriculture and Trade Policy from 1995 to 1998; led the creation and launch of Peace Coffee, a fair-trade coffee company; and led a multitude of inner-city new immigrant enterprise and woodland owner cooperatives efforts in Minnesota.

Haslett-Marroquin is currently a member of the Rotary Club of Northfield, MN; board member with Conservation Core of Minnesota and Iowa; founding and steering committee member of Regeneration International and Regeneration Midwest, a 12-State alliance; advisory board member for the Savanna Institute; and chief strategy officer at Main Street Project. Haslett-Marroquin has broken new ground in the field of regenerative food and agriculture engineering through an innovative poultry-centered regenerative agriculture system he has pioneered. He has an agronomy degree from the Central National School of Agriculture, studied at the Universidad de San Carlos in Guatemala, and graduated in business administration from Augsburg College in Minneapolis. He currently lives and farms in Minnesota with his wife, Amy, and three kids.

Keefe Keeley, Savanna Institute

Keefe Keeley is co-executive director of the Savanna Institute, a nonprofit organization charted to catalyze the development and adoption of resilient and scalable agroforestry systems. Recent research emphases at the Institute have included tree crop variety trials, silvopasture establishment techniques, pollinator habitat, carbon sequestration, and long-term land access for agroforestry. Educational offerings include farmer training, landowner outreach, farm planning tools and guides, and community development through events and PerennialMap.org. Keeley recently co-edited a bioregional anthology called *The Driftless Reader* about the unglaciated area just to the west of his home in Madison, Wisconsin.

Emily Lachniet, Appalachian Sustainable Development

Emily Lachniet serves as the agroforestry program manager for Appalachian Sustainable Development, assisting landowners in growing native fruit and nut trees, such as pawpaws, persimmons, and elderberries, and forest farming native medicinal herbs, such as ginseng, goldenseal, and black cohosh. Along with her colleagues, she has developed the Appalachian Harvest herb hub, a processing and aggregation center located in the Appalachian Harvest Food Hub in Duffield, Virginia. She loves getting to work with these special plants at work and at home on a small farm in Glade Spring, Virginia, where she lives with her husband and daughters. A graduate of Michigan State University with a bachelor's degree in professional forestry, Lachniet has made southwest Virginia her home since 2001.

Jacob Marty, Green Fire Farm, LLC

Jacob Marty is a sixth-(re)generation farmer who focuses on combining conservation and agricultural practices for truly sustainable lands and communities. Marty has a degree in wildlife ecology from the University of Wisconsin-Stevens Point and extensive understanding of ecological concepts. Along with his father, Jim, and influenced by Aldo Leopold, Green Fire Farm has transitioned 250 acres of conventional grain production into rational grazing for beef cattle, hogs, sheep, and poultry since 2015. In 2016, a pilot silvopasture planting of 1,000 redbuds, apple, pear, chestnut, and other fruit and nut trees was established on 8 acres. Hogs and sheep are raised in the alleys of the planting while the trees mature to provide future shade, windbreak, aesthetics, and supplemental forage.

John Munsell, Virginia Tech

John Munsell is an associate professor in the Department of Forest Resources and Environmental Conservation at Virginia Tech. He received his Ph.D. and master's degree from the State University of New York and his bachelor's degree from Tulane University. Munsell is past-president of the Association for Temperate Agroforestry and associate editor for the journal Agroforestry Systems. He is a social scientist and extension specialist who studies private forest and farm stewardship, agroforestry, and whole-farm planning and collaborative conservation. He is co-author of a forthcoming book on community food forests and resides in Blacksburg, VA, with his family, where he enjoys playing string bass and making venison jerky.

Nate Olive, Ridge to Reef Farm (R2R)

Nate Olive, Ph.D., is a farmer/director at Ridge to Reef Farm (R2R) on the island of St. Croix, United States Virgin Islands. He and his wife, Shelli Brin, manage 180 hilly acres of sub-tropical forest with varied stocks of tropical fruit trees, bamboo, vegetable fields, and wild forest areas. R2R produces USDA-certified organic fruits and vegetables, as well as pasture-raised livestock in an ecological farming strategy. Primary produce markets include a local Community Supported Agriculture program, a Farm-to-School hub, and an herbal supplement company that specializes in Moringa oleifera leaf products. The farm also offers agritourism activities, such as tours, volunteer vacations, and off-grid farm-to-table dinners. In recent months, Hurricane Maria (Cat-5) ravaged the lands of R2R and the town of Frederiksted, St. Croix. The resiliency of their diverse agroforestry strategy is now put to the test.

Vickie Roberts-Ratliff, Shelton Roberts Properties, LLC

During the last 18 years, Vickie Roberts-Ratliff has been immersed in managing Shelton Roberts Properties, her family's fourth-generation farm, which includes planting a plantation of trees, developing management plans, and understanding the importance of forestry to Mississippi's economic development. Roberts-Ratliff's uncanny knack to grasp this industry led her to be selected to serve in leadership roles on numerous committees, as well as president, within the local forestry association in 2011. Currently, Roberts-Ratliff is district program assistant for Fulton and Cobb County Soil and Water Conservation districts with the Georgia Association of Conservation Districts. She is married to Whitfield Ratliff, a fellow landowner. They reside in the Atlanta, GA, area.

Mark Shepard, Forest Agriculture Enterprises, LLC

Mark Shepard is the Chief Executive Officer of Restoration Agriculture Development, Inc., and Forest Agriculture Enterprises, and he runs New Forest Farms, a 110-acre perennial agricultural savanna, one of the first of its kind in the United States. Trained in both mechanical engineering and ecology, Shepard has developed and patented equipment and processes for the cultivation, harvesting, and processing of forest-derived agricultural products for human foods and biofuels production. Shepard was certified as a permaculture designer in 1993 and received his Diploma of Permaculture design from Bill Mollison, the founder of the international permaculture movement. He is a 20-year farmer member of the Organic Valley cooperative, the world's largest organic farmers' marketing co-op. Shepard also serves on the board of directors of the Southwest Badger Resource Conservation and Development Council and The Stewardship Network.

Jay Variyam, USDA Economic Research Service

Jay Variyam is the director of Economic Research Service's (ERS) Food Economics Division. He leads ERS's food policy research focused on food and nutrition assistance programs, food security, food markets, food safety, and consumer food choices. A major emphasis is the development and analysis of consumer and food market data, including data on food prices, household food purchases, consumer dietary behaviors, and time use. Variyam is a steering committee member of the National Collaborative on Childhood Obesity Research and a member of the Interagency Council on Human Nutrition Research. Variyam holds a Ph.D. in agricultural economics from the University of Georgia.

Committee Member Biographies

Gary Bentrup, USDA National Agroforestry Center

Gary Bentrup is a U.S. Department of Agriculture (USDA) Forest Service research landscape planner at the USDA National Agroforestry Center in Lincoln, NE. He received a bachelor's degree in landscape architecture from Kansas State University and a master's degree in landscape architecture from Utah State University. His work focuses on developing resources for designing multi-functional agroforestry practices that address landowner and public goals. Some of his products include the CanVis Visual Simulation Kit, Non-timber Forest Product Calculator, and *Conservation Buffers: Design Guidelines for Buffers, Corridors, and Greenways,* which has been translated into Spanish, Chinese, French, Korean, and Mongolian. Bentrup grew up on a farm near Deerfield, KS, which he and his sisters currently manage as absentee landowners.

Dean Current, University of Minnesota

Dean Current has a Ph.D. in natural resource economics and master's degrees in forest economics and anthropology. He is program director for the Center for Integrated Natural Resources and Agricultural Management at the University of Minnesota. He has more than 40 years of experience in Latin America, South and Southeast Asia, and the United States working on issues related to the sustainable management of agriculture, agroforestry, natural resources, and associated livelihood impacts.

For the last 17 years, he has been working on markets and value chain analysis to identify sustainable agriculture and natural resource management opportunities that provide livelihood improvements for local communities, while preserving and enhancing the ecosystem services provided by agricultural and forested landscapes.

Christopher Hartley, USDA Office of Environmental Markets

Christopher Hartley is the deputy director and senior environmental markets analyst with the U.S. Department of Agriculture (USDA), Office of Environmental Markets. He is responsible for the development of policy, tools, and metrics to support landowner participation in markets for ecosystem services. He previously worked for the USDA Natural Resources Conservation Service in Washington, DC, and in California and served with the U.S. Peace Corps as an agricultural extension agent in Senegal, West Africa. He holds a doctorate degree in agricultural ecology and masters' degrees in agronomy and international agricultural development from the University of California-Davis. He is a certified crop advisor and a licensed pest control advisor with active farming interests in California and Oregon.

Marlen Eve, USDA Agricultural Research Service

At the U.S. Department of Agriculture (USDA), Agricultural Research Service (ARS), Marlen Eve serves as acting deputy administrator within the Natural Resources and Sustainable Agricultural Systems program area and as a national program leader (NPL). As NPL, Eve oversees ARS research on all aspects of soil and air management and pasture and rangeland resources. Eve joined ARS from a detail position as senior advisor for Climate Change in the USDA Office of the Chief Scientist. Prior to that, he directed the development of new tools for farm-scale estimation of greenhouse gas emissions and reductions within USDA's Climate Change Program Office within the Office of the Chief Economist. Eve has also been responsible for coordinating national-level greenhouse gas inventories for agriculture and forestry. Earlier in his career, Marlen was an ARS soil scientist in Fort Collins, Colorado, where he generated the first national greenhouse gas inventory for agricultural soils using the Intergovernmental Panel on Climate Change methodology.

Tricia Kovacs, USDA Agricultural Marketing Service

Tricia Kovacs coordinates efforts across the U.S. Department of Agriculture (USDA) to support the local and regional food sector, with additional focus on market access and food safety. Prior to joining USDA, Kovacs managed regional markets programs at the Washington State Department of Agriculture, where she was founding program manager for its Farm-to-School program and led the Small Farm Direct Marketing program. Kovacs was lead author on publications that help farmers and buyers understand complex market requirements, including *Bridging the GAPs Farm Guide: Good Agricultural Practices* and *On-Farm Food Safety for Small, Mid-Sized and Diversified Fruit and Vegetable Farms*, and *A School's Guide to Buying Washington-Grown Food*. Kovacs holds a master's degree in sustainability, planning, and environmental policy from Cardiff University in Wales and a bachelor's degree from the University of Virginia. Originally from rural Appalachian, VA, she lives with her husband and two children in Washington, DC.

Kate MacFarland, USDA National Agroforestry Center

Kate MacFarland is the assistant agroforester for the U.S. Department of Agriculture (USDA), National Agroforestry Center (NAC) located in Lincoln, NE. She is part of the technology transfer team at NAC. Her work focuses on providing leadership for national and regional workshops and trainings, developing outreach materials for science delivery for a range of technical and general audiences, and supporting the integration of agroforestry into USDA programs. MacFarland also is involved with NAC's human dimensions work.

MacFarland has a master's degree in community and regional planning from the University of Oregon, where her research focused on ecosystem services, natural resource management, and economic development. She also has a bachelor's degree in natural resources from Cornell University.

Eric Norland, USDA National Institute of Food and Agriculture

Eric Norland, certified forester, is the national program leader and forest resource management and national extension forester at the U.S. Department of Agriculture (USDA), National Institute of Food and Agriculture. He provides leadership for the Renewable Resources Extension Act, co-leads the McIntire-Stennis Cooperative Forestry Research program, and advises and coordinates agroforestry research and extension programs. He has worked in Extension for 36 years at Ohio State University Extension, where he began his career as a county extension agent, and has been at USDA since 2002. He received his degrees in forestry and environmental biology at The Ohio State University. Norland is a fellow of the Society of American Foresters and is a certified forester.

David Smith, USDA Economic Research Service

David Smith is an agricultural economist at the U.S. Department of Agriculture, Economic Research Service (ERS). Smith interned with ERS in 2011 and 2012 and has been an agricultural economist at ERS since 2015. Between 2010 and 2015, he was a researcher at the Center for Integrated Natural Resources and Agricultural Management, working on perennial bioenergy production and agroforestry. With a focus on conservation on working agricultural land, Smith's current research includes work on conservation practices, Federal conservation programs, pollinators, pests, and pest management. Smith has a Ph.D. in applied economics and bachelor's degrees in environmental studies and political science from the University of Minnesota.

Susan Stein, USDA National Agroforestry Center

Susan Stein is director of the U.S. Department of Agriculture's National Agroforestry Center (NAC). Based in Lincoln, NE, NAC advances the health, diversity, and productivity of working lands, waters, and communities through agroforestry—the integration of trees and agriculture. Research and outreach efforts are conducted with a network of natural resource and agriculture professionals and scientists. NAC is in the USDA Forest Service, Research and Development Deputy Area and is managed as a partnership with the Forest Service's State and Private Forestry Deputy Area and the USDA Natural Resources Conservation Service. Stein's prior experience includes managing the National Forest Stewardship Program, advising Forest Service field units on compliance with the National Environmental Policy Act, and serving as the Forest Service International Agroforestry Coordinator. She has also led efforts to integrate open space conservation tools and practices into Forest Service programs and produced the *Forests on the Edge* publication series, widely used to inform local and regional planning efforts. International work before joining the Forest Service includes leading an agroforestry outreach project in Somalia and managing a forest policy review for the Democratic Republic of Congo. Stein has a master's degree in forestry from the Yale School of Forestry and an undergraduate degree in psychobiology from Mount Holyoke College.

Richard Straight, USDA National Agroforestry Center

Richard Straight is the U.S. Department of Agriculture (USDA), Forest Service lead agroforester with the USDA National Agroforestry Center (NAC) in Lincoln, NE. NAC is a partnership of the Forest Service Research and Development, State and Private Forestry, and the USDA Natural Resources Conservation Service (NRCS). Straight was born and raised in Iowa and received a degree in forest management from Iowa State University. His first professional forestry position was as the city forester in North Central Iowa. From community forestry, Straight then moved to Central Nebraska with the State Forest Service to practice “flatland forestry” or conservation forestry. There, he worked 7 years with farmers and ranchers designing windbreaks, riparian buffers, and wildlife habitat plantings and assisting communities with their tree programs, in coordination with Federal, State, and local conservation programs. The final 2 years, prior to coming to NAC in 2000, he was the NRCS State staff forester for Nebraska.

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