



Mid-Atlantic Sustainable Biomass for Value-added Products Consortium: Accomplishments, Engagement, and Impacts

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masbio.wvu.edu

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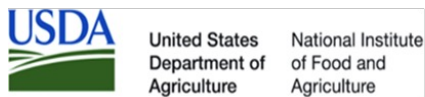
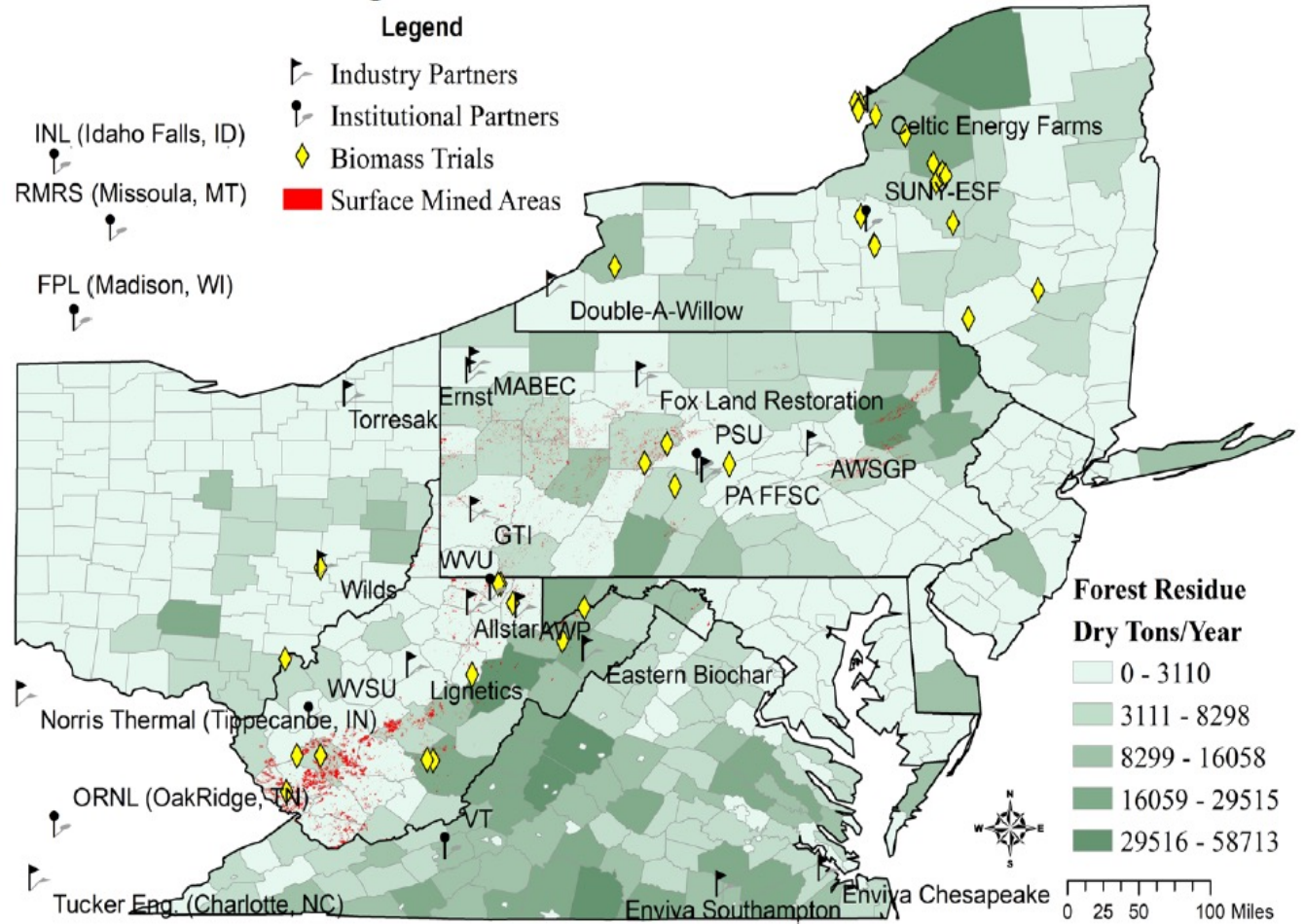
Xin Li, West Virginia Uni.
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 Evelyn Thomchick, Penn State Uni
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 ~25 Masters and PhD Students
 ~ 5 Post-doc Students

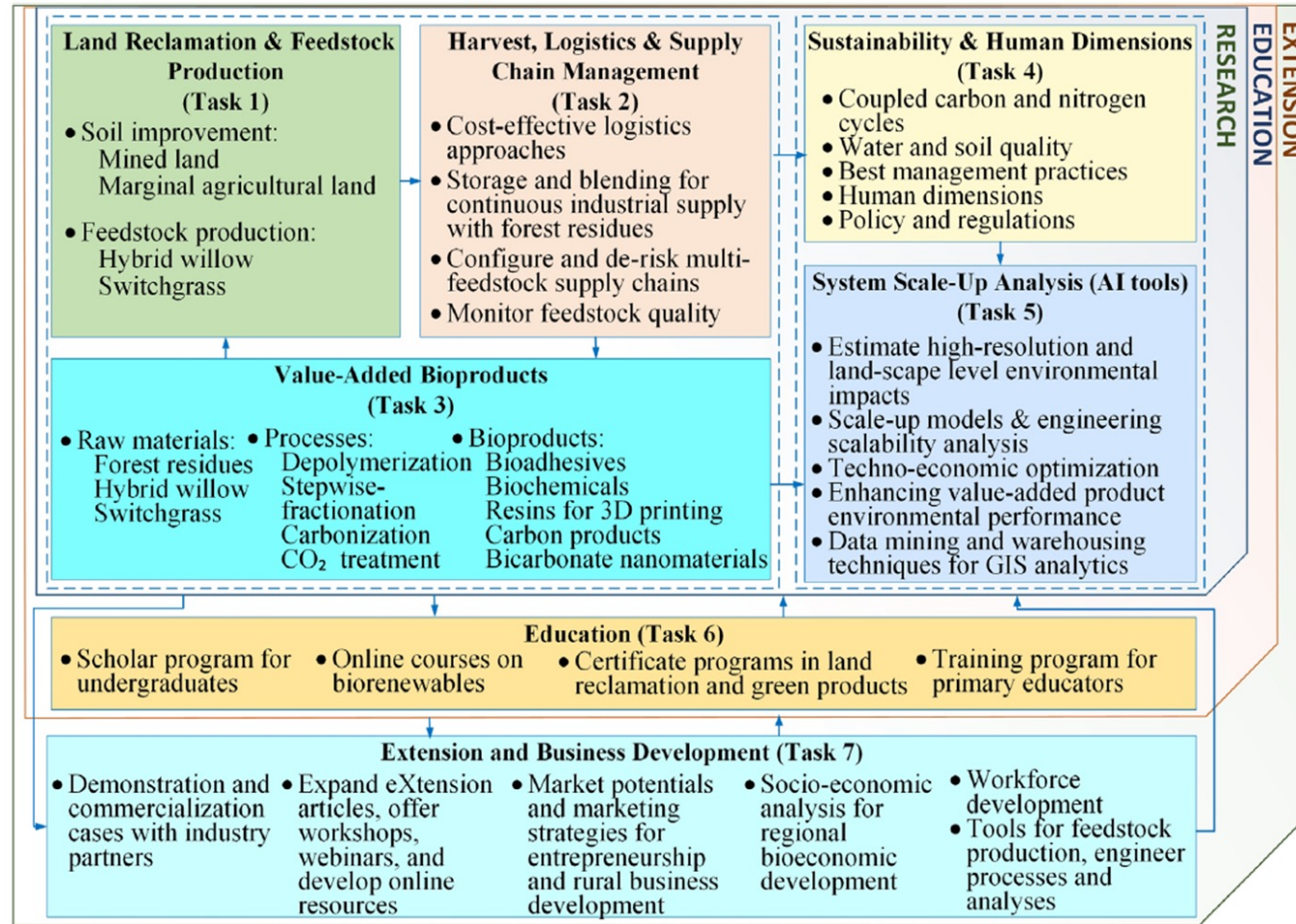


MASBio

- A regional consortium
- Sustainable production
- Bioeconomic development



Research Education and Extension Integration



Accomplishments: Feedstock production with biochar



AMENDMENT STUDY TREATMENTS 2021																		
PLOT	AGRONOMY FARM			JACKSON'S MILL FARM			REEDSVILLE FARM			LP MINE			ALLSTAR MINE1			ALLSTAR MINE2		
	CROP	Survival	TRT	CROP	Survival	TRT	CROP	Survival	TRT	CROP	Survival	TRT	CROP	Survival	TRT	CROP	Survival	TRT
1	W		F	W	85	B	S		C	S	ok	C	W	0	F	W	83	F
2	W		B	W	90	F	S		F	S	ok	B	W	75	C	W	83	B
3	W		C	W	83	C	S		B	S	ok	F	W	60	B	W	83	C
4	S	poor	B	S	ok	F	W		F	W		C	S	ok	C	S	ok	B
5	S	poor	F	S	ok	B	W		B	W		B	S	ok	B	S	ok	F
6	S	poor	C	S	ok	C	W		C	W		F	S	ok	F	S	locust	C
7	W		B	S	ok	B	S		B	W		B	W	82.5	B	W	84	C
8	W		C	S	ok	C	S		F	W		C	W	97.5	C	W	60	B
9	W		F	S	ok	F	S		C	W		F	W	100	F	W	70	F
10	S	poor	F	W	90	F	W		B	S	ok	F	S	ok	F	S	ok	B
11	S	poor	B	W	84	C	W		F	S	ok	B	S	ok	C	S	ok	F
12	S	poor	C	W	84	B	W		C	S	ok	C	S	ok	B	S	ok	C
13	S	poor	C	S	mod	B	W		F	S	ok	C	W	78	B	S	ok	C
14	S	poor	F	S	ok	F	W		B	S	ok	B	W	66	F	S	ok	F
15	S	poor	B	S	ok	C	W		C	S	ok	F	W	47	C	S	ok	B
16	W		B	W	100	B	S		C	W		F	S	poor	F	W	87	B
17	W		F	W	90	F	S		F	W		B	S	poor	B	W	70	C
18	W		C	W	67	C	S		B	W		C	S	poor	C	W	48	F
19	S	poor	F	W	80	F	W		F	S	ok	C	W	70	B			
20	S	poor	C	W	83	B	W		C	S	ok	F	W	58	C			
21	S	poor	B	W	73	C	W		B	S	ok	B	W	0	F			
22	W		C	S	ok	C	S		B	W		B	S	poor	C			
23	W		B	S	ok	F	S		F	W		F	S	poor	B			
24	W		F	S	ok	B	S		C	W		C	S	poor	F			
avg. growth willows	2-3ft			2-6ft			2-6ft			<1ft			<1ft			<1ft		

Switchgrass

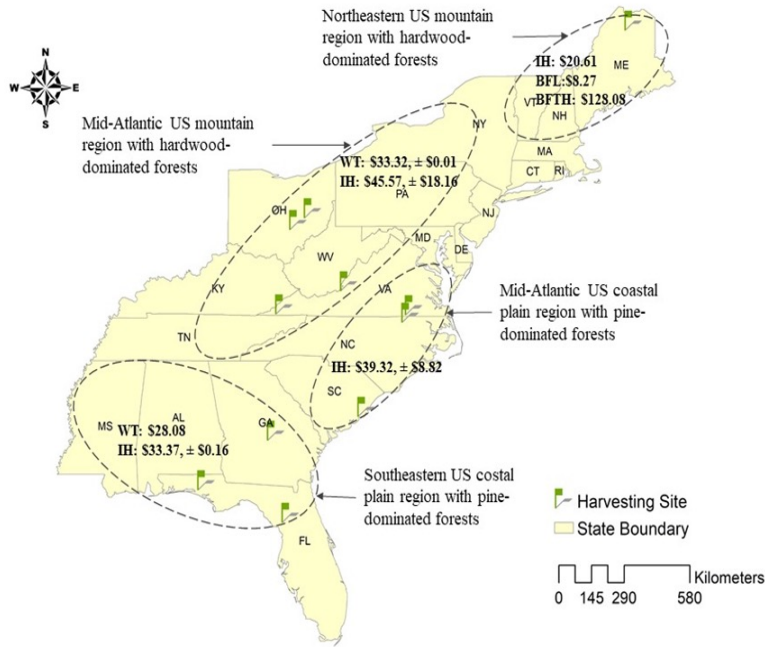


Hybrid willow



Accomplishment: Biomass Harvest, Logistics, and Supply Chains

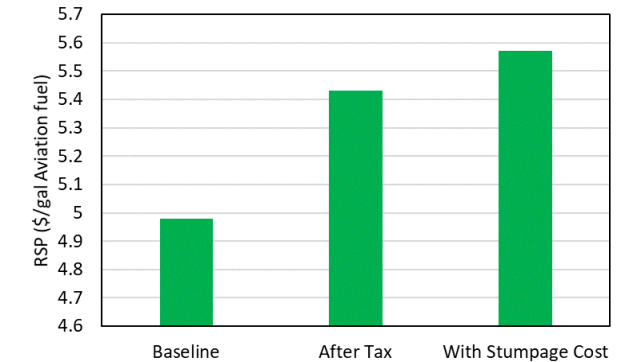
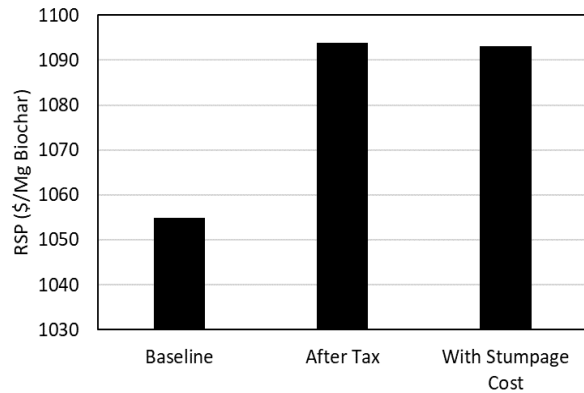
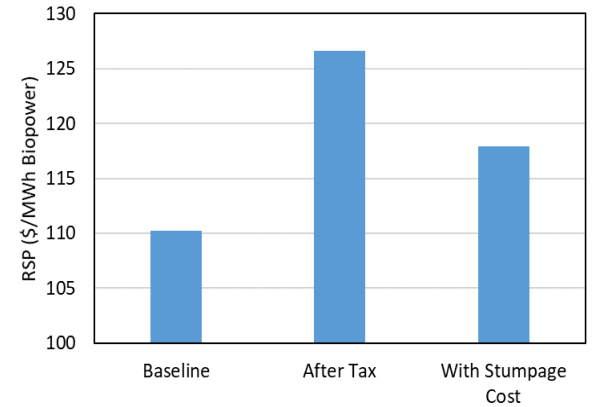
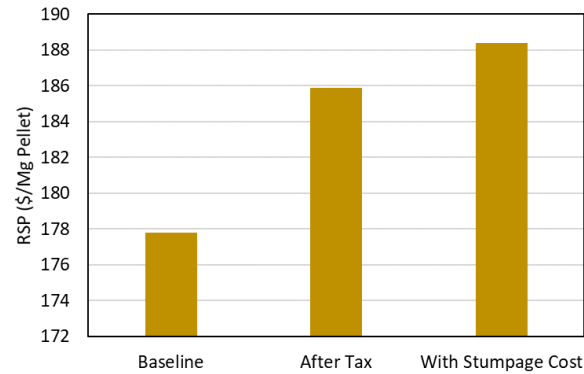
Biomass Harvest Costs



Zhang, X., Wang, J., & Strager, M. P. 2022. Industrial Development and Economic Impacts of Forest Biomass for Bioenergy: A Data-Driven Holistic Analysis Framework. Resources, Conservation and Recycling, 182, 106296.

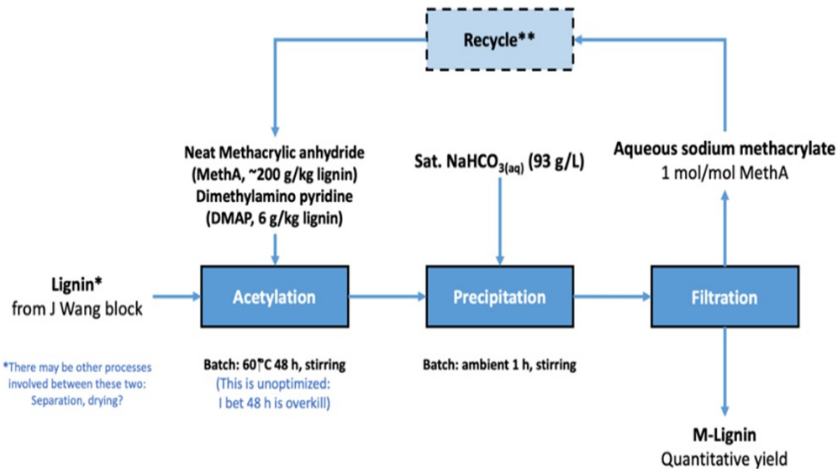
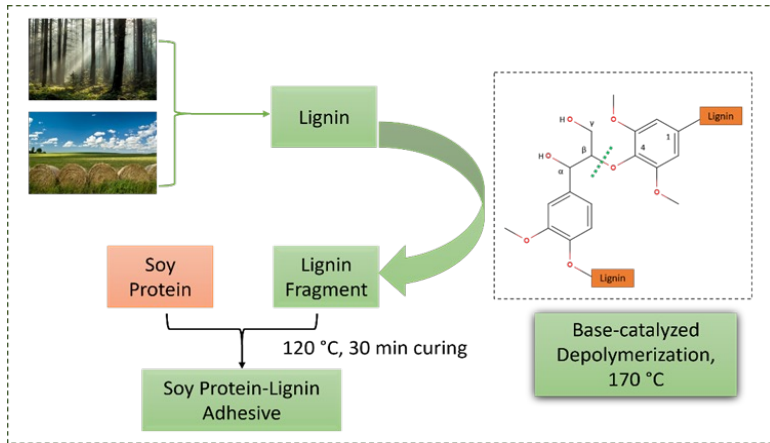


Required Selling Price of Bioenergy Products

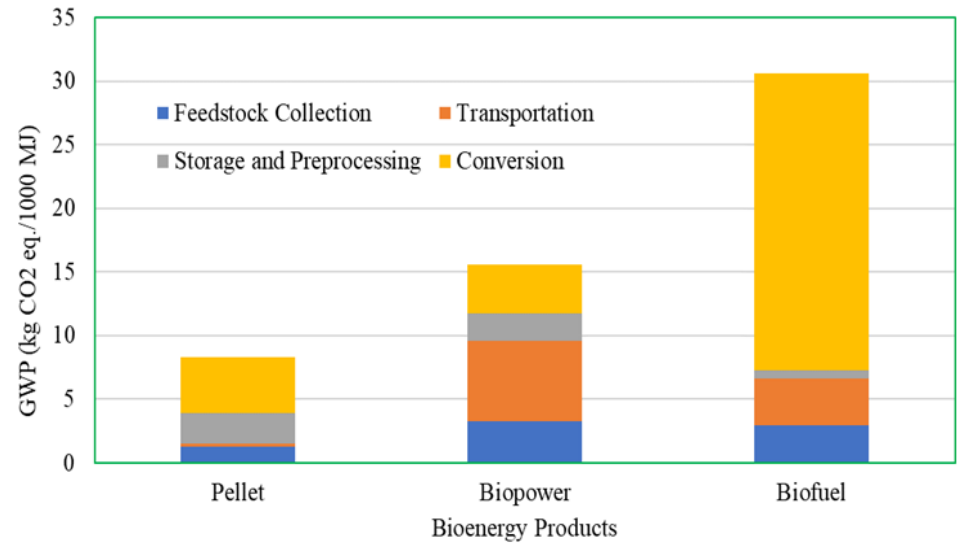


Accomplishment: Chemical Processes and TEA/LCA of Value-Added Bioproducts

Lignin Fragments and Soy Protein-Lignin Adhesive



Life Cycle GWP of Bioenergy Products

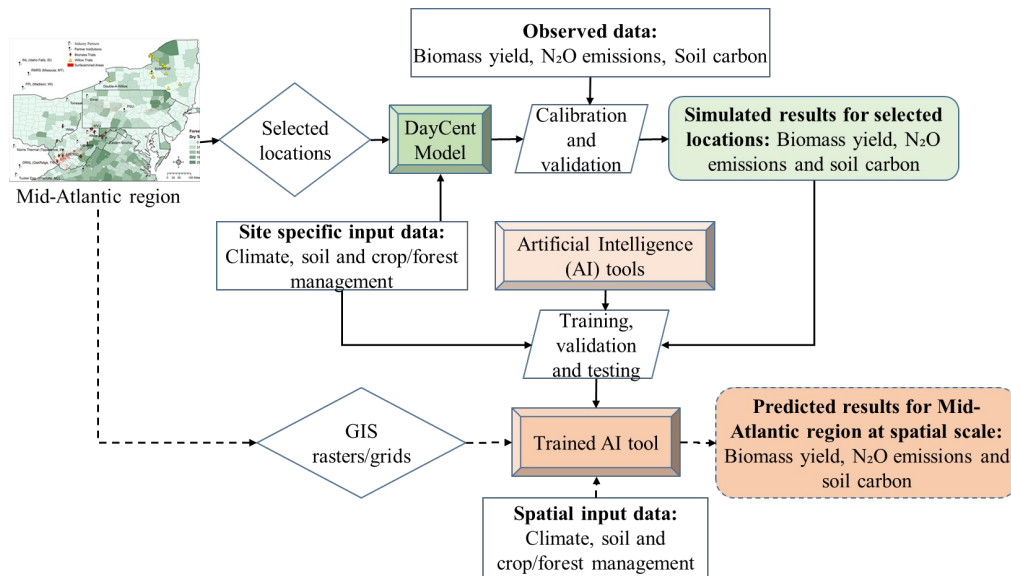


Wang, Y., J. Wang, X. Zhang, and S. Grushecky. 2020. Environmental and Economic Assessments and Uncertainties of Multiple Lignocellulosic Biomass Utilization for Bioenergy Products: Case Studies. *Energies* 2020, 13, 6277.

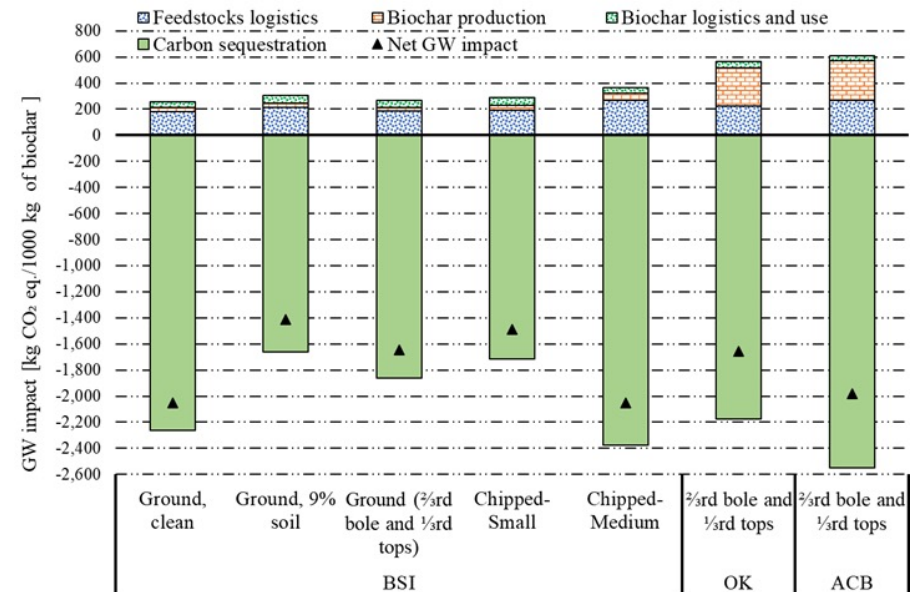


Accomplishments: AI for Sustainability of Value-Added Bioproducts

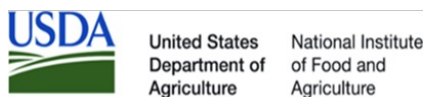
AI App and Engaged with UIUC AIFARMS



Life Cycle Impacts of Biochar



Sahoo K. et al. 2021. Life-cycle assessment and techno-economic analysis of biochar produced from forest residues using portable systems. The International Journal of Life Cycle Assessment. 26(1): 189-213.



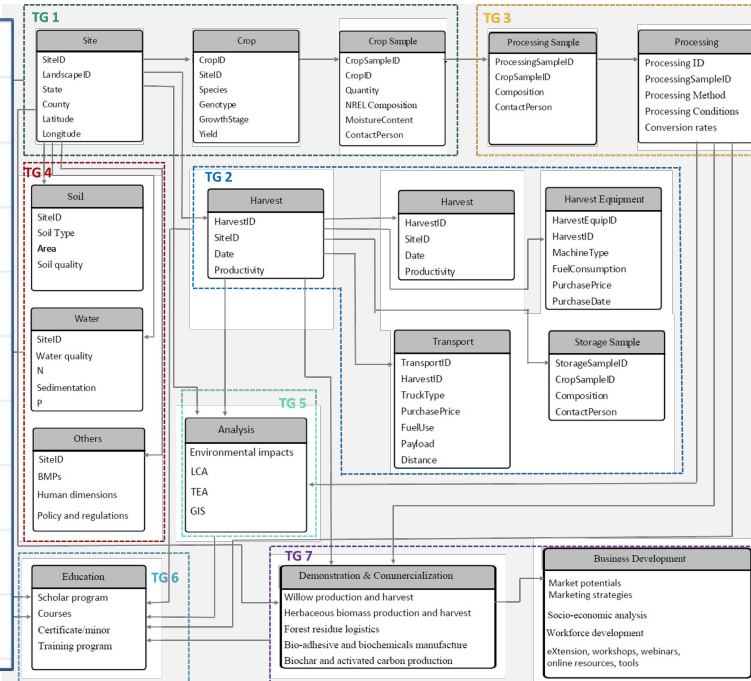
Engagement

- 1) Interactions of Task Groups and partners
- 2) Leadership team and advisory board
- 3) Engagement with students
- 4) Data management and sharing
- 5) Project evaluations
- 6) Increase promotion of MASBio work

- MASBio Data Commons
- MASBio.wvu.edu
- @_MASBio



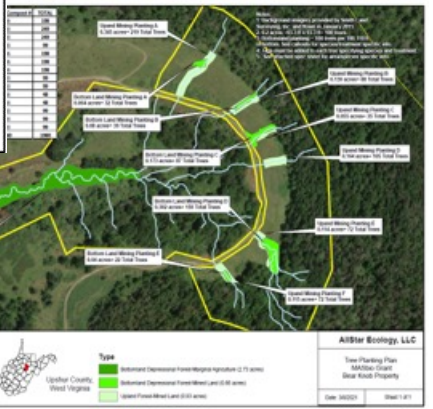
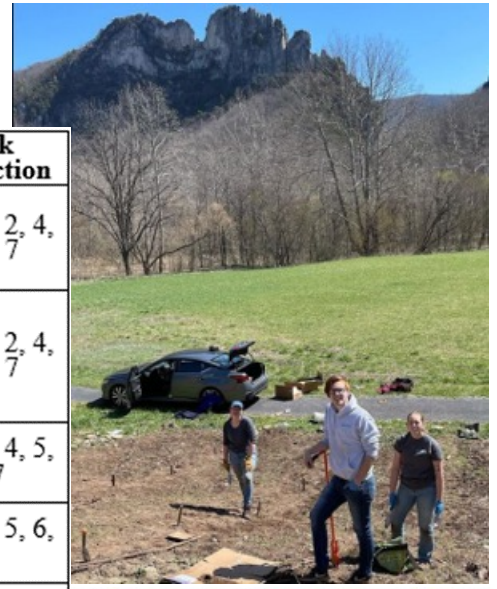
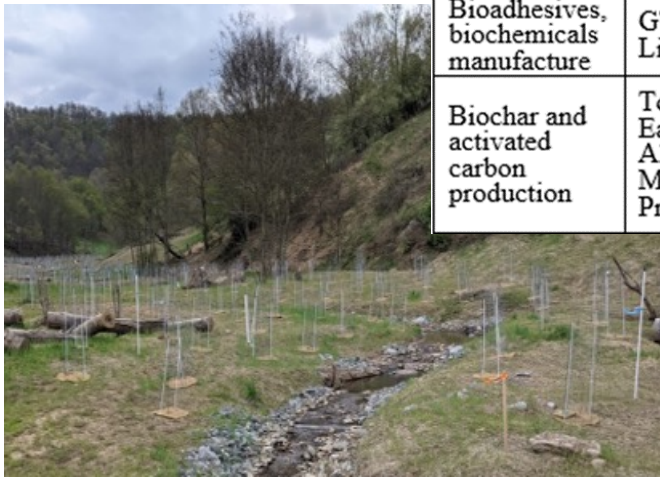
MASBio Data Commons	
Name	↑
	Project Management
	TG1_Land Reclamation and Feedstock Production
	TG2_Harvest, Logistics and Supply Chain Management
	TG3_Value-Added Biomass Products
	TG4_Sustainability and Human Dimensions
	TG5_System Scale-Up Analysis
	TG6_Education
	TG7_Extension and Business Development



Engagement: Demonstration and Commercialization with Industry Partners



Demo Case	Partner	Product	Scale	Task Interaction
Hybrid willow production and harvest	Double-A-Willow Celtic Energy Allstar Ecology	-Bioproduct feedstock -Chipped and storage piled biomass	~2,500 planted acres ~10,000 dry tons/yr	Task 1, 2, 4, 5, 6, 7
Herbaceous biomass production and harvest	Ernst Biomass The Wilds	-Baled biomass for bioproducts -Processed bioproduct for poultry bedding and stormwater remediation	~5,000 ac, ~20,000 tons/yr	Task 1, 2, 4, 5, 6, 7
Forest residue logistics	Allegheny Wood Products Lignetics	-Forest residue logistics demonstration to value-added products	~1 million tons production	Task 2, 4, 5, 6, 7
Bioadhesives, biochemicals manufacture	GTI Lignetics	-Value-added chemicals and adhesives from biomass feedstock	Pilot scale	Task 3, 5, 6, 7
Biochar and activated carbon production	TorreSak Eastern Biochar Allstar Ecology Metzler Forest Products	-Biochar to activated carbon and syngas -Portable production unit -Environmental packaging -Products for land and stream restoration	~ 6,000 tons/yr	Task 3, 5, 6, 7



Engagement: Courses, Teacher Training, Internships, and Seminar Series

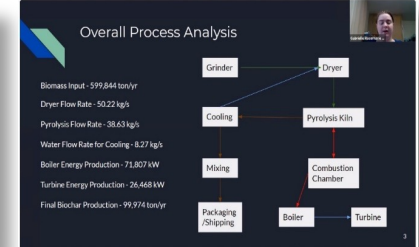
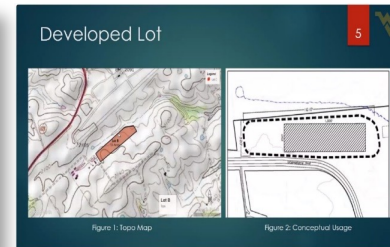
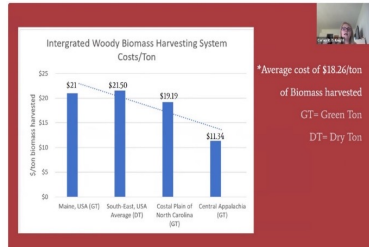
Undergraduate Design Course of Commercial-Scale Biomass Systems offered during the Fall and Spring Semesters of 2021/22; Penn State, SUNY-ESF, Virginia Tech, WVU

MASBio Mid Atlantic Sustainable Biomass Consortium **USDA** **NIFA**

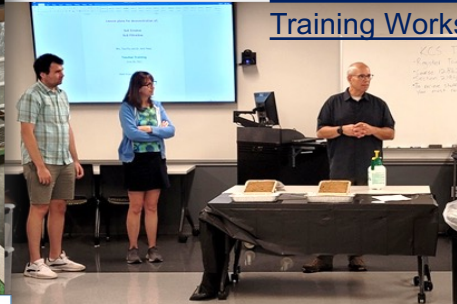
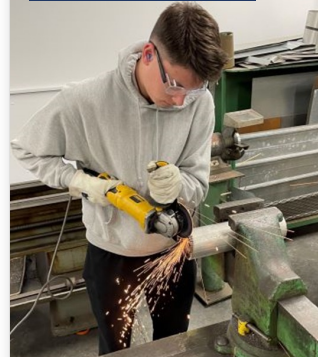
BIOPRODUCTS RESEARCH SUMMER INTERN PROGRAM

TODAY is the New World. EXPLORE AND EXCEL.

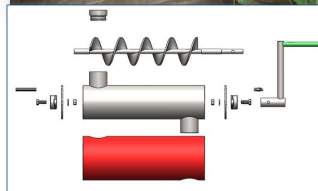
INVESTIGATE **INQUIRE**



Y1: Design of Large Biochar Production Facility ; Y2: Design of Smaller, Mobile Biochar Production Facility



Biomass Products and Biorenewables Teacher Training Workshop for WV 4th-5th Grade



Undergraduate Summer Research Scholar Program and MASBio Spring Seminar Series (12 seminars)

MASBio 2022 Seminar Series

SPRING SEMINAR 2022

REGIONAL OPPORTUNITIES FOR BIOMASS & BIOPRODUCTS

Mondays at 12:20pm (Eastern, US)

Date	Topic	Speaker
13 Jan	The MASBio Vision	Jinglin Wang, West Virginia University
14 Jan	Feedstocks - Perennial Grasses	JMF Brizuela, West Virginia University
15 Jan	Feedstocks on Marginal Land	Dwain Grashel, West Virginia University
17 Feb	Feedstocks - Short Rotation	Mike Jacobson, Penn State
14 Feb	Feedstocks - Forest Residue	Chad Bolding, Virginia Tech
20 Feb	Supply Chains	Clinton Haffey, Idaho Nat'l Lab
27 Mar	Supply Chains	Tim Vuk, SUNY ESF
27 Mar	Biomass Conversion	John Hill, West Virginia University
28 Mar	Biomass Conversion	Bingyan Li, West Virginia University
04 Apr	Biomass Conversion	Steve Chapp, Penn State
11 Apr	TEA Evaluation	Tristan Brown, SUNY ESF
18 Apr	LCA Evaluation	Richard Bergman, USDA Forest Products Lab

REGISTER ONLINE (Open to the public)
https://www.usda.gov/webteam/register/vhr_ar3-Dm0h0z0u0a000



Impacts

Stream restoration

Bear knob (All Star Ecology)

- 6000 feet
- 2000 trees
- 3 char treatments
- First year measurements complete

WVU Ruby/Stony Run (WVU Farm)

- 5000 feet
- 1800 trees
- 2 char treatments

Stakeholder focus groups

MASBIO Stakeholders Sessions

- First completed, second scheduled
- More contacts/ideas needed from other tasks – groupings include: government, NGO/environmental, Scientist/Consultants, Industry non-biochar, industry biochar
- Goal is mixed focus groups

Biomass to Biochar Financial model

- Adapting previous model for this effort
- Will validate on MASBIO partnership

Ecosystem Services

Natural Gas Midstream (Industry Partner)

- 200 trees
- 2 char treatments

Nursery (RES Environmental)

- 60 total – 2 ages, 3 species, 2 treatments

Managed Forestland (WVU Research Forest)

- 2 treatments in managed forest
- Soil C changes
- Impacts on herb populations

Industry Feedstock (Consol Energy)

- 3 acres
- Switchgrass, willow, biomass sorghum, pollinators

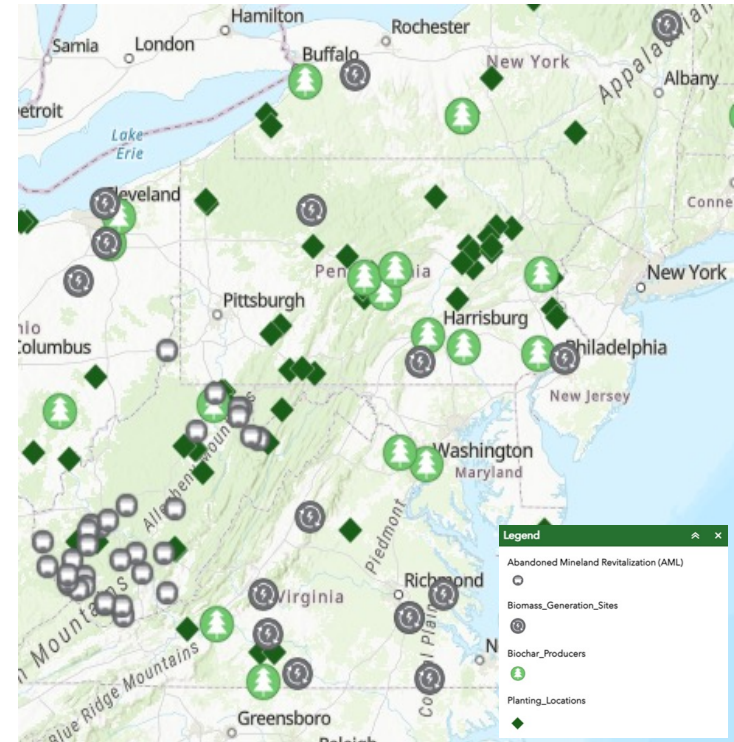
Extension

Van High School (Boone County WV)

- Five groups of students presented results from biochar experiments (greenhouse versus lab, biochar versus 100% sand, w/wo irrigation)
- Hosted online seminar with WVU and University of Texas faculty

Additional Partner Development

- Continue to build industry partners (recent examples)
- Partnership with WVU Extension
- Certificate program with Eastern CC



A mapping application for biomass planting locations, biopower generation, biochar producers and abandoned minelands projects in the Mid-Atlantic.



Impacts

- 40+ interaction and collaborative events/activities with industry partners
- 22 Educators (primary and secondary) accomplished the teacher training course
- 55 Presentations and Webinars
- 29 undergraduate students accomplished a design course at PSU, VT, SUNY ESF and WVU
- MASBio Students and Post-Docs
 - 25 masters and PhD students
 - 5 Post-Docs
 - 5 summer scholars
- 20 Publications
- 2 Conferences/many webinars, and 1 seminar series
- MASBio Reports: Quarterly (8), Annual (2)



MID-ATLANTIC SUSTAINABLE BIOMASS FOR VALUE-ADDED PRODUCTS CONSORTIUM

West Virginia University

MASBio is supported by the Agriculture and Food Research Initiative Competitive Grant No. 2020-0502-21181 from the USDA National Institute of Food and Agriculture.

The Mid-Atlantic Sustainable Biomass for Value-Added Products Consortium (MASBio) is a regional consortium including 8 universities, 2 DOE national labs, USDA Forest Service RMRS and FPL, 12 industry partners.

MASBio GOALS & OBJECTIVES

To deliver a sustainable and economically feasible biomass for value-added products system in the Mid-Atlantic region of the U.S., and to promote the regional decarbonized bioeconomy.

- Leverage and strategically utilize available resources and geographical advantages in the region.
- Over 10 million acres of mined and marginal lands
- More than 5 million dry tons of forest residues produced annually
- 1,250 acres of hybrid willow and switchgrass on 30+ established sites
- Develop 20+ sites

TIMELINE

MASBio Kick-Off

- Pre and post event planning by consortium
- Kick-off Planning August 23, 2021
- Formal MASBio project launch

Interactions

- Presentations and coordination of National Biomass Week, Dec. 1-11, 2021
- State engagement meetings in counties established site ready for analysis
- Consensus growth for selection of growing sites, biomass production, and marketing
- Summer convening of researchers, industry partners, and stakeholders

Education

- MASBio Day Strong & Program
- Teacher Training Workshop in Charleston, WV (WV State U, WPAU, etc.)
- Field visits, test interactions, growing trials

Next Steps

- Active stage
- Open planning
- Timeline
- Program evaluation

MASBio Management

- Facilitation of a broad-based planning process with industry partners
- Building of growth analysis and production (GHG) modeling process
- Develop willow and switchgrass infrastructure
- Production market development
- Research and development
- Business plan development

Students

- Agreement on degree course and experiential program from PSU, SUNY ESF, WVU
- Advisory Board Meeting March 2022

Annual Meeting

- MASBio Annual Meeting May 10, 2021
- Research and development plan
- Annual report

CURRENT ACCOMPLISHMENTS

- 20+ interaction and collaborative events/activities with industry partners
- 10 Educators (primary and secondary) accomplished the teacher training course
- 27 Presentations and Webinars
- 17 undergraduate students accomplished a design course at PSU, VT and WVU
- MASBio Students and Post-Docs
 - 10 masters and PhD students
 - 4 Post-Docs
- 6 Publications
- 1 Courseware
- MASBio Reports: Quarterly (8), Annual (2)
- MASBio Task Forces
- Student Support, webinar series, summer intern program
- Data Management and Sharing Modeling, collaborative and integrative
- Stakeholder Engagement, regional decarbonized economic development

STAKEHOLDER ENGAGEMENT

Demo Case	Partner	Product	Scale	Task Interaction
Midland willow production and harvest	Duck-A-Wild, Cyclic Energy, Allure Energy	Bioproduct feedstock, Chipped and storage piled biomass	~2,500 planted acres, ~10,000 dry tons/yr	Task 1, 2, 4, 5, 6, 7
Herbaceous biomass production and harvest	Esport Biomass, The Wilds	Bioproduct biomass for veg products, Processed bioresidue for poultry bedding and distributor contribution	~5,000 ac, ~20,000 tons/yr	Task 1, 2, 4, 5, 6, 7
Farmstead biomass	Allegheny Wood Products	Energy residue, Logistics demonstration to value-added products	~1 million tons production	Task 2, 4, 5, 6, 7
Recycled/retired carbon production	GTI, Logistics	Value-added chemicals and alternative from biomass feedstock	Pilot scale	Task 3, 5, 6
Blocker and recycled carbon production	TerraMark, Kistler, Blocker, Munster, Forest Products	Bioproduct for activated carbon and syngas, Biomass production used for environmental packaging products for food and stream restoration	~6,000 tons/yr	Task 3, 5, 6

CONTACT US

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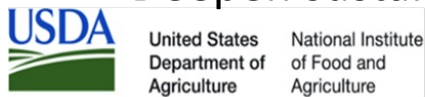
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1407 Ag Sci Building, Morgantown, WV 26506

Logos for West Virginia University, ESF, INL, OAK RIDGE, PennState, USDA, UAS, VT VIRGINIA TECH, WEST VIRGINIA STATE UNIVERSITY, WISCONSIN.



Impacts

- Market and commercialize innovations developed by MASBio
- Effective Land Uses and Ecosys Services
 - Climate-Smart Biomass for Bioproducts
 - Reclaimed mine and marginal land in the Mid-Atlantic Region
 - Increase yield of willow and grasses
 - Increase carbon sequestration
- Sustainable Bioeconomy
 - Green solutions for sustainable, large-scale production of bio-chemicals and other bioproducts
 - Increase the number of Industry partners and stakeholders
 - Deepen sustainability focus and approaches





Contact Us

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