The Center for Agroforestry

Pathway to 2030

EXECUTIVE SUMMARY

The University of Missouri Center for Agroforestry (UMCA) experienced strong growth across all mission areas during the 5-year period (2015-2019) leading up to the development of the new strategic plan. Postitive research productivity was reflected in the growing number of publications and the level of funding from competitive grants (annual expenditures exceeding $3 million). A large number of outreach activities were hosted or supported by UMCA annually. UMCA has offered three graduate degree options: 1) Campus MS, 2) Online MS, and 3) Online Graduate Certificate, with a total of 48 graduate students in the previous 5-year period. In 2019, UMCA received a 550-acre land gift linked to a substantial endowment, and in the same year was recognized as a CAFNR Program of Distinction.

Planning ahead to 2030, UMCA refined a vision of agroforestry which will be defined as "integrating trees, crops, and livestock for healthy, profitable farms and vibrant communities". Considering the question "Why do we do what we do?", UMCA is committed to improving the health of the earth and its inhabitants through an agricultural transformation into multifunctional, perennial systems. As such, agroforestry can be promoted as an ideal solution to societal problems including climate change, natural resource limitations, food insecurity, and threats to human health and well-being. A clear set of research themes will help guide the efforts of UMCA in the coming ten years.

Research will focus on several key themes although investigations will not be limited to these areas:

- Theme 1: Breeding and selecting specialty crops for farm diversification and profitability
- Theme 2: Encouraging livestock integration for income opportunities and resilience
- Theme 3: Protecting natural resources through conservation of valuable soil and nutrients
- Theme 4: Supporting community development through markets and value-added opportunities
- Theme 5: Promoting human health through diverse nutrient-dense foods and clean drinking water
- Theme 6: Transforming the landscape to integrate agroforestry and perennial specialty crops

Outreach efforts will focus on developing and expanding a full suite of resources, tools, and programs that provide comprehensive training for natural resources professionals, farmer-landowners, and the broader public, towards the development of well-supported peer learning networks. UMCA will engage with and host both public and targeted events that highlight research translation, dissemination, and networking, to build an informed cultural awareness of agroforestry. Teaching and education plans will emphasize the highest quality instruction and teaching excellence. Educational programs will be expanded with a broader array of course offerings at the graduate level, a new annual course at the undergraduate level, and formalization of an Agroforestry PhD Emphasis Area, among other changes. Economic development will be fostered within UMCA (innovation in hands-on R&D) and for rural and urban communities (technology transfer). Finally, a new emphasis on Inclusion, Diversity, and Equity (IDE) includes specific goals for the coming decade to embody diversity and commit to creating an environment where all individuals feel welcome, valued, respected, and safe.

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INTRODUCTION

The Center for Agroforestry at the University of Missouri, established in 1998, is one of the world's leading centers contributing to the science underlying agroforestry practices, which combine trees and/or shrubs with crops and/or livestock.

Agroforestry practices include alley cropping, windbreaks, silvopasture, riparian and upland perennial buffers, forest farming, and urban food forests. These practices help landowners create multifunctional working landscapes to provide a wide range of benefits including:

- Diversification of products, markets, and farm income
- Protection and improvement in soil, water, and air quality
- Mitigation and adaptation to climate change
- Conservation of agroecosystem biodiversity
- Improvements in human health and well-being

UMCA is guided by a mission to support the long-term future of rural and urban working farms and forests through land use strategies that achieve economic, environmental and social sustainability. Our vision is to further enhance our status as a preeminent global center in agroforestry research, economic development, education and outreach that will offer sustainable and resilient solutions to some of the greatest challenges we face today – climate change, natural resource degradation, loss of biodiversity, and economic and food insecurity.

UMCA is primarily supported through sponsored projects, including a recurring grant from USDA-Agricultural Research Service (USDA-ARS). UMCA also benefits from endowments and relationships with other units at MU and beyond (e.g., Lincoln University, external agencies). All of the faculty have academic appointments in the School of Natural Resources, which provides office and lab space to each member. Faculty performance is evaluated by both the director of the Center for Agroforestry and formally by the director of the School of Natural Resources. For most of the 2015-2019 period, the Center for Agroforestry consisted of one director, one associate director, five Professional Track faculty members, and five staff. The data in this report are based on the output of that core group. In mid/late-year 2019, several positions were filled: a new director and two new faculty lines. As these new members have been transitioning into the new roles, their outputs have not been included in the report.

The long history of success provides a **solid foundation for the path forward** where the future vision of agroforestry encourages a broad landscape transformation to integrate perennial specialty crops that could offer a wide array of environmental benefits including carbon sequestration, climate change adaptation, biodiversity enhancement, water quality improvements, and wildlife habitat. These perennial systems will also support human inhabitants through nutrient-dense fruits and nuts, diversification and profitability of farm enterprises, and the psychologically restorative beauty of a landscape that mimics natural forest and savanna ecosystems. UMCA is poised to lead this transformation, by providing the rigorous scientific research necessary to quantify the outputs and to develop new resources, from the molecular genetic/genomics level to the systems-based work at the landscape level. The teaching and education, outreach, and economic development efforts will build on the base of basic and applied research, to translate that knowledge to different audiences and to create the innovative products necessary for economic viability.

STRATEGIC PLANNING PROCESS

Beginning in August 2019, UMCA undertook a strategic planning process that began with a semester-long, comprehensive information gathering phase (Figure 1). The culmination of that work was a Five-Year Review document that was presented to Provost Latha Ramchand, Associate Provost Matthew Martens, and CAFNR Dean Christopher Daubert. In the spring semester and through the summer, the focus was on future planning.

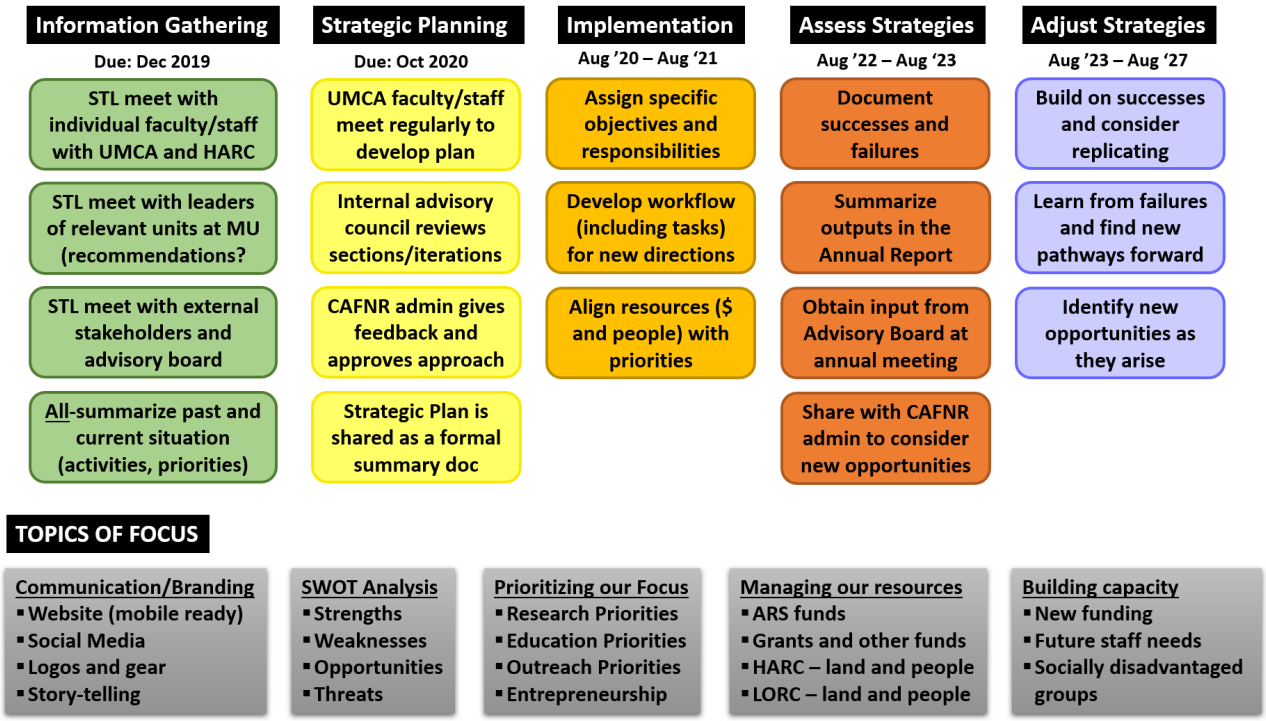

Figure 1. *Diagram of Strategic Plan Timeline, including objectives, goals, and areas of focus (Abbreviations are STL: Sarah T. Lovell, Director; UMCA: Univerisity of Missouri Center for Agroforestry; CAFNR: College of Agriculture, Food and Natural Resources; ARS: USDA Agriculture Research Service; HARC: Horticulture and Agroforestry Reseach Center; LORC: Land of the Osages Research Center).*

BASELINE ASSESSMENT (5-Year review)

UMCA is expectionally active in all four mission areas emphasized by the University of Missouri – teaching, research, service and economic development.

Research Strengths and Activities

Most of the funding for the Center for Agroforestry is committed to research. This mission has been a primary focus of the Professional Track Faculty for the past five years and will continue into the foreseeable future. The faculty are productive in publishing their scientific results in peer reviewed journals, book chapters, abstracts, and reports. Research topics have been broad, but primarily relate to

the development of agroforestry and other land use practices that serve as sustainable and resilient solutions combining production and conservation. Across the 5-year period, the dominant research topics include: soil quality, human health benefits, bioenergy crops, general agroforestry, and cover crops. Comparing the topics in 2015 to 2019, there has been a shift from bioenergy to cover crops, as well as an overall increase in the diversity of topics (Figure 2).

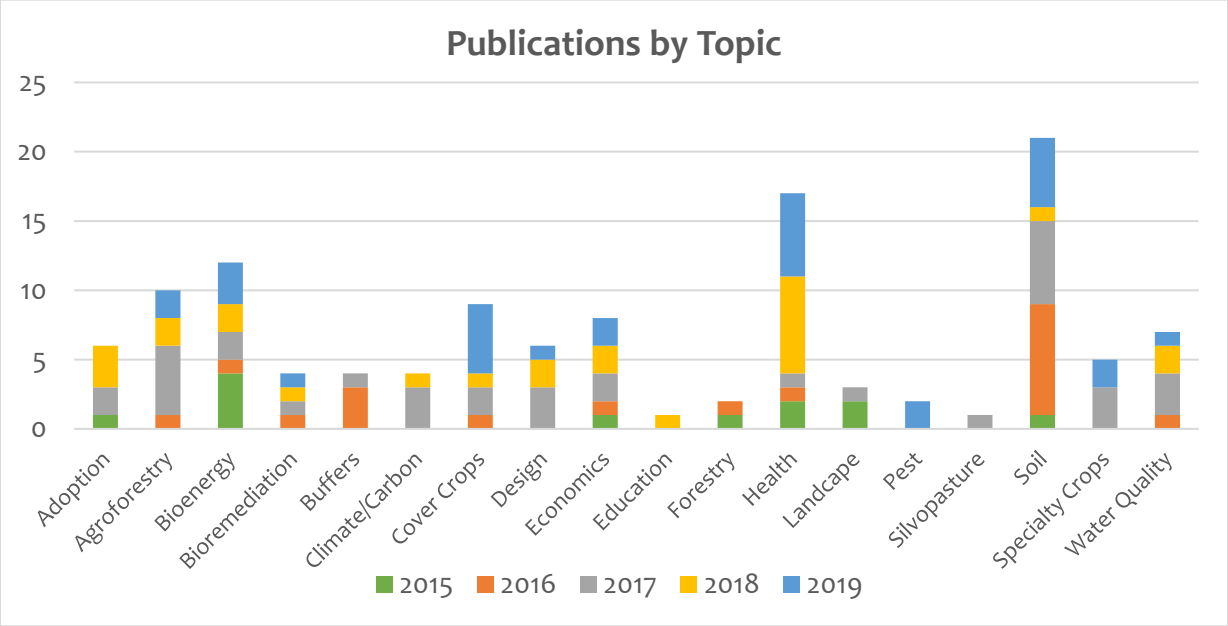

***Figure 2**. Topics of research based on publications by faculty at the Center for Agroforestry*

The research activities for the Center for Agroforestry are best captured in the articles and chapters published. Several manuscripts were recognized as featured, best, etc. by respective flagship journals. In the past five years (2015-2019), faculty have averaged over four to six publications per FTE each year (Figure 3). Another metric of performance in research is the funding brought in by the faculty from competitive grants. Since grants run on different cycles, we have included a "snapshot" for 2019 of all active grants (includes total of multi-year grants). The total funding from the five faculty was $6.125 million, most of which is allocated for the Center for Agroforestry, as shown in Table 1 and Figure 4.

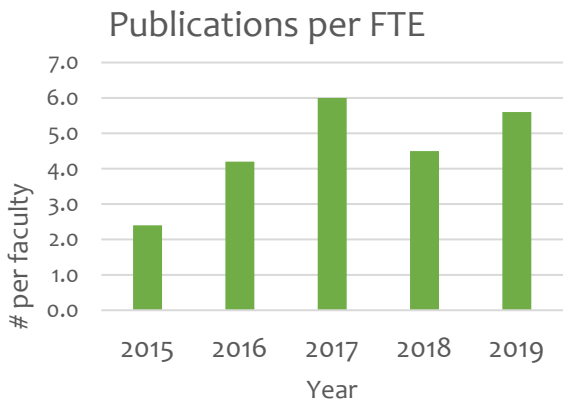

***Figure 3**. Average number of publications/faculty*

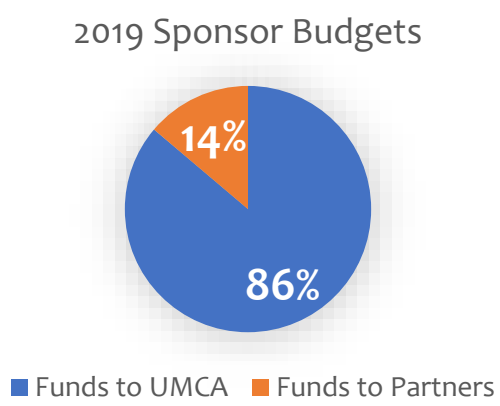

***Figure 4**. Allocation of funding from sponsored projects*

Outreach Strengths and Activities

One of the primary goals of UMCA is to bring our research findings to producers, agencies, stakeholders and the public. Using the most recent year (2019) as an example, UMCA faculty and staff estimated they have engaged with and/or trained 8,800 producers, trainers, stakeholders, and community members as part of our hosted outreach and extension (O/E) activities. Additionally, participation in other non-UMCA hosted activities resulted in reaching an estimated 7,600 people. This includes an estimated 25 trainings, workshops, and producer engagement events, and at least 24 digital media outlets. Upwards of 19 community engagement and formal networking opportunities were reported in 2019, and this is undoubtedly a conservative estimate.

These metrics can only describe estimated exposure and participation. In an attempt to measure the *impact* of our efforts to meet this component of our mission, our O/E activities have been broadly categorized into areas of function and potential impact level. While many events and activities can arguably meet criteria for multiple categories, emphasis was given to the primary goal of the UMCA participants' time investment for each interaction.

- **Networking**: These primarily represent events that faculty and staff participate in to provide opportunities for *meeting new potential partners or practitioners and increasing general visibility of UMCA and agroforestry practices*.
- **Digital Media**: Items here represent our *virtual outreach*, including the new monthly Agroforestry Podcast, a periodic webinar series launched in 2015, newsletters and outreach publications. Future updates to the website are discussed in Part II.
- **Community Engagement**: These activities result in UMCA faculty and staff *engaging with members of the public to raise awareness of agroforestry and UMCA*, but not necessarily an audience that will likely adopt agroforestry practices. These also include major community education and enrichment activities, such as UMCA's annual Missouri Chestnut Roast.
- **Conferences and Symposiums**: This category includes conferences and symposiums where UMCA faculty and staff engage with various members of the public, producers, academics, and stakeholders in a variety of settings, *generally including a presentation or poster where our work is disseminated*.
- **Training and Workshops**: This refers to activities and events where the primary goal is to *train and educate natural resources professionals and potential adopters of agroforestry practices*.
- **Producer Engagement**: This includes activities where the primary focus is *directly engaging* with current agroforestry practitioners and potential adopters in order to *develop meaningful relationships or provide specific consultation.*

In Figure 5, a summary of events and activities attended by UMCA faculty and staff during 2019 illustrate estimates of each employee's efforts (in hours, including time spent in travel and preparation) as well as an estimate of the number of people reached at each event. For each event, the total employee hours spent were divided by the number of audience members reached, to achieve the Hours:Audience Index (HAI).

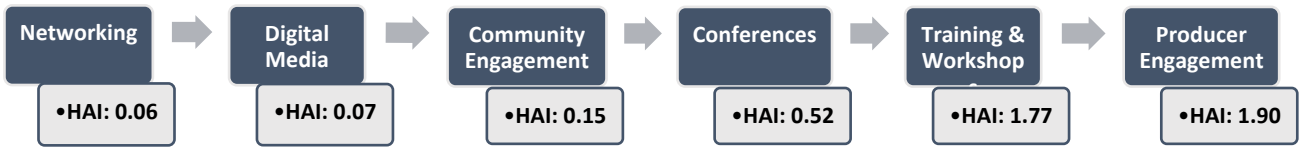

Figure 5. *Top, outreach activities. Bottom, schematic representing the different Outreach and Engagement Categories ordered by increasing average Hours Audience Index (HAI) for each category in 2019*

UMCA organizes several staple events and activities each year, which showcase the breadth of O/E efforts. A few of these annual activities are described in detail below.

The Annual Agroforestry Academy (*Training/Workshop, HAI: 13.13*): Incidentally, this is the event with the highest HAI of all annual activities, yet one considered most successful with regards to impact on producer engagement and adoption of agroforestry practices. Beginning in 2013 as part of an innovative joint project composed of the Mid-America Agroforestry Working Group partners and supported by USDA SARE, the Academy has proven popular and effective for in-depth, accessible agroforestry education. In the last 5 years, 120 farmer-landowners and natural resources professionals have completed the intensive short course, many of whom have extended UMCA's reach by offering spin-off agroforestry programs in their own regions.

The Agroforestry Symposium (*Conference, HAI: 2.06*): This event offers an opportunity for producers, stakeholders, and researchers to engage with each other on MU's campus as they share data and ongoing project information. With attendance ranging between 250 and 500+ (both in-person and via virtual livestream), the Symposium is a recurring opportunity for networking and building awareness, while also fostering more intensive information exchange between researchers and potential adopters.

The Missouri Chestnut Roast Festival (*Community Engagement, HAI: 0.17*): A celebration of the fall chestnut harvest, is the signature field event for MU's Horticulture and Agroforestry Research Center, and one of UMCA's most substantial public events. Held on the first Saturday of October, the Festival annually draws between 2,000 and 4,000 visitors (turnout depending primarily on weather) for family-friendly activities, educational seminars, farm tours, local artisan and food vendors, live music, and hands-on demonstrations.

The Agroforestry Podcast (*Digital Media, HAI: 0.07*): New to UMCA's outreach media in 2019, the Agroforestry Podcast capitalizes on the growing popularity of downloadable audio to reach audiences near and far. Syndicated in all podcast apps, the 30-minute episodes released monthly are a free and readily accessible way to share timely voices from UMCA's own research faculty, and from our network of agroforestry practitioners, agriculture and natural resources professionals. The podcast is coordinated, hosted, and delivered by UMCA's Education Program Coordinator. Despite limited promotion during the first season, unique listener downloads continue to rise, with 30-50 new listeners each day, and more than 1,000 total downloads per episode.

Teaching Strengths and Activities

The teaching strength of UMCA focuses on the graduate programs, currently with 3 different degree offerings: 1) Campus MS, 2) Online MS, and 3) Online Graduate Certificate. UMCA also funds a number of Ph.D. students who are advised by Center faculty, although there is not currently an official Ph.D. Agroforestry emphasis area.

Graduate Programs

Over the past 5 years, 2015-2019, a total of 48 students have completed graduate programs under the auspices of UMCA. Total graduates by year are as follows: 6, 12, 10, 10, and 10 for each year from 2015 to 2019. The breakdown of graduate students is as follows: 19 in Online MS, 15 in Thesis MS, 17 obtaining a Graduate Certificate, and 2 obtaining a PhD in the School of Natural Resources. *Note, the above numbers add up to greater than 48, because some students have received the grad certificate in addition to the thesis MS or online MS.*

Table 2. Online Course Enrollment figures 2015-2019

Agroforestry: Online Master's Degree Courses		**Enrollment: Primarily Online Enrollment**				
	Instructor	**2015**	**2016**	**2017**	**2018**	**2019**
FOREST 7385 Agroforestry I: Theory, Practice and Adoption.	Gold	21	24	23	27	17
FOREST 8385 Ecological Principles of Agroforestry	Jose/Bardhan	9	12	11	14	10
FOREST 8395: Agroforestry Economics and Policy	Godsey/Cai	8	11	12	8	7
ENV_SC 7396 Agroforestry for Watershed Restoration	Udawatta	7	10	10	6	8
ENV_SC 7314 Soil Fertility and Plant Nutrition	Motavalli	15	12	17	6	9
NAT_R 8325 Introduction to Geographic Information Systems	He *(only AF students included)*	2	1	1	5	7
FOREST 7390 Watershed Management and Water Quality	Hubbart/Argerich	no data	no data	not offered	4	not offered
NAT_R 8300 Urban Biodiversity, Conservation, Planning	Nilon	not offered	not offered	not offered	10	14
NAT_R 8024 Program Dev't & Eval. in Informal Settings	Li	not offered	not offered	not offered	8	9
BIOCHM 8120 Advanced Medicinal Plant Science	Vincent	9	3	16	3	4
BIOCHM 8130 Commercial Use of Biodiversity**	Vincent	not offered	not offered	not offered	not offered	not offered
NAT_R 7353 Natural Resource Policy/Administration	Aguilar *(only AF students included)*	not offered	5	not offered	4	not offered
		2015	**2016**	**2017**	**2018**	**2019**
Total UMCA Generated Credit Hours		**71**	**78**	**90**	**95**	**85**

*Note: FOR 7385 was offered 2x per year from 2015-2018, only once in 2019. **Initiates Spring 2021*

Current enrollment in graduate degree programs (up to Fall semester 2019) totals 42, with 16 in online MS, 6 in thesis MS, 16 in graduate certificate, and 7 in the PhD program. Again, several students are double counted since they will receive a graduate certificate plus the MS or online MS.

Competitive Advantages:

1) Formal Degree: To the best of our knowledge, as of June 2020, there are NO other U.S.universities offering graduate training in agroforestry that actually appears on official course transcripts. That said, many other U.S. universities are training graduate students in agroforestry.
2) Only Online Programs: Also, as of June 2020 (via google search), there are no other U.S. universities that offer either an official graduate certificate (online or otherwise) or online master's degree in agroforestry.
3) Cost: Out of pocket tuition costs of our online programs at $15,040 (Fall 2020 data), likely as low as can be found anywhere in the U.S. because MU only charges online students at the in state graduate tuition rate. In addition, SNR does not currently add a tuition surcharge.
4) Highly Rated Program: An external program rating service ranked UMCA's online programs at the top of the lists. A current search reveals that UMCA's program is rated #1 on this website: 2020's Best Online Forestry Degree Programs https://www.publicservicedegrees.org/online-degrees/forestry-programs/
   Our students also have high ratings about UMCA's program. In a recent current student survey (Stubblefield, 2020), our graduate students rated their overall experience with Mizzou Agroforestry on a scale from "very poor" to "excellent." 80% (12 of 15) rated their experience as "excellent" (26.67%) or "good" (53.37%). Results from a similar survey targeting previous program students (Cai et al, 2020) also indicated that our former graduate students give the program high ratings: 76% (16 of 21) rated their experience as "excellent" (38.10%) or "good" (38.10%).
5) High Quality Courses: According to our student survey results (Cai, et al., 2020; Stubblefield, 2020), students mentioned that our courses were not only comprehensive and thorough, but also were applicable to agroforestry, relevant to job activities, and consisted of interesting topics.

Economic Development – Strengths and Activities

Dr. Chung-Ho Lin and his team are the primary group working on economic development activities, with successful transfer of inventions to industry. Spin-offs from his research include start-up companies, Elemental Enzymes Inc. and Tiger Energy LLC (now Tiger Enzyme Solutions).

1. Elemental Enzymes, now a self-sustaining company with offices in St. Louis, MO; Columbia, MO; and Jacksonville, FL. The first commercial product PONCHO/ VOTiVO 2.0 was launched in the U.S. by Bayer in 2018 (corn, soybean and cotton). Its agriculture products have been applied on more than seven million acres of American farmland, contributing to more than one billion additional pounds of corn grown in the U.S. In 2019, it was expanded to 40 million acres in the U.S. Elemental Enzymes currently has 18 products in the market, 4,000 active field trials, and created over 42 positions for scientists and professionals in the region.

2. Tiger Enzyme Solutions has been focused on 'blood type' conversion (production of universal blood type O), water treatment, bioremediation, and production of specialty chemicals using a programmable novel continuous-flow enzymatic reactor system developed by Dr. Lin and collaborators.

3. Seventeen patents (3 granted, 2 provisional, 12 pending) and 10 invention disclosures have been generated from this research.

4. Dr. Lin has developed an entrepreneurship curriculum "FOR 8401-Translational Research and Entrepreneurship".

5. Dr. Lin works with several biotech companies to support their R&D and to facilitate product development. These companies include: SCD Probiotics, Proviera Biotech, NutraPet Systems/Caribbean Probiotics Industries, Kelly Foods Corporation, Barnes & Associates Attorney LLC, Bartimus Frickleton Robertson Goza, AgriGro, and Cummings, Cummings & Dudenhefer Law Firm.

Other Economic Development Activities include UMCA Annual Research Symposia:

1. 8th Annual Agroforestry Symposium: Enhancing Health, Conservation and Livelihoods: Medicinal Plants in Agroforestry, January 26, 2017
2. 10th Annual Agroforestry Symposium: Innovation to Entrepreneurship, Jan. 31, 2019
3. 11th Annual Agroforestry Symposium: Show Me More! Value-Added Processing for Missouri Agriculture and Forestry, January 30, 2020

UMCA Economic, Market and Consumer Research in Specialty Crops:

Faculty and staff have developed resources for the scientific community and practitioners. Several examples include:

1. Chestnut, Black Walnut and Elderberry Economic Decision Support Tools (excel based)
2. Cai, Z., Gold, M. and Brannan, R. 2018. An Exploratory Analysis of U.S. Consumer Preferences for North American Pawpaw. *Agroforestry Systems.* DOI: 10.1007/s10457-018-0296-5
3. Cernusca, M.M. and M.A. Gold. 2015. Breaking down market barriers for elderberry growers and producers. *Acta Horticulturae* 1061:269-277.

Interrelationships with other Units on Campus and External Partnerships

UMCA has developed strong relationships with other units on campus through grant collaborations, funding graduate students, and project partnerships. In addition, linked to the Center's solid science and research programs are numerous partnerships with landowners, natural resource professionals, federal and state agencies, other Universities, and for profit and non-profit organizations. Through these critical relationships, UMCA and its partners produce an array of positive outcomes for landowners, businesses, the natural environment and society as a whole.

MU programs that have partnered with UMCA include: Ag Systems Mgt., Food Systems & Bioengineering; Bioinformatics Institute; College of Agriculture, Food & Natural Resources; Dalton Cardiovascular Research Center; School of Medicine: OB., Gyn. & Women's Health; Reproductive Medicine and Fertility & Andrology Lab; Family & Community Medicine Dept.; School of Natural Resources; University of Missouri Extension; Mizzou Advantage; Life Sciences Center; Center for International Programs

Partnerships with MU faculty have been successful with the following units: Agronomy; Agriculture Education & Leadership; Animal Model Core; Biochemistry; Cell & Immunobiology Core; Center for Family & Policy Research; Children & Family Across Cultures; Civil & Enviro. Engineering; Fisheries & Wildlife; Forestry; Horticulture; Human Development & Family Sciences; Life Science Center; Metabolomics Center; Metagenomics Center; Molecular Microbiology & Immunology; NMR Core; Plant Sciences; Physics; Proteomics Core; Rural Sociology; Soil, Environmental & Atmospheric Sciences; USDA-Forest Service; USDA-ARS campus unit; Veterinary Pathobiology

MU AES Research Centers have hosted UMCA research activities: Bradford Research & Extension Center; Greenley Memorial Research Center; Horticulture & Agroforestry Research Center; South Farm Research Center; Southwest Research Center; Thompson Research Center; Wurdack Farm

External Partnerships: State Agencies (MDC, MDA, MDNR); Federal Agencies (e.g., USDA NRCS, National Agroforestry Center, HTIRC); Universities (e.g., Lincoln Univ., Notre Dame); Business (e.g., Forrest Keeling Nursery, Hammons Products), Non-profit (e.g., Savanna Institute, Green Lands Blue Waters, Assoc. For Temperate Agroforestry, Missouri Nutgrowers Assn)

Budgetary Information

UMCA has consistently exceeded $3,000,000 in expenditures in the past 5 years (Table 3, Figure 6). Those expenditures come predominantly from grants and contracts, nearly all of which is competitive grant funding. In 2019, a substantial contribution was included in the gifts/endowments category, as UMCA received a donation of 550 acres of land to become a research center (recently named "Land of the Osages Research Center), and the value of that land is included for that year.

Table 3. Expenditures 2015-2019

	2015	2016	2017	2018	2019
General Operating	$103,003	$88,966	$177,056	$147,833	$83,390
Service Operations	$2,362	$3,825	$24,090	$10,117	$16,246
Gifts/Endowments	$32,289	$13,248	$24,400	$10,278	$899,914
Grants & Contracts	$3,026,192	$2,896,720	$4,376,550	$3,312,852	$3,198,782
TOTAL	**$3,163,846**	**$3,002,759**	**$4,604,113**	**$3,483,098**	**$4,200,351**

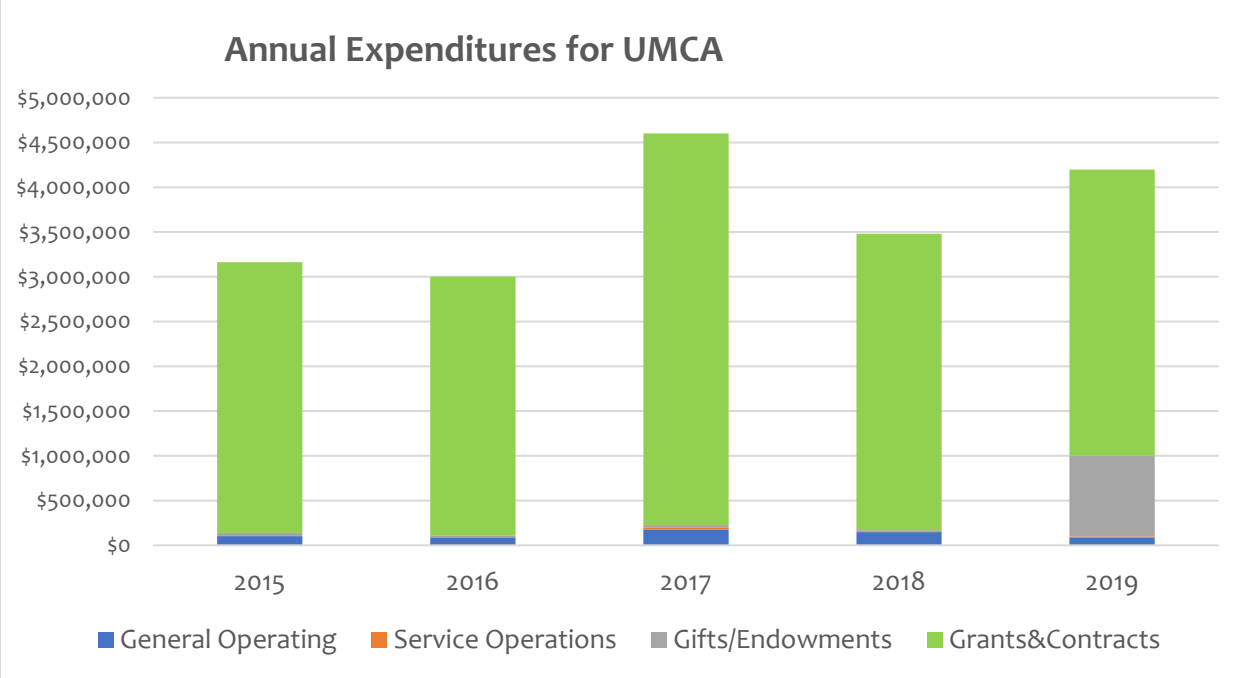

Figure 6. *UMCA Annual Expenditures for each year across different categories*

USDA-ARS Funding. The primary source of funding for UMCA has been through an ongoing grant that is provided by USDA-ARS, at nearly $1,000,000 per year. The funding has allowed UMCA to average six Professional-Track Faculty, as well as a number of Postdoctoral Research Associates, Graduate Students, and staff.

Endowments. UMCA has been the beneficiary of two major endowments that contribute to the program. In 2006, the H. E. Garrett Endowed Chair Professorship was established by a generous donation from Doug Allen, to support the director of the Center for Agroforestry. On his passing, Mr. Allen bequeathed his 550-acre farm and an endowment to support the operation and research activities to focus on agroforestry. This farm, now officially named Land of the Osages Research Center, is the first new MU research center in over 30 years.

PATHWAY FORWARD

For the past ten years, the path of UMCA has been primarily guided by their "Road Map 2020" visioning document, developed under the direction of then-director, Dr. Shibu Jose. The goals have been accomplished, and the time has come to develop a new Strategic Plan. New director, Dr. Sarah Lovell, has been leading the planning process, starting with a baseline assessment in Fall 2019. The goals and plans laid out below are intended for implementation in the next ten-year period from 2020 to 2030.

Conceptualizing a BIG VISION

In brainstorming sessions with faculty and staff, each individual considered what they were passionate about and had unique skills in. Following that summary, the group explored the shared passions, strengths, and drivers as they applied to UMCA. Jim Collin's "Hedgehog Concept"* focuses on the intersection of 1) what we are passionate about, 2) what we are the best in the world at, and 3) what drives the economic engine. Through the process, a vision for UMCA began to come into clearer focus, but with the recognition that a fully developed concept would only be revealed over time.

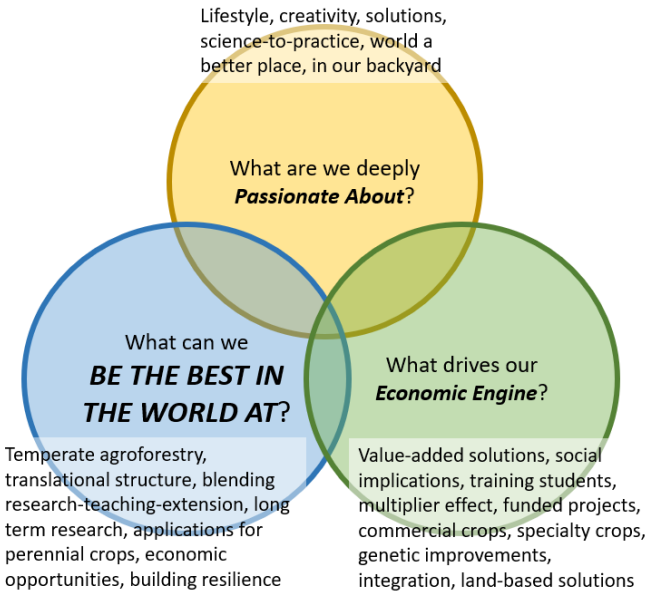

Figure 7. *Hedge Hog concept answered by UMCA Faculty and Staff* (*Source: Good to Great)

Communicating the Message

The concept of "agroforestry", as well as the purpose of UMCA, needs to be clearly articulated for greater understanding by the general public and specialists. Using an initial set of twelve different concepts developed internally, additional input was gathered from UMCA/HARC Advisory Board members, current graduate students, and other stakeholders to narrow to a definition and vision. Figure 8 below captures those themes.

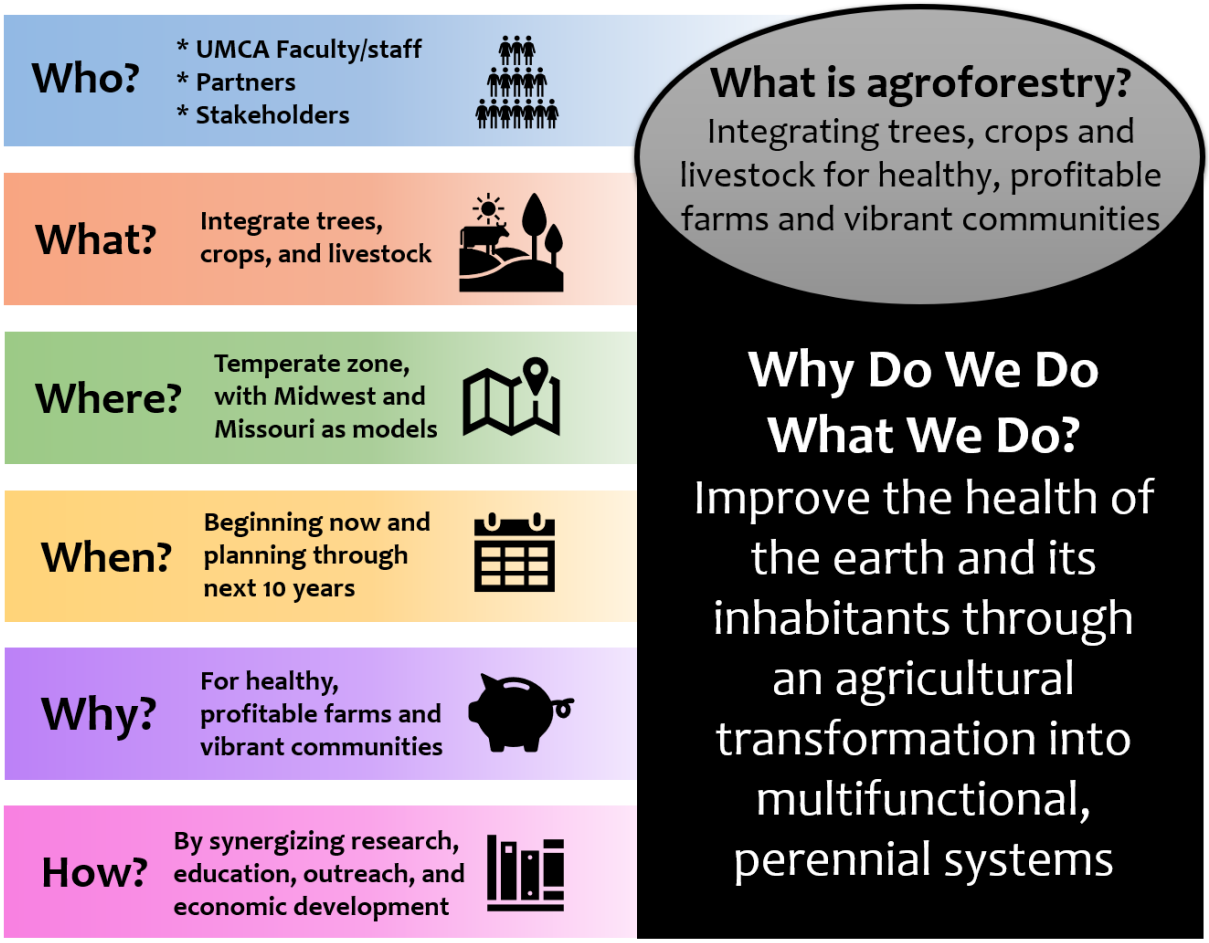

Figure 8. *Diagram to communicate the UMCA vision, including a clear definition of the discipline.*

Further expanding on the "how", we explored the potential for the performance of UMCA to be defined by the reach of influence. Somewhat like a "multiplier effect", if the group can identify some key influencers, the message can spread beyond those with whom we have direct contact. These influencers can be experts, students, landowners (e.g., farmer champions), or other stakeholders that serve as important nodes for transmitting information. Figure 9 shows how the reach can become broad with a few key influencers. This approach also suggests that we might focus more on "train-the-trainer" efforts to a greater extent than attempting to contact a large number of individuals.

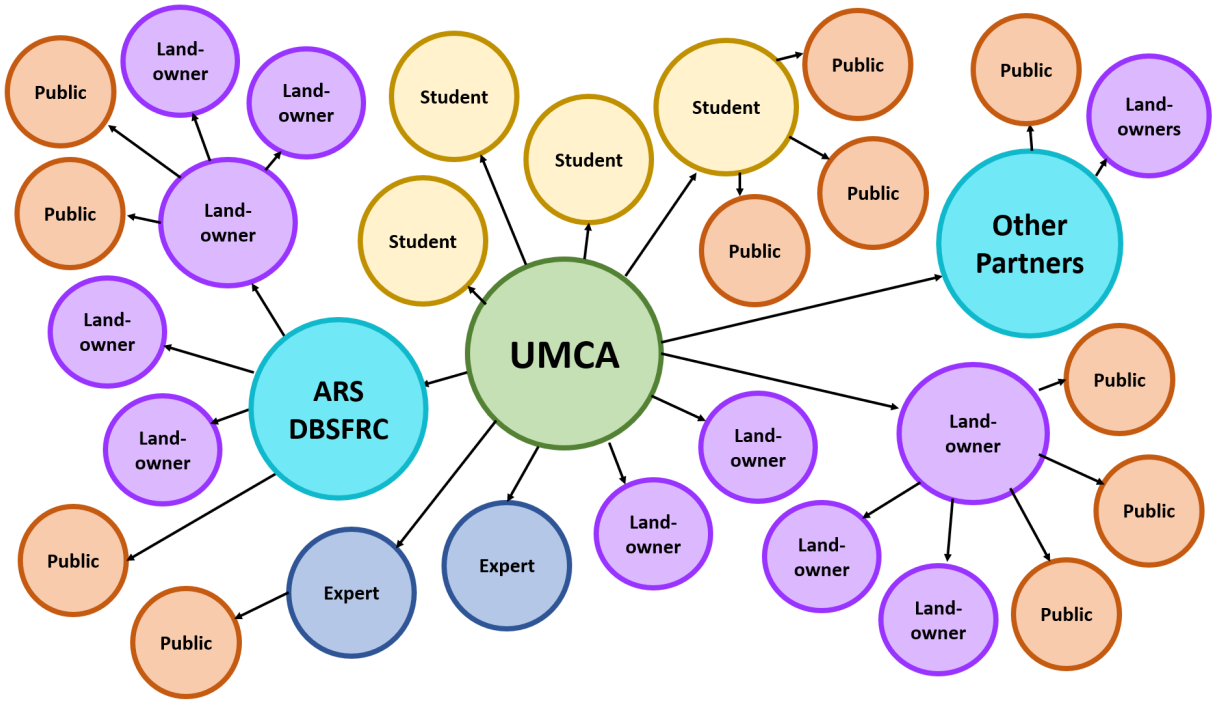

Figure 9. *Conceptual diagram depicting how UMCA can reach a broad audience by connecting with key influencers, to create a "multiplier effect". Partners can include those from state and federal agencies (e.g., NRCS, MDC, MDNR), other Universities, foundations, non-profits, and the private sector. ARS Dale Bumpers Small Farms Research Center (DBSFRC) is a key partner through shared funding agreements.*

Research Plans

Agroforestry will be emphasized as an ideal ***SOLUTION*** to key ***PROBLEMS*** we face as a society:

- Mitigating and adapting to climate change
- Protecting natural resources (water, soil, air)
- Enhancing food security and family farm livelihoods
- Improving human health and well-being

A clear set of research themes will help guide the efforts of UMCA in the coming ten years. Research by individual investigators will not be limited to these areas, but these will be the focus of the broad efforts and the messaging of the Center's work.

Theme 1: Breeding and selecting specialty crops, particularly tree nuts and berry shrubs, to diversify small farm enterprises with high-value opportunities.

Nut tree breeding will focus on three primary species that have demonstrated strong potential in Missouri and other parts of the Midwest – Chinese chestnut, black walnut, and northern origin pecan. Chinese chestnut improvement emphasizes yield stability and regional adaptation through a new participatory breeding initiative. Within this initiative, attention is also paid to integrating component traits for high yielding genetic backgrounds with high nut quality. Because chestnut growers cultivate both clonal and seedling material, our program seeks both superior individuals and progeny. Black walnuts will be improved for market quality (e.g., percent kernel, color) with a goal to shift production from a low value

wild crop to a higher value cultivated crop. Northern pecan will be selected for low-input production systems (e.g., durable scab resistance) and nut quality suitable for direct to consumer marketing (e.g., high percent kernel, light color, efficient shelling). Additional areas of emphasis for pecan include adaptation to climate extremes (e.g., flooding) and promoting the planting of the best available cultivars. Work on berry shrubs will focus on native species with metabolomic profiles that promote human health. Elderberry cultivars will be selected and developed for yield, insect and disease resistance, and phytonutrient content. New research on Aronia species and Amelanchier species will begin with assessing performance in Missouri and other parts of the Midwest. Genetic resources will also be assembled for future specialty crop improvement, emphasizing native nuts/fruits such as pawpaw, persimmon, and hazelnut. Innovative approaches will be used, including decentralized selection and evaluation to adapt cultivated material across the South-Central region and greater Midwest (depending on crop). Potential for integration of specialty crops into agroforestry systems will be explored, including the evaluation of suitability in those diverse settings (e.g., plant interactions, site-specific conditions).

Theme 2: Encouraging livestock integration for additional income opportunities, responsible animal management, and resilient ecosystems.

Silvopasture research will focus on integrating trees and crops with livestock in managed intensive grazing systems to optimize the complex interactions that come with livestock management. Specific foci will examine opportunities for mutual system benefits, including high-value animal product markets, improved animal nutrition and welfare, and ecosystems services provided by livestock. Temperate silvopasture includes planting trees into existing grazing spaces for shade and fodder, as well as strategically integrating livestock into established woodlands to manage understory and non-native invasive species, restore degraded forests, and optimize grazing land use. Research in silvopasture will investigate practical management strategies for all types of silvopasture, and seek to better understand the interactions and implications on every component of the system (animals, trees, forages, wildlife/pollinators, soil, water, etc.). Alternative annual and perennial forage and fodder resources will also be evaluated for livestock consumption and for use in agroforestry or silvopasture production systems. Finally, opportunities for collaboration to address mainstream livestock management challenges (antimicrobial use, reproductive efficiency, health and zoonosis risks, waste management) within the context of agroforestry will be considered as additional offshoots of this research theme.

Theme 3: Protecting natural resources including water quality, soil health, and air quality, while improving overall land productivity through conservation of valuable soil and nutrients.

Remediation of non-point source pollution will be explored with the use of multi-species perennial and woody forest buffers in long-term paired watershed studies at the Greenely Center and under different agricultural practices at HARC watersheds. Vegetative buffers will be examined for the potential removal of nutrients in ground water and mitigation of herbicides and antibiotics in the environment. Chemical and biological processes associated with these functions will be elucidated. Changes in soil chemical, biological, physical properties associated with the addition of trees, shrubs and grasses will be characterized to consider how agroforestry improves overall environmental quality. Multispecies buffers will be evaluated for their effectiveness in sequestering soil carbon and reducing greenhouse gas emissions, to demonstrate the impacts on climate change. The potential for multispecies buffers to improve biodiversity and influence insect population dynamics and pollination will be quantified. The

effectiveness of windbreaks will be determined based on reduction in soil erosion and in the mitigation of odors from livestock production areas.

Theme 4: Supporting community development through market expansion and value-added opportunities.

New market opportunities will be characterized for crops such as chestnut, black walnut, elderberry, pawpaw and shiitake mushrooms. Existing resources such as financial decision support tools, consumer and producer surveys, and market analysis will be continuously updated for key specialty crops. The potential for value-added processing will be determined, with an emphasis on greater profitability (e.g., elderberries and aronia for nutraceuticals and natural dyes). Value-added processing will be further enabled by developing new regional structures such as coops. Peer exchange and network building will be facilitated for infrastructure development through champion farmers and cooperative spin-offs.

Theme 5: Promoting human health through availability of nutrient-dense local foods, clean drinking water, and safe food free of major contaminants.

Nutritional benefits of black walnut (heart health), elderberry (immunity and antioxidants), and other foods that can be grown on small farms for local consumption will be quantified. Cultivars will be selected and developed specifically for components that contribute to human health. Value-added processing that preserves nutrients and lengthens shelf-life will be emphasized. For safe drinking water, wells contaminated with an array of carcinogenic pollutants including atrazine, polyfluoroalkyl substances (PFAS) and dioxin can be cleaned using stabilized enzyme systems. Phytoremediation technologies will be developed to remediate the contamination of organic pollutants and contaminants including pharmaceuticals and personal care products in water and food crops. Monitoring programs will be developed to reduce the health risk and exposure of communities to harmful chemicals (e.g., from hydraulic fracturing chemicals) and pathogens (e.g., coronavirus) of emerging concern.

Theme 6: Transforming the landscape to fully integrate agroforestry and perennial specialty crops, based on spatial analysis and land use planning.

In order to prioritize and plan for transition to a perennial landscape, appropriate areas throughout the Midwest will be identified and mapped, particularly considering marginal lands that are less suitable for annual crops. Suitability maps will be developed to identify "opportunity" lands for various agroforestry practices and specific tree and shrub species with high market potential and adaptive capacity. Land use scenarios will be modeled for converting suitable opportunity lands to perennial agriculture, considering different levels of adoption, and the scenarios will be tested for biophysical and social implications in order to prioritize areas for targeted promotion or implementation. Land will be transitioned to agroforestry and perennial specialty crops over time, with resources allocated based on this prioritization.

Additional Resource Needs to Fully Achieve Research Goals:

- Greater synergies with partners at USDA-ARS Dale Bumpers Small Farms Research Center
- Faculty member to work on berry crop selection and breeding. In short term, this may be accomplished through affiliated faculty such as Andy Thomas and Patrick Byers.

- Faculty member to work on community development and sustainable economics. In short term, may be accomplished through affiliated faculty in DASS.
- Faculty member committed to work on urban agroforestry and traditional ecological knowledge. In near term, will be covered in part by Hannah Hemmelgarn and Sarah Lovell's group.

Outreach Plans

In order to meet UMCA's 2030 program goal of developing continuity and connectedness in outreach and education programs that translate basic and applied research into materials for educators, natural resources and agriculture professionals, rural landowners, and the next generation of family farms, we will pursue the following objectives:

- Develop and expand a full suite of resources, tools, and programs that provide comprehensive training for natural resources professionals, farmer-landowners, and the broader public, towards the development of well-supported peer learning networks.
- Engage with and host both public and targeted events that highlight research translation, dissemination, and networking, to grow an informed cultural awareness of agroforestry.

In order to fulfill these objectives, we must consider the diversity of audiences to whom we are committed for increasing awareness and adoption of agroforestry, and how each audience may be uniquely served. Specifically, we have identified three primary audiences:

1. **Technical service providers (TSP)** are natural resources and agricultural educators at every level, including: Youth (4-H, FFA, high school and extracurricular program leaders); undergraduate and graduate school faculty; federal agency personnel and NGOs; USDA service providers, conservation districts, and community organizations; and Extension, Master Gardener/Naturalist program leaders. TSP are agency personnel and educators engaged professionally in some aspect of outreach or producer support. This audience is best reached with intensive, in-depth training that emphasizes technical and scientific understanding. Professional development for TSP may be further supported by relevant guiding resources accessible in print or online. Specific efforts and consideration should be given to TSP's both belonging to and priority-serving resource-limited, underserved and beginning farmer demographics.

2. **Farmers/landowner (F/L)** innovators are interested in adopting agroforestry practices for commercial production of specialty crops and other agroforestry-based enterprises primarily to access niche markets; and/or for integration of conservation practices and ecological stewardship for the environmental benefits of agroforestry. Farmers/landowners can be generally defined as "people who may practice agroforestry." The F/L audience also includes those who are enthusiastic about learning agroforestry practices, but have been unable to engage in production as a result of limited access to land or finance. Extension and outreach needs for this group should be "practice" based (as opposed to theory-based), with hands-on experiential delivery and support for farmer-to-farmer peer exchange. Specific and intentional efforts will be made to include resource-limited, underrepresented and beginning farmers, understanding that land-tenure and access varies considerably among practitioners, and puts some target audiences at a disadvantage.

3. **Members of the general public (GP)** who can bring agroforestry into a broader realm of cultural awareness and community food systems. This is the most all-encompassing audience we hope to reach. This group is accessible via visual presence and social engagement (e.g. public field events and social media), with greater emphasis on inspiring success stories and introductory materials than on in-depth technical knowledge. Content for the general public should be designed to inform without academic jargon, with the primary goal of generating consumer awareness and interest. Specific and intentional efforts will be made to invite, include, and offer engagement opportunities among resource-limited or underrepresented demographic groups, understanding that consumer profiles and cultural awareness varies based on socioeconomic status and social opportunity.

With these unique audiences in mind, a sustainable E/O (Extension/Outreach) program cannot be uniformly prepared or delivered to meet all E/O goals. Furthermore, it will be critical to leverage UMCA personnel resources appropriately in order to meet the Center's other goals. Using the HI Index (Hours: Impact), annual E/O activities can be categorized loosely according to target audience and outcome goal by method of delivery. Therefore, UMCA's 10-year E/O plan can be summarized as *channeling existing outreach infrastructure into focused efforts that specialize E/O programs and resources to meet specific audience needs, while consistently and continuously assessing the desired/resulting impact for each activity.* This will be done by:

1. **Providing continuity and connectedness in agroforestry E/O programs and materials towards the development of well-supported peer learning networks**
   - Expand content and access for UMCA's digital and print media resources in cooperation with University Extension, including production and dissemination of research-backed technical guides, decision support tools, video recordings, case studies with producers and the Agroforestry Podcast. Specific programming and materials will be included to address the needs of resource-limited and minority groups. These materials will be developed by UMCA research faculty with support from UMCA outreach staff and MU Extension personnel. (Primary target audiences: TSP, F/L, and GP).
   - Create multiple levels of agroforestry certification for F/L and TSP. This includes initiating, piloting, and establishing a Master Agroforester program (or equivalent) in partnership with MU Extension (Primary target audiences: F/L, and GP). Additionally, initiating, piloting, and establishing a Certified Agroforester credential program in partnership with USDA and relevant professional societies (Primary target audiences: TSP).
   - Support the extended reach of certified F/L and TSP peer networks, by packaging and disseminating materials for specific audience groups and approaches to retain peer-network information integrity. Facilitation and promotion of peer learning network engagement opportunities may include support of champion farmers, farmer-led field events and mapped networks (Primary target audiences: TSP, F/L, GP).
   - Systematically evaluate impact and accessibility by creating a standardized array of evaluation protocols for categorized E/O activities, such as public outreach events (GP), field days and workshops (F/L), and train-the-trainer programs (TSP). For each category, evaluations will be piloted and refined, and metrics will be recorded and reviewed annually.

2. **Growing an informed cultural awareness of agroforestry for public engagement and support**

- Host public and targeted outreach events with explicit objectives and evaluation protocols, such as the Missouri Chestnut Roast & Field Days, the Agroforestry Symposium, and occasional hosting of regional, national, and international conferences (e.g., 2027 North American Agroforestry Conference).
- Maintain UMCA presence at high-impact partner conferences and events, with a UMCA exhibit, planning committee participation and presentations at events such as the Savanna Institute's Perennial Farm Gathering and the North American Agroforestry Conferences, where UMCA research faculty and GRAs share important findings.
- Increase mass communication efforts and track data analytics for all audiences, including amplifying UMCA's social media presence (e.g. Youtube channel, FB, Instagram, Twitter), continuing digital newsletters such as Green Horizons and Action in Agroforestry E-News, and making continued efforts to engage with public media (radio, tv, news).

Current and Additional Resources Needed to Reach Outreach Goals:

- UMCA's outreach and education staff will be largely responsible for orchestrating the above objectives, with support from administrative support staff and partners within and beyond MU.
- Current UMCA research faculty will be expected to commit 10% of their time to sharing research findings relevant to target audiences at outreach events (2.a, 2.b) and in expanded materials and programs (1.a, 1.b., 1.c).
- At least one additional outreach staff hire will be needed to ensure that the above objectives are fulfilled. There is potential to make this an extension faculty postion.
- Continued financial support from USDA ARS, USDA SARE, USDA NRCS, and other awarded projects with outreach components will be essential to fund the materials, supplies, and staff time needed to complete these activities.

Education/ Teaching Plans

The UMCA graduate program within the School of Natural Resouces aims to equip its students "to possess the technical knowledge to advise landowners, businesses, scientific communities, conservation agenicies and other organizations that seek to create multi-functional working landscapes".

In order to fillfull UMCA's 2030 education program objectives, we will:

1) Provide high quality instruction / teaching excellence;
2) Offer a broader array of courses at the graduate level;
3) Synergize efforts with programs in the School of Natural Resources
4) Formalize the Agroforestry Ph.D. Emphasis Area;
5) Establish alternatives to written Final Project options for online MS students (portfolio, video production, graphical)
6) Connect online grad students with projects in local areas
7) Create and coordinate regional practical experiences for more online grad students to have "hands on" opportunities
8) Create a new "dedicated advisor" position to handle online graduate program curriculum and administration of student progress, forms, deadlines
9) Create an undergraduate agroforestry certificate or minor that includes two UMCA courses and an undergraduate internship

Other needed improvements include:

1) Adding more description / detail to Mizzou Online course listings
2) Adding short video introductions to all UMCA course offerings
3) Create an online graduate student handbook including more content and clearer expectations on MS Final Projects to help guide students through the program
4) Foster better networking and more exchange among current and past graduate students
5) Link to relevant programs in the School of Natural Resources

With a focus on teaching excellence, UMCA is committed to improving the quality of courses and programs currently offered. A survey of current and former graduate students has been completed. The results from both surveys are being used to identify strengths and weaknesses. Courses will be reviewed on a rotating basis to explore opportunities for updating and improving content. Training specific to online course development will be provided for faculty. Increasing the quality of courses and programs should help maintain enrollment numbers in all education programs (Graduate Certificate, Online MS, Campus MS, future Campus Ph.D. at desired levels.

Assuming that all UMCA faculty average 2-3 on campus GRAs, it is suggested that all UMCA faculty also agree to add one online MS student to their workload to help maintain our online enrollment numbers.

The recent survey revealed that our graduate students would also like to see new course options in:

1) agroforestry business;
2) agroforestry landscape design;
3) in-depth information on the core agroforestry practices, and ecology/plant science/silviculture.

Graduate educational course offerings will also be expanded in the future, including the addition of new online graduate courses to be developed by Drs. Lin, Conway, and Revord. A new undergraduate course, to be offered by Dr. Lovell, will introduce concepts of agroforestry to a new audience. UMCA is also putting forth a request to add a formal Ph.D. emphasis area in Agroforestry in the near term and exploring the option of an undergraduate minor in agroforestry.

To better communicate the content of the educational programs, 1-3 minute videos will be developed that describe each individual course. Collectively, UMCA will create a more comprehensive video that describes all the graduate program offerings available at MU.

Economic Development Plans

The innovative culture fostered by MU will allow UMCA to continue to have a significant impact on a variety of industries within the state of Missouri, around the United States, and all over the world. UMCA will incorporate research into the educational curriculum with hands-on Research & Development. To foster economic development for rural and urban communities, networking with local biotech companies, start-ups, other businesses and investors must be done through technology transfer. Seminars, symposia, and invited lectures will promote UMCA's mission.

Educational curriculum. UMCA faculty developed the first entrepreneurship course for translational research and entrepreneurship within CAFNR (8401-Translational Research and Entrepreneurship) to

help graduate students prepare themselves to become entrepreneurs and strive to make an economic impact in the state of Missouri and beyond. The curriculum will be reinforced by arranging lectures be delivered by invited guest speakers from local industries and startups.

Hands-on research R&D. Due to the innovative and cross-disciplinary culture and endeavors on MU's campus, UMCA will continue the efforts to offer hands-on training, allowing students to translate laboratory discoveries and invention into commercial products and applications.

Networking with local biotech companies, start-ups, business and investors. The Agroforestry lab works with several biotechnology companies in the region to support their research, facilitate product development, and strengthen their economic impacts. UMCA will continue to explore other industries and opportunities.

Technology transfer to foster economic development for local communities. Technology transfer of inventions to industry can create start-ups/spinoffs from UMCA's benchtop research. We will work closely with MU Technology Advancement Office (TAO) to license the patents and inventions to industries. These discoveries and intellectual properties could help foster economic development for local communities and generate significant revenue for MU/UMCA through technology licensing.

Seeking foundation funds. As a global leader in agroforestry research, UMCA is an ideal candidate for funding from individual donors and private foundations wanting to support solutions for climate change concerns, food security issues, community health, and more. The leadership of Director Sarah Lovell and Associate Director Mike Gold will assist MU Office of Foundation Relations in identifying appropriate donors to approach with a detailed outline of goals.

Sales of UMCA items and plant materials. UMCA staff and faculty will develop different types of kits that promote agroforestry through educational activities and health promoting products. As much as possible these kits will contain items from UMCA Missourian partners with educational materials developed by UMCA faculty.

Sales to campus catering/dining. As agroforestry products such as elderberries, pecans, chestnuts, etc. become available, UMCA staff will explore potential sales to Eckles Café, campus dining, and others on campus.

Other sales. UMCA faculty and staff will develop a program for sales of the agroforestry academy training manual, cd of agroforestry practices, cd recordings of presentations on maple syrup, alley cropping, chestnut, pecan, and elderberry production. Approaches such as charging a membership fee for access to in-depth online materials and/or charging for printed hard copies will be considered. Options to develop and sell a financial planning tool manual will be explored. As specialty crop research continues, the plant materials developed into new cultivars will be reviewed for patent submission. These patents will be a source of income.

Seminars, symposia, invited lectures. UMCA faculty and staff will continue to provide information to industry, academia, agencies, and the public to further the mission of research and development through seminars, the annual symposium and invited lectures.

Inclusion, Diversity, and Equity

UMCA celebrates diversity and is committed to creating an environment where all individuals feel welcome, valued, and respected. We intend to actively pursue opportunities to better support students, staff, and faculty of underrepresented minorities (URMs) within UMCA, and beyond, as part of School of Natural Resources and CAFNR. UMCA has already begun to make strides to bring awareness to this topic, through purposeful efforts such as including a land acknowledgement statement in our primary outreach media to recognize the history of indigenous peoples as the stewards of the lands where our institutions now exist. Below is a list of specific goals for the coming decade.

Commit to partipating in and documenting annual engagement and training for faculty and staff on relevant Inclusion, Diversity, and Equity (IDE) topics. Each of UMCA's faculty and staff will be expected to engage with professional development activities on IDE topics continually. The activities could include seminars, workshops, or formal training and should be included in the CV of each member of faculty and staff. The sum of these activities will be captured in a special section of the Annual Report. UMCA has the potential to create some of this content as well, drawing on materials such as those curated through the new course on IDE in Agroforestry. Research projects that include underrepresented and minority groups (e.g., urban agroforestry, international activities) can be highlighted in training and engagement activities.

Highlight accomplishments of individuals from diverse groups. We will ensure strong representation of Black, Indigenous, and People of Color (BIPOC) and other underrepresented groups as speakers at symposia and other major events. The accomplishments of diverse individuals within our team and in our broader community will be highlighted. A future Agroforestry Symposium will focus specifically on IDE in agroforestry (planned for 2022). Examples from and of BIPOC scientists will be incorporated in education and outreach materials to normalize their presence in STEM.

Prioritize research that addresses inequities and disproportionate impacts on BIPOC or other minoritized groups. Agroforestry can play an important role in social justice and development of culturally appropriate solutions. We will seek funding to support research that assists those groups disproportionately impacted by conditions such as lack of access to clean air, soil and water, and income opportunities. Other opportunities to support these groups might include: catering some plant breeding objectives for local adaptations and specific end-uses, exploring cultural land-use practices, and including members of those communities as co-researchers to be involved throughout the project development.

Respect and Protect Traditional Ecological Knowledge. We will clearly state the roots of agroforestry in practices of Indigenous Peoples in outreach and education materials. We hope to cultivate an enduring relationship with the Osage Nation through work at Land of the Osages Research Center, and also in partnerships for projects at the Osage Nation in Pawhuska, OK. An opportunity to elucidate Traditional Ecological Knowledge would be the development of a chemical database for phytochemicals in medicinal plants used traditionally by Osage Nation or other tribal groups. We intend to establish a faculty line that would focus specifically on Traditional Ecological Knowledge and other cultural dimensions of agroforestry.

Develop a Graduate-Level Course on IDE in Agroforestry (Fall 2020). The purpose of the course is to train our students for a better understanding and appreciation of the unique challenges faced by minoritized and underrepresented groups. The focus of the course is on the intersection of IDE with agroforestry, considering issues as they specifically pertain to the field of agroforestry. The goal is to show how these topics connect with students' current and future work and how they might become agents of change, appreciating their role in IDE in their careers. TED-style talks developed by the students on IDE-agroforestry themes and intentions will be shared within our group and the greater public.

Develop relationships with minority-serving institutions. We intend to seek out future partnerships with Historically Black Colleges & Universities (HBCUs), Tribal Colleges & Universities (TCU), and Hispanic-Serving Institutions (HSIs). Emphasis will be placed on connections with those located in Missouri, where they exist, or others in the Midwest region. In the near term, opportunities will be explored with Lincoln University, a HBCU and 1890 Land-Grant Institution. Research and outreach on organically-grown specialty crops would be a logical connection, with their certified Alan T. Busby Farm.

Establish internships for BIPOC undergraduate students. We intend to ensure fair pay, mentoring, and other resources for successful experience with a cohort of at least two students each summer. The program will include a wide range of research activities and professional development opportunities.

Protect our students, recognizing risks are not shared equally. Protocols will be developed to address safety in field work with special attention to risks for BIPOC and women in remote locations. Protocols will also be developed for safety during community disease spread such as COVID-19 pandemic, considering risks for groups disproportionately impacted.

Summary of Future Funding Needs

To achieve our future goals, the Center will continue to build and strengthen its partnerships with universities, natural resource agencies, the private sector, agricultural organizations, nonprofits, and landowners across our state and the globe.

A key goal of UMCA is to secure funding from a more diverse set of sources, including foundations/gifts. UMCA's core faculty and Center Director Lovell are committed to pursuing and exploring new funding streams. For example, the Center Director will become actively involved with the Sustainable Agriculture & Food Systems Funding network (http://www.safsf.org/). UMCA faculty will continue their ongoing efforts to bring in external funding to support a portion (20-25%) of their salaries, allowing for more flexibility in the current USDA-ARS budget.

See next page for a summary table, including future goals and needed resources, across the missions of research, outreach, teaching/education, and economic development.

Table 4. Summary of future plans and resources.

FUTURE PLANS	RESOURCES NEEDED
Communications	
Improve messaging around agroforestry and UMCA efforts	Funding for a 50% staff role committed to communications and branding
Research	
Breeding and selecting woody specialty crops for high-value products	Additional faculty member to focus on berry crops selection and breeding
Encouraging livestock integration	None additional at this time
Protecting natural resources	None additional at this time
Supporting community development	Additional faculty member to focus on sustainable economics, community development
Promoting human health	Additional faculty member to focus on urban agroforestry and traditional ecological knowledge
Transforming the landscape	Currently covered by postdoctoral researcher
Outreach	
Providing continuity/connectedness for well-supported peer learning networks	Commitment from existing faculty (10% time) for sharing resources and expanding materials
Growing informed cultural awareness of agroforestry for public engagement/support	At least one additional outreach staff or extension faculty position
Education/Teaching	
Broaden the array of course offerings	Existing faculty and any future research hires
Formalize the Agroforestry PhD Emphasis	No additional resources needed
Improve communication with online students, and create practical experiences	Dedicated online advisor position needed
Create undergraduate agroforestry certificate or minor	Support from other SNR faculty/courses
Economic Development	
Hands-on research R&D and networking with industry	Support from business and industry partners
Technology transfer for local communities	Relationship with MU Tech Advancement Office
Seeking foundational funds	Support from regional industrial partners/investors
Sales of products to public, dining, other	Allocation of staff time to support the efforts
Inclusion, Diversity, and Equity	
Commit to engagement and training	Existing faculty and staff time commitment
Highlight accomplishments, prioritize research, protect students of BIPOC/URMs	Existing faculty and staff time commitment
Respect Traditional Ecological Knowledge	New faculty hire needed for this topic
Develop IDE course, undergrad internships	Existing faculty, need support for internships

KEY GOALS AND EVALUATION

The Center for Agroforestry has been successful at integrating the core tenents of the institution – research, teaching, outreach, and economic development. The following goals are intended to summarize the areas of greatest opportunity, without limiting activities to these alone.