Co-producing knowledge: Academics and non-academics partner to build synergistic teams to produce sustainable pathways to advance the emerging field of bamboo farming, manufacturing and processing in Alabama

Marcy L. Koontz, Ph.D.
Associate Professor
The University of Alabama
Marcy.Koontz@ua.edu

Abstract

Black Belt Bamboost project was developed to advance knowledge of bamboo as a catalyst for a new type of agricultural development, identify associated potential end markets, as well as its processing, manufacturing, and general awareness within the state of Alabama, specifically the Black Belt region. It exists to provide a launch pad for leaders in multidisciplinary research collaboration, education, and the community to partner in order to build synergistic teams to develop discoveries that will position Alabama to be a leader in the emerging field of bamboo farming, manufacturing and processing. It also serves as a platform for individuals engaged in creative pursuits using bamboo. This paper examines the development of this interdisciplinary community engagement project. With the belief that a co-production of knowledge is essential for developing more sustainable pathways, an agorist strategy was used to bring non-academic and academic communities along with public, private and governmental institutions together.

Keywords: co-production of knowledge, sustainability research, bamboo, bamboo in Alabama

"1. Introduction"

Bamboo is a grass, not a tree, and is considered a non-wood forest product. Bamboo grows in tropical and subtropical regions and there are approximately 1250 species in 69 genera. [3] It has often been referred to as the 'poor man's timber' but in the last decade this opinion has begun to change as new uses for bamboo have emerged especially as a substitute for wood. [12]

Today bamboo can be found in flooring, textiles, paper, structural support systems, and as a sound reduction material in automobiles. There is a growing interest in bamboo and many countries have begun to implement studies, institute funding opportunities for plantation owners, growers and processors as it is increasingly proving to be an important economic asset. It is often termed "Green Gold," for its forecasted return on investments. [22]

The International Network for Bamboo and Rattan (INBAR) is an intergovernmental organization dedicated to improving the social, economic, and environmental benefits of bamboo and rattan. [9] "At the end of August 2012, 38 countries had acceded to its Establishment Agreement" which includes accepting its mission and purposes. Its mission "is to improve the well-being of producers and users of bamboo and rattan, while maintaining a sustainable resource base by supporting innovative research and development. INBAR reports that China is the largest exporter of bamboo while the United States is the largest importer of bamboo and

bamboo related products. The global bamboo market is currently at $7 billion annually but is predicted to reach $17 billion by 2017. [21]

In June 2012, at the Rio+20 United Nations Conference on Sustainable Development, held in Rio de Janeiro, Brazil, Kimberly-Clark Corporation, "One of the world's largest makers of personal paper products, the company operates through four business segments: personal care, consumer tissue, K-C Professional, and health care" [8], announced it would cut its reliance on timber and source 50 percent of its fiber from alternative, environmental friendly sources by 2025. [13] The company has been researching and testing the viability of using alternative fibers including bamboo in the production of its products. In particular it is considering the environmental implications of these alternative plants in respect to scale of land use, impacts on biodiversity and biogenic carbon accounting. In their initial study, which was limited in scope, results indicated that bamboo has less impact on the land than softwood trees because it regenerates in three years as opposed to 30-50 years for trees. [19]

"1.1 Bamboo Farming in the United States"

Until recently the possibility of farming bamboo in the United States as a crop was not possible because there has never been an economical supply of juvenile plants to establish large groves of bamboo. A sustainable bamboo industry is now possible due to advances in tissue culture research, specifically with the largest temperate bamboo species Moso, coupled with other types of propagation techniques.

Experiments with bamboo were conducted at Auburn University in Alabama in 1933, when the first introductions were made from several nurseries in the United States, particularly the U.S. Plant Introduction Station at Savannah, Georgia. Researchers at Auburn University and the Experiment Station in Camden, Alabama began tests comparing bamboo to Loblolly pine production in the 1930s, and continued through the 1960s to determine if bamboo could be a renewable alternative crop for pine trees. The research was sponsored by a USDA grant and the next step in the research was to build a processing plant to test and stimulate interest in growing bamboo. [18]

Large scale experiments at Camden began in 1959, when approximately four acres of timber bamboo were planted in order to compare yields of bamboo and pine for pulp production. In 1960, approximately 100 acres of five species were planted to study the problems of production, harvesting and utilization of bamboo. These experiments were initiated with the active cooperation of the New Crops Research Branch of the United States Department of Agriculture. The discontinuation of cooperation by the Department on July 1, 1965, reportedly as an economy measure, resulted in drastic curtailment of planned harvesting research and abandonment of plans for utilization research. It is believed that political or economic pressures at the time ended the funding for the research even though it showed very positive and encouraging results. Results revealed that the bamboo species Phyllostachys bambusoides out performed Loblolly pine in terms of dry wood tonnage per acre. [18]

There are still bamboo groves in Camden but are not being used for testing or research, and the viability of some of the species is questionable. When comparing a pine plantation and a grove of bamboo, pines are typically thinned every 10-15 years while bamboo can be harvested on a yearly basis after the initial establishment period of 3-5 years. Bamboo does not have to be replanted while removed pines from the

plantation have to be replanted. Much of the bamboo is still growing at the station today and includes 17 different species. [18]

In spring 2010, a conversation began in the state of Alabama regarding the possibility of growing bamboo as a new agro-forestry crop with farmers, citizens, members of community groups, and public, private and governmental institutions. The intent was to begin a dialogue that could encourage and lead to the development of a strategic framework for exploring the possibilities of creating a bamboo agricultural and industrial complex in Alabama. The conversation was sparked by the scientific breakthrough made by researchers at Booshoot Gardens, Inc. who had discovered how to rapidly propagate bamboo through tissue culture processes. This allowed, for the first time, the possibility of large scale plantings of bamboo, in particular the Moso species.

The Black Belt region of the United States is one of the few places where this timber bamboo species will grow to a mature size. There are 18 counties in Alabama that are included in this region which stretches across the state from the Mississippi to Georgia state lines. Moso is used for food, fiber, paper, plywood, furniture, flooring, and a variety of architectural structural materials. This region in the state of Alabama was once sought after for its rich soil and was known as the Cotton Belt during the 18th century to the early 20th century. However since 1915, when the boll weevil devastated the cotton crops, this area never recovered and has remained economically depressed, with extremely high unemployment rates, poor social services and a dire socioeconomic situation.

In June 2010, farmers were invited to attend a presentation and take part in an open discussion forum held on the campus of the University of West Alabama. Listening to and witnessing the farmers realize they were being asked to be part of a process of discovery from the beginning, that their knowledge and expertise could help define the system, proved to be an important realization and provided the key to building a framework for how to begin the process of potentially introducing bamboo to Alabama as an agroforestry crop.

Also during spring 2010, Friends of Historic Northport, Inc. (FHN), a nonprofit located in Northport, Alabama, was gifted 200 acres of land along the Black Warrior River on which to develop the Van de Graaff Arboretum and Historic Bridge Park. With the establishment of this public park, FHN was able to further its mission by preserving a part of the natural environment of this riverfront community that has played an essential role in its history.

Ironically, prior to being named Northport in 1871, this area of Alabama was known as “Canetuck” because it was a dense cane break wilderness. Over the years Canetuck was translated to Kentuck, and then the town was officially named Northport for its location along the Black Warrior River. [11] Northport, like many other southern towns located along a major river, prospered from the growing, ginning, warehousing and shipping of cotton. Unfortunately the “boom days” of growing cotton in the south are long gone, however, the rich, black, fertile soil remains.

The accessioning of this land, coupled with the historical significance of bamboo in the area, provided the catalyst to combine two seemingly disparate occurrences, and proved to be the linchpin for taking the idea of bamboo, as a new agroforestry crop in Alabama, into a tangible process and project.

This paper discusses the development of the Black Belt Bamboost project and how this publically-driven, interdisciplinary community engagement project is bringing non-academic and academic communities

together along with public, private and governmental institutions to form partnerships in order to pursue bamboo education, research and outreach opportunities.

"2. Creating an Engaging Space/Place"

It became apparent early in the dialog process that there needed to be a public place or space for academic and non-academic individuals to gather, explore and learn about bamboo and the diverse possibilities associated with it as an agroforestry crop. This lead to the idea of creating a public bamboo park (Figure 1) as a launch pad for bamboo education in order to further inquiry and research, and pave the way for establishing a sustainable bamboo industry in the Black Belt region of Alabama. The park could also be a place that showcased the full value cycle of bamboo and become a livability showcase in the community.

"Figure 1. Site plan for the bamboo park"

The FHN Board of Directors were approached regarding the possibility of using some of the land it had been gifted for the bamboo park, in particular part of the 27 acres located on the south side of 5th Street adjacent to Kentuck Park. The board agreed to the allocation of five acres for the project. In addition to the public bamboo park, plans to incorporate a one acre test plot of bamboo for farmers, and a bamboo build center began to develop. The next step in the process was to engage young people within the community to help drive this idea forward.

"3. Recruiting the Community Leaders"

The process of developing a bamboo agricultural and industrial complex within the state of Alabama is multifaceted and a long-term proposal which could be perceived as overwhelming and daunting. The concept of building a public bamboo park however is simple to comprehend and a tangible goal that is obtainable in a relatively short-term timeframe. The plan for the bamboo park included planting 15 different species of bamboo, a pavilion, water feature, and space for public art installations. It was believed that once this part of the project was started, it would be easier for others to join, as the idea would be visible and not in its present abstract format.

It was important to reach out to individuals within the community who could come together and form a group with both social and task cohesion. The "spreading of great ideas" is the mantra of TED (Technology,

Entertainment, Design), and its mission is, "We believe passionately in the power of ideas to change attitudes, lives and ultimately, the world. So we're building here a clearinghouse that offers free knowledge and inspiration from the world's most inspired thinkers, and also a community of curious souls to engage with ideas and each other." [16] The belief of this organization is that "there is no greater force for changing the world than a powerful idea, and offers the following insights about an idea:

"Table 1. The power of an idea"

1.	An idea can be created out of nothing except an inspired imagination.
2.	An idea weights nothing.
3.	It can be transferred across the world at the speed of light from virtually zero.
4.	And yet an idea, when received by a prepared mind, can have extraordinary impact.
5.	It can reshape that mind's view of the world.
6.	It can dramatically alter the behavior of the mind's owner.
7.	It can cause the mind to pass on the idea to others.

Individuals selected for participation needed to have the ability to grasp the powerful nature of this idea of bamboo as an agroforestry crop in Alabama, how it could be a game changer for the state, and be able and willing to use their skills and talents to bring it to fruition. Thus, the group dynamics, its cohesion, over both the short and long term, would ultimately determine the success of this project.

"4. Developing the Group"

Carron [4] defined social cohesion as how well the members of the group like each other and how well they work together. Task cohesion reflects the degree to which the members of the group work together in order to achieved their goals. According to Townsend [17], the following factors affect cohesion:

"Table 2. Factors that affect cohesion"

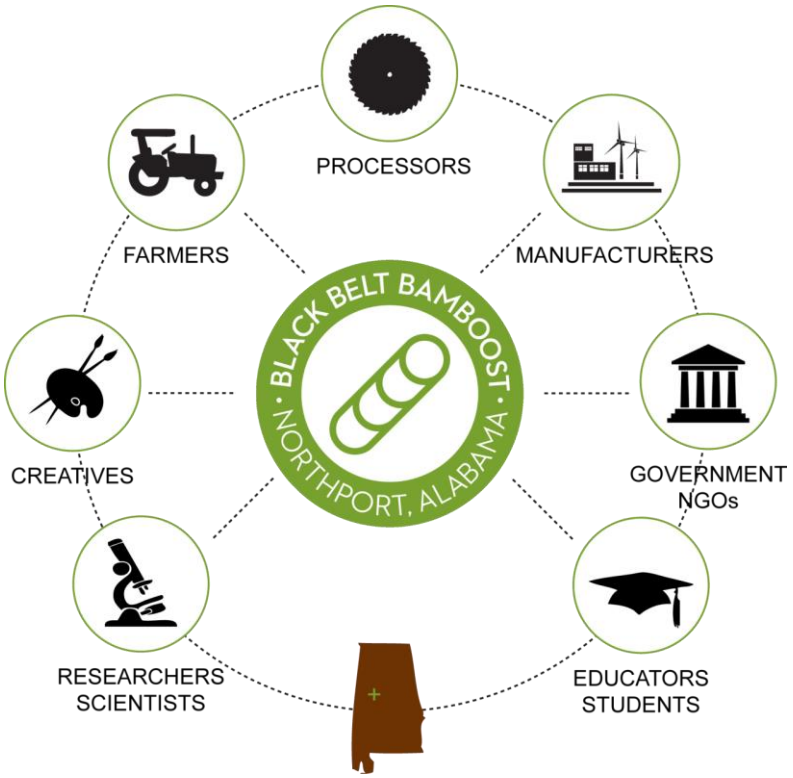
1.	Stability	Cohesion develops the longer a group is together with the same members
2.	Similarity	Cohesion develops when the more similar the group members are in terms of age, sex, skills and attitudes
3.	Size	Cohesion develops more quickly in small groups
4.	Support	Cohesive teams tend to have managers and coaches who provide support to team members and encourage them to support one another
5.	Satisfaction	Cohesion is associated with the extent to which team members are pleased with each other's performance, behavior and conformity to the norms of the team

Invitations were sent to 20 individuals to attend an exploratory meeting on 6 November 2010, and 14 accepted the challenge. Prior to the meeting, on October 27, 2010, a request was sent to 25 graphic designers around the world asking them to take 36 hours to develop a visual reaction to the word bamboo. Eighteen designers, representing eight states and five countries, participated. Their designs were the cover art for informational books distributed at the first meeting. Included in each book was a card printed with instructions to check the box next to the sentiment, "I left my ego at the door," or "Oops, I forgot." The Black Belt Bamboost project was officially launched on 6 November 2010 in order to: " boost our community through bamboo awareness

and positively affect its economy, education, and creativity by building strong sustainable bonds between environment and community through strategic educational endeavours and creative activities one bamboo shoot at a time."

"5. Building the Project Framework"

If this project was to progress, a framework needed to be constructed to support its vision and strategies, and be flexible and dynamic in order to adapt to community participation and feedback. Establishing sustainable social cohesion, task interaction, shared responsibility, and recognizing, as shown in Figure 2, that all community sectors and leadership would need to act collectively, were determined to be key factors for creating and achieving project goals. After that initial meeting with farmers it was apparent too that education needed to be the keystone in the developmental framework.



"Figure 2. The project framework: Partnership and connectivity"

Farmers as a group are essential to this endeavor, and Riggenbach [14] states that farmers were traditionally their own stewards of knowledge but that stewardship has been undermined by modern day capitalism. And, "since knowledge is power, and its origin has changed, many farmers find themselves in a top-down approach to knowledge, where they are at the bottom end." The researcher suggested three examples of methodologies for bottom-up research:

"Table 3. Methodologies for bottom-up research"

1.	Farmer-To-Farmer Exchanges	Facilitating the flow of information between farmers.
2.	Participatory Agricultural Research	When scientists work together with farmers.

3. Peer-to-peer Collaboration:	Create an open source environment where farmers can exchange their innovations and build on others.

Street Science [7], is an approach to research this is described as a "process that emphasizes the need to open up both problem framing and subsequent methods of inquiry to local knowledge and community participation." Local knowledge being defined as "the scripts, images, narratives, and understandings we use to make sense of the world in which we live." Through the framework of 'street science,' farmers, community members and researchers could combine forces within this project.

Knowledge is produced through a co-production framework, a process in which scholars seek a connection with rather than dominance over their subjects/objects of interest. Corburn, [7] states that "Street Science ought to be conceptualized as a process that encompasses many of the key principles of the broad set of participatory research methods increasingly called participatory-action research and community-based research. However, Street Science differs from these techniques by not taking as a priori truths the meanings and definitions of issues framed by professionals."

Co-production of knowledge between academic and non-academic communities is a prerequisite for research aiming at more sustainable development paths. Sustainability researchers face three challenges in such co-production: (a) addressing power relations; (b) interrelating different perspectives on the issues at stake; and (c) promoting a previously negotiated orientation towards sustainable development. The first of these three challenges, power, can be seen in Table 4. [15]

"Table 4. Challenges of knowledge co-production to be addressed by sustainability researchers"

Challenges	**Concrete meaning in the four case studies**	**Implications for researchers (based on theory and practice)**
Power	Addressing power relationships between different actors	Need to advocate the co-existence of thought and thought styles and make these explicit
Integration	Ensuring that a common understanding emerges	Need to advocate the co-existence of thought collectives and thought styles and make these explicit
Sustainability	Ensuring that knowledge co-production serves the purposes of 'sustainable development'	Need to promote the orientation towards sustainable development throughout the process of knowledge coproduction

And, in Table 5, the researchers [15] provide summarizes for each of the three challenges of their study.

"Table 5.Three basic roles through which sustainability researchers met the challenges of knowledge co-production (power, integration and sustainability) research"

Role	**Expectations**	**Norms**
Reflective scientist	Capable of providing expertise based on scientific knowledge validated according to the norms of the natural or social sciences between different actors	Validate knowledge according to quantitative and qualitative procedures
Intermediary	Able to make different thought styles visible	Provide leadership in view of representing

	and to link them around common interests	common interests
Facilitator	Capable of enhancing communicative processes between thought collectives, based on respect, openness and deliberation	Promote joint reflection oriented towards a common understanding of situations and collective action, as part of a learning process

Prior to development, it was necessary to recognize that participants navigating within a co-production of knowledge framework, in any capacity, would be challenged throughout the process by the concept of power, as perceived or attributed characteristic of another, and the role it could play in determining the success or failure of a project. The Community Knowledge Project [6] is "an experimental practice of knowledge making that seeks a transformative connection between the people and outcomes of research-action and health programming." The partners in this project established the following values to guide their work:

1. True implementation of community-based participatory action research methods requires community-design, not just community participation.

2. Participation in our model begins with the premise that the community is already powerful. It already has activists and agents of change. It lacks the creative space/tension for productive conflict.

The partners believed that:

> A knowledge project is the catalyst for community. It involves gathering information, formally and informally in order to define the reasons for coming together, the kinds of meaningful action that are necessary, and the imagined results of the activities. Research-action conveys an orientation toward knowledge making that requires continual investment in community.
>
> Because outcomes are never guaranteed, and because participants hold different positions within stratified social orders, each moment in a knowledge project must catalyze connections that always entail mutual benefits and investments (risks). To ensure connections between pasts, presents and futures of all participants in a knowledge project, only those actions that result in improved connections, understandings and mutual benefits for all should occur. A test of any knowledge project that embodies the research-action principles of a community knowledge project is that if a project ends, people should feel loss, not relief. [5]

Instead of stabilizing the social identities that shape the boundaries between academic and non-academic communities, sustainability research aims to produce an agora (Figure 3) in which the boundaries are provisionally blurred; the resulting ‘messiness’ of ‘divided identities’ is the necessary condition for engaging with ‘others’ and ultimately helping to reshape the involved groups’ ‘perceptions, behavior and agendas that occur as a function of their interaction’. [10]

"Figure 3. Agora. The intersection of academic and non-academic knowledge; a gathering place"

The Black Belt Bamboost project framework was constructed by valuing 'street science' and the important role it can play in extending and refining scientific inquiry, and building sustainable bridges between science and practice to create an agora.

"6. Discussion"

The purpose of this paper was to present the development of the Black Belt Bamboost project, a community-based project designed to raise awareness about bamboo and how the diversity of this plant, and its associated applications, are providing a vast array of engagement opportunities to educate and connect people. This plant could be a catalyst for a new type of agricultural development in Alabama, specifically the Black Belt region of the state, where opportunities are few, and many of the counties consistently rank as some of the poorest in our nation. Through this project, education, research and outreach activities will showcase how bamboo can change the lives of many, not just a few, improve our environment, and become an economic and creative benefit in our community, state, and nation as a whole.

The project, an agora, based on the concept that a co-production of knowledge between academic and non-academic communities is essential for developing more sustainable pathways, is comprised of interdisciplinary partnerships in order to pursue research and education on multi-dimensional platforms for developing new industries, and the integration of social-economic-environmental technical approaches to assist in establishing Alabama as the epicenter for the bamboo industry with the United States. Outreach and educational activities and experiences are extended to the citizens of the state and beyond.

It offers opportunities for education and enrichment for students including those in K-12 STEM programs, 4H programs and undergraduate and graduate students in the fields of science, engineering, human sciences, and art and design. Through public events such as lectures, art exhibits, workshops and presentations to associated groups and organizations, this project engages the wider community with bamboo in new and unexpected ways.

The information in Table 6 illustrates the number of individuals, institutions and organizations that have partnered with this project since it began in late 2010.

"Table 6. Black belt bamboost project partners and collaborators since fall 2010"

Academics/Researchers	32
Non-academics	118
Government Agencies	2
For-Profits Partners	8
Non-Profits Partners	1
Higher Education Partners	7
Graduate Student Research Projects	5
Undergraduate Research Projects	3
K-12 Students	425
Elementary & Middle Schools	2

In October 2011, the project members were contacted by the Federal Emergency Management Agency's Long-Term Community Recovery Team, who were in the area to develop a plan for the state after a devastating tornado ripped through the community on 27 April 2011. As a result of that meeting, the idea of how bamboo could be a game changer for the state, and become a part of Alabama's future, was articulated in *Accelerate Alabama*, the economic development strategic plan for the state, developed by the Alabama Economic Development Alliance by Executive Order of Governor Robert Bentley. [2] The information was also included in two additional reports: Tornado Recovery Action Council's *Cultivating A State Of Readiness: Our Response To April 27* [20] and *Geiger, Alabama 2011, Long Term Community Plan*. [1]

The public bamboo park has been developed on one of the five acres of land designated for this project. The land is centrally located and highly visible, situated at one of the major gateways into the Black Belt region, and within a few miles of three institutions of higher education: The University of Alabama, Stillman College, and Shelton State Community College. In addition, it is adjacent to Kentuck Park, where the nationally recognized Kentuck Festival of the Arts is held each year, and at the end of the Northport Levee Walking/Biking Trail.

Individuals have begun to have the opportunity to learn about and explore all of the varied and wonderful aspects of bamboo through a diverse array of artistic, cultural, educational and recreational opportunities. There are fifteen different species of bamboo planted in the park. During the spring/summer of 2014, bamboo plants will be transplanted from the groves in Camden, Alabama, which were part of the historic planting in the 1950s, to the bamboo park in Northport, Alabama. In the fall of 2012, an MFA graduate student from The University of Alabama used bamboo as her medium for sculpting large scale outdoor art pieces for her graduate showcase, *Signs of Life*. These sculptures were constructed on site at the bamboo park and on exhibit to the public for one year. In the summer of 2014, another MFA graduate student will exhibit her showcase in the bamboo park. The bamboo park can become a destination, offering a place of serenity, beauty and culture, drawing residents and visitors from the local, regional, and international communities, and will help this community thrive.

In the near future, farmers will have the opportunity to learn about and explore best practices for farming through the use of a one acre planting of Moso, the timber bamboo at the park. Academic researchers will also be able to utilize this test planting for specific studies. In addition, plans include an organic garden which

would allow farmers to see how to intercrop with bamboo, use the fodder from bamboo to make fertilizer, feed for catfish and chickens, and use canes for hoop houses and other garden structures.

A bamboo build center will be constructed in a later phase of this project. Bamboo is a renewable material with a simple production process and is expected to be a sustainable alternative for more traditional materials like concrete, steel, and timber. Individuals will be able to attend workshops at the Bamboo Build Center focusing on how bamboo can be used in innovative and experimental ways that demonstrate its architectural possibilities. In addition, there will be rotating exhibitions featuring the potential for small scale value added bamboo processing and manufacturing.

During the last three and half years the Black Belt Bamboost project has been able to bring together farmers, educators, students, researchers, scientists, community members, government officials, and local business owners through a variety of endeavours and activities. It is a long term project, and through continued, committed participation by its partners, there exists the potential for real and measurable social, economic, and environmental benefits that ultimately could reinvigorate jobs and the economy in Alabama's Black Belt region.

It is believed the Black Belt Bamboost project will continue to:

1. Bring public attention to the possibilities of developing a bamboo industry in Alabama
2. Raise awareness of bamboo as a catalyst for agriculture development in the state
3. Showcase the full value cycle of bamboo and the possibilities for creating downstream industries
4. Provide an opportunity to explore an alternative energy source

And through the above, the Black Belt Bamboost project will develop into a Regional Bamboo Center in order to coordinated bamboo research and creative activities, provide contact and support for bamboo farmers and become recognized as a leader in building a positive bamboo culture in the southeast.

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