Bioenergy Alliance Network of the Rockies

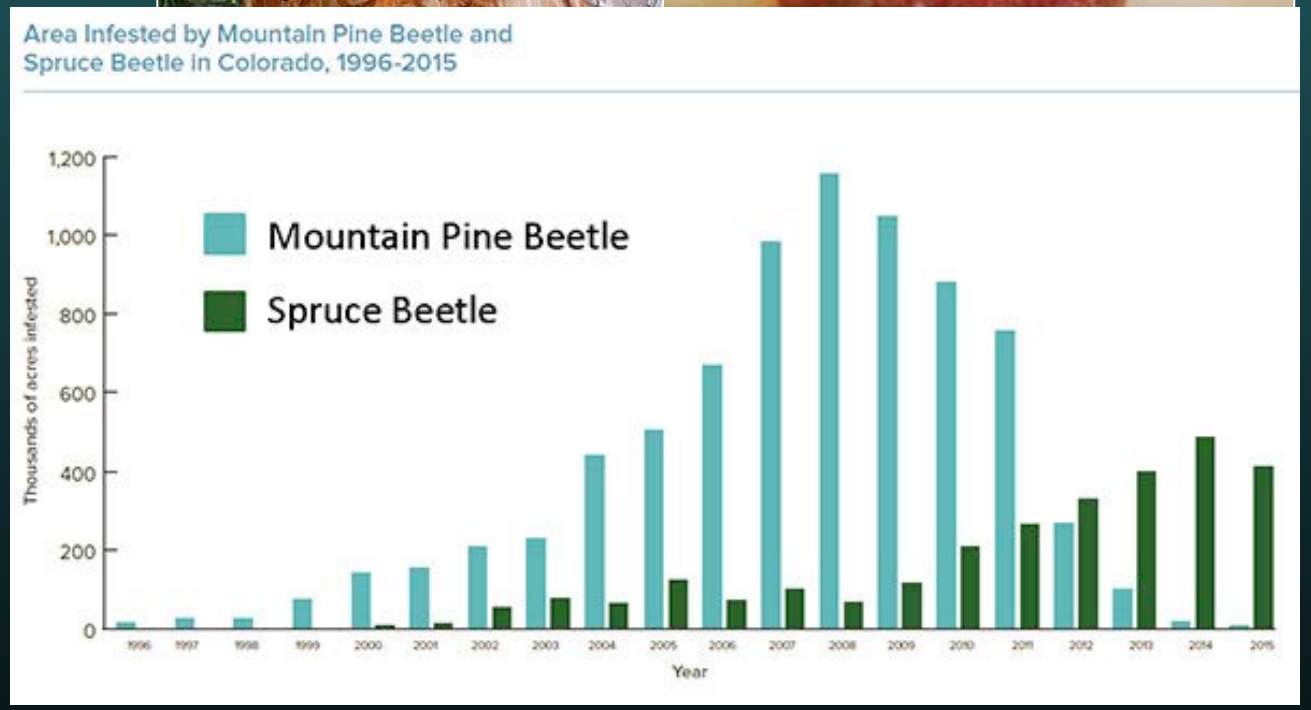
2018 CAAFI Biennial General Meeting (CBGM) & Integrated ASCENT Symposium

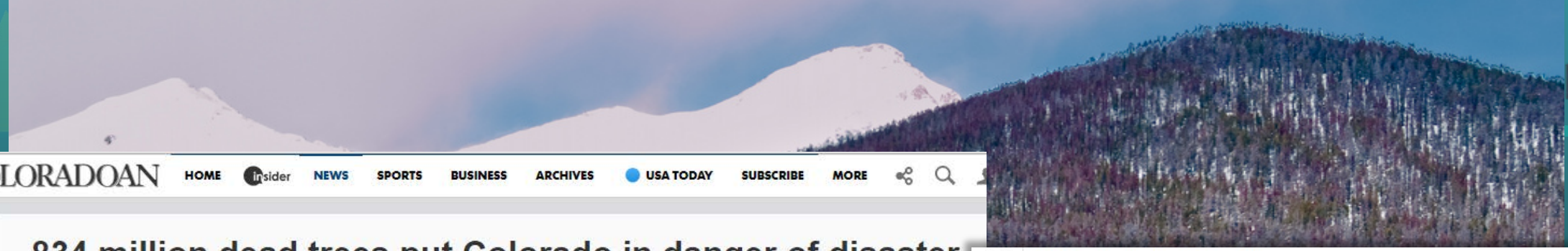
John Field[1], Keith Paustian (PD)[1,2], Amy Swan[1], and many, many others!

[1]Natural Resources Ecology Laboratory, Colorado State University
[2]Soil and Crop Sciences, Colorado State University

Little bug, big problem

- Mountain pine beetle is native, but current infestation driven by:
  - **Management**: Past harvest, fire exclusion
  - **Climate**: Summer drought stress, milder winter minimum temps
- Spruce beetle infestations picking up as MPB runs out of hosts





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834 million dead trees put Colorado in danger of disaster

Jacy Marmaduke, jmarmaduke@coloradoan.com Published 8:15 a.m. MT Sept. 29, 2017

Colorado State Forest Service entomologist Dan West surveys the state's forests every summer in a tiny plane. It's exciting, fascinating and a little scary. Here's what he sees out there. Wochit

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Colorado's forests are a living graveyard where 834 million dead linger among the survivors.

'A tremendous problem'

Planes [illegible] and the

Another High Park Fire

The High Park Fire burned more than 87,000 acres and 259 homes west o[illegible] See how the burn area has recovered. Jacy Marmaduke

DP It's not your imagination. More trees than ever...

NEWS · COLORADO NEWS

It's not your imagination. More trees than ever are standing dead in Colorado forests

Annual survey estimates there are 834 million standing-dead trees, threatening watersheds and worsening risk of ruinc

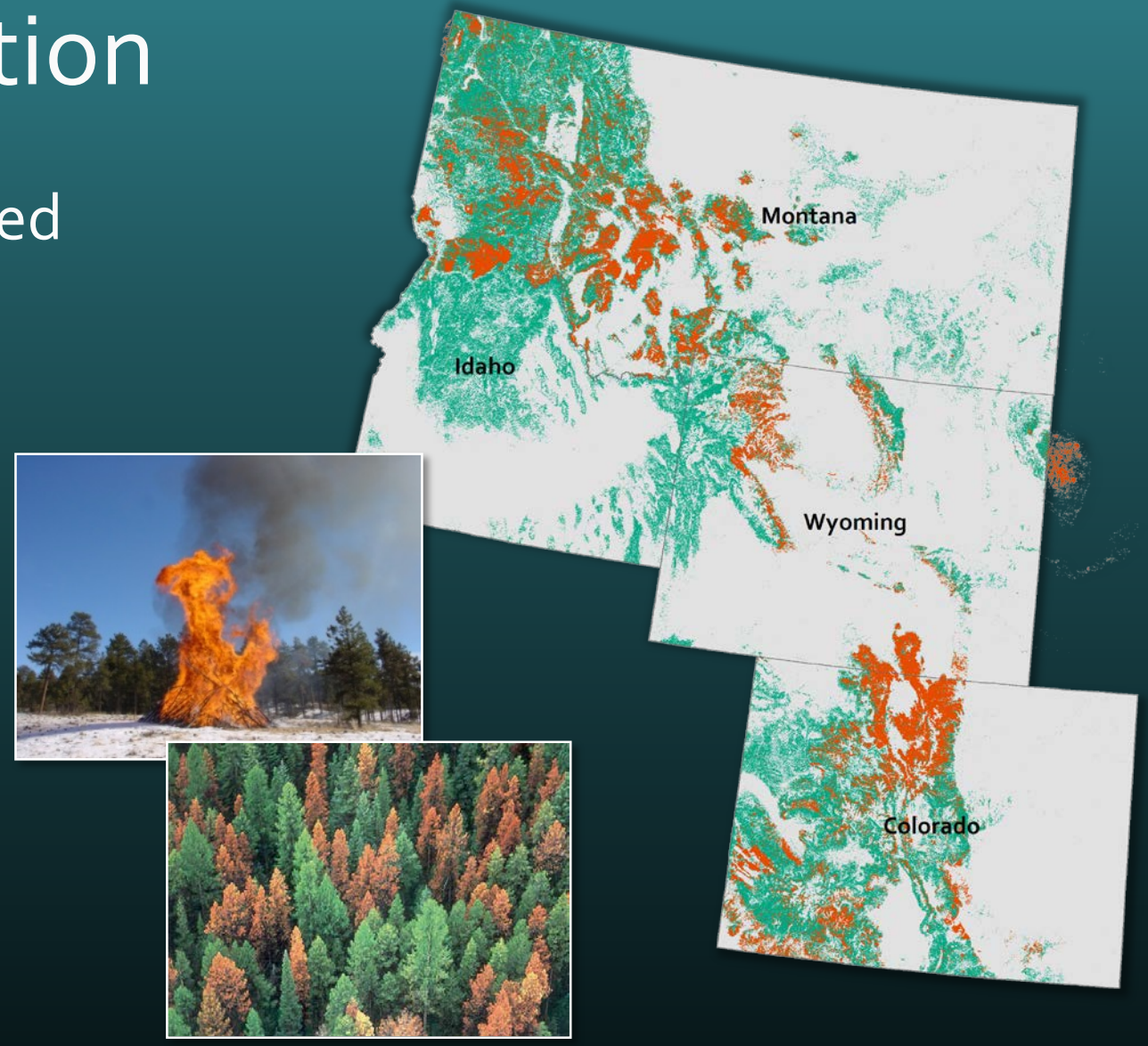
Photo provided by Colorado State Forest Service

Standing-dead trees are shown on Wolf Creek Pass in Mineral County.

By BRUCE FINLEY | bfinley@denverpost.com | The Denver Post
PUBLISHED: February 15, 2017 at 1:08 pm | UPDATED: February 16, 2017 at 2:53 pm

Scale of current infestation

- >42 million acres of forest impacted
  - Much of that in BANR 4-state area (CO, WY, MT, ID)
  - Predominantly on federal land
- Diverse management objectives
  - Timber salvage
  - Fire risk mitigation
  - Ecological restoration
  - Safety & recreation
- Some harvest happening, but demand for more acres treated



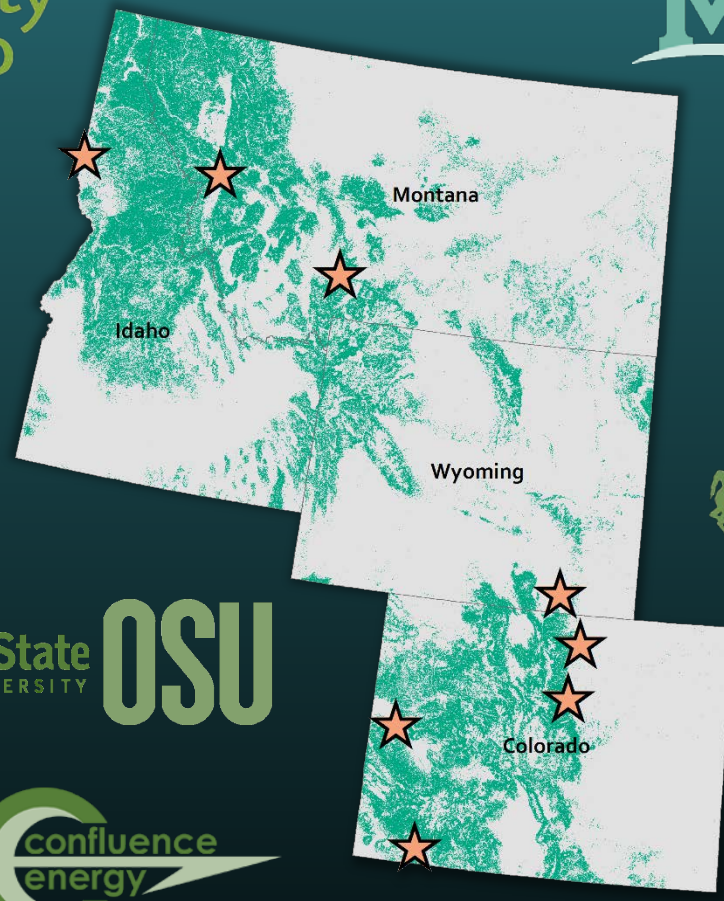
Beetle-kill for bioenergy

- Biomass already exists on landscape
  -> remote sensing instead of genetics
- Generally assuming biomass co-production during timber harvest (free ride out of the woods)

Pros:	Cons:
• Large biomass per area • Avoids food-v-fuel issues • Low stumpage costs	• Spotty and episodic • Challenging access • Expensive logistics
Infrastructure availability? Environmental impacts? Public perceptions?	

Bioenergy Alliance Network of the Rockies

The goal of BANR is to provide **science-based underpinnings** – through targeted research, education, training and extension – to support the development of sustainable biofuel/bio-products from beetle-killed and residual wood feedstocks.



Cool Planet Energy Systems

- Started in 2009
- Multi-stage pyrolysis process
- Catalytic conversion to low-O renewable fuel blend stock
  - Fuel fleet-tested with Google & Ventura County
- Plans for commercial-scale production in Louisiana
- Pivot to focus on Cool Terra engineered biocarbon (biochar) co-product

BANR Objectives

COULD we harvest?

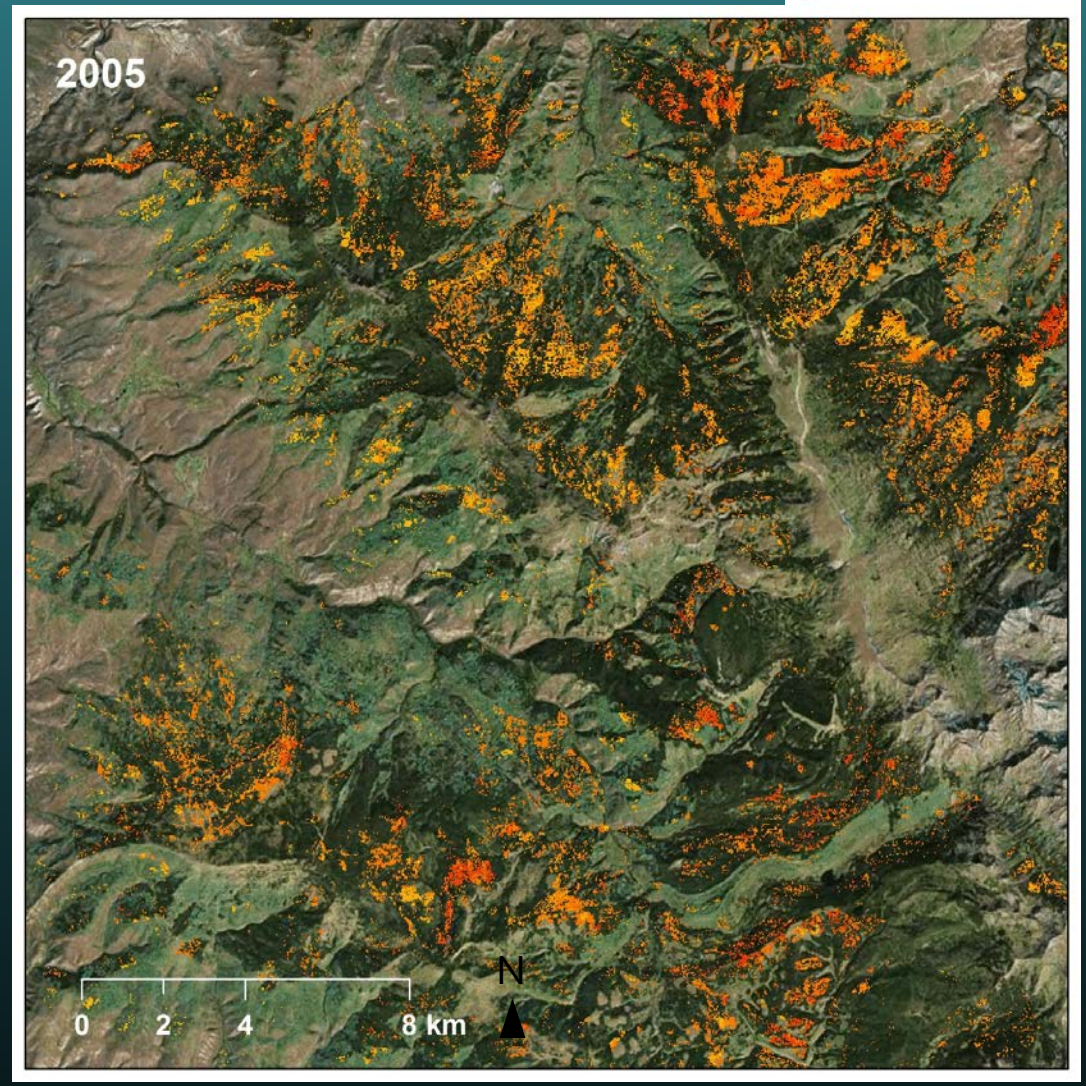
1) Compile a regional General Feedstock Atlas & select Site-Specific Biomass Inventories
2) Develop Feedstock Specifications and Low-Cost Harvest and Processing Systems

SHOULD we harvest?

3) Quantify Local-Scale Economics & Environmental Sustainability Limits
4) Determine Wider Economic & Climate Value of Biofuel Products and Biochar Co-Product
5) Articulate Social & Policy Barriers, Make Recommendations
6) Develop Education Curricula, Extension/ Outreach Program, Health & Safety Guides

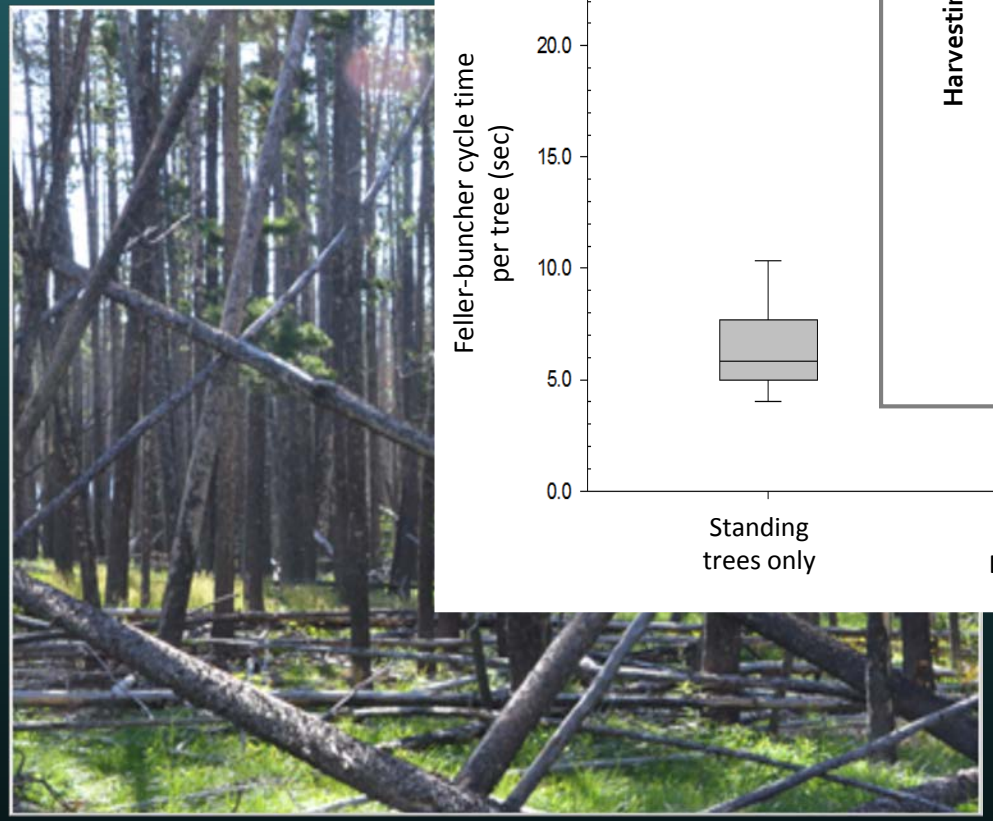
Biomass Atlas & Inventory

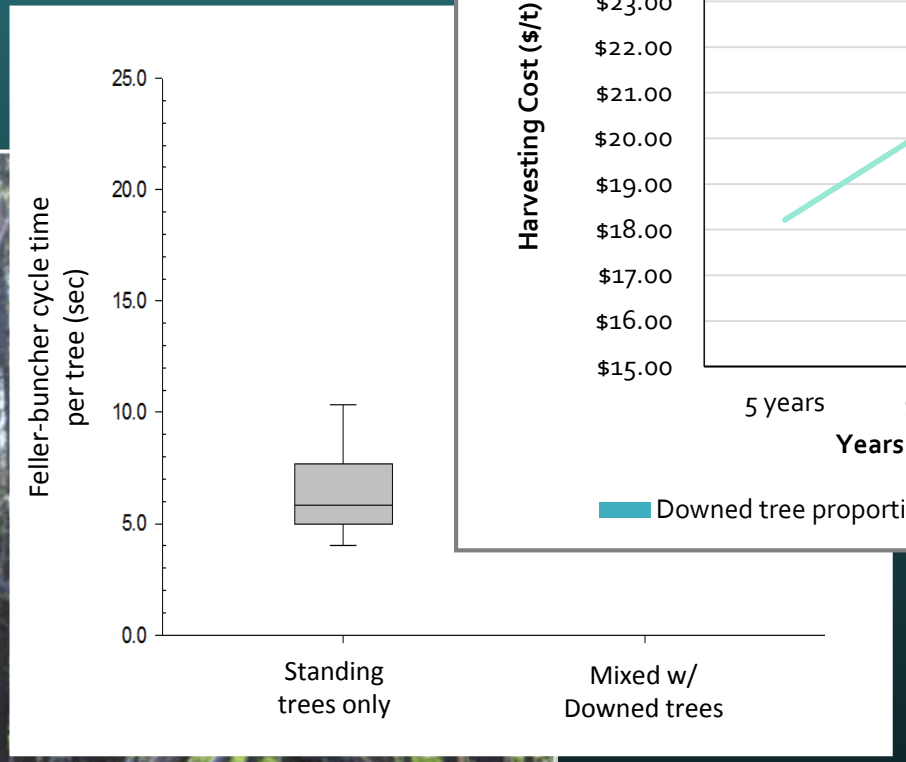
- Allometric data collection (destructive sampling, LiDAR) -> biomass mapping
- Outbreak severity vs. time

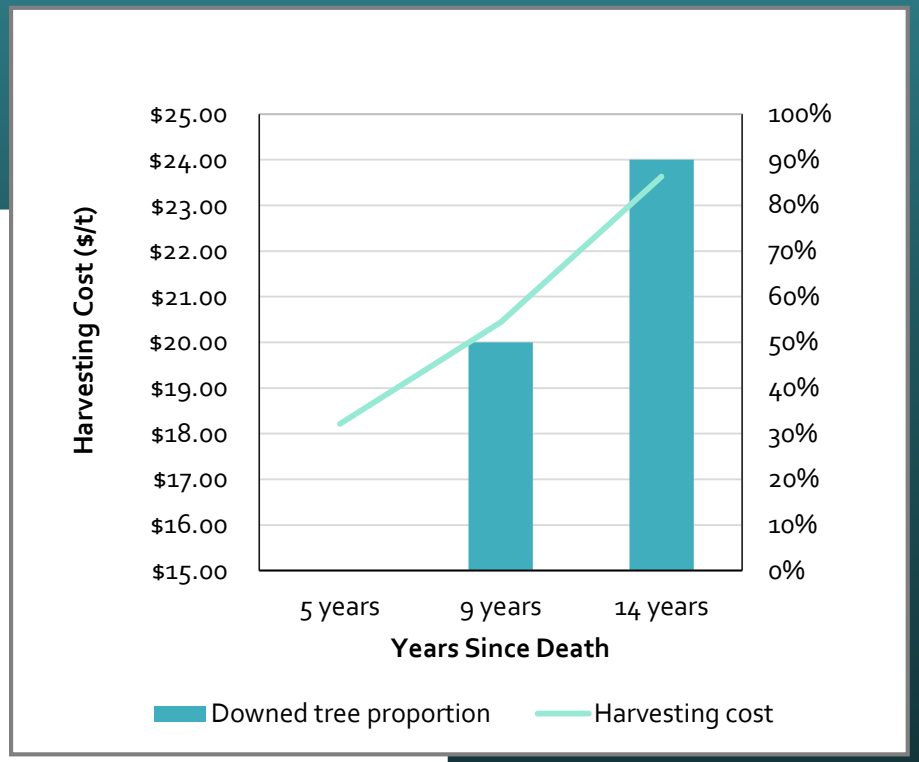


Harvest Logistics

Feller-buncher cycle time is highly affected by **downed trees**

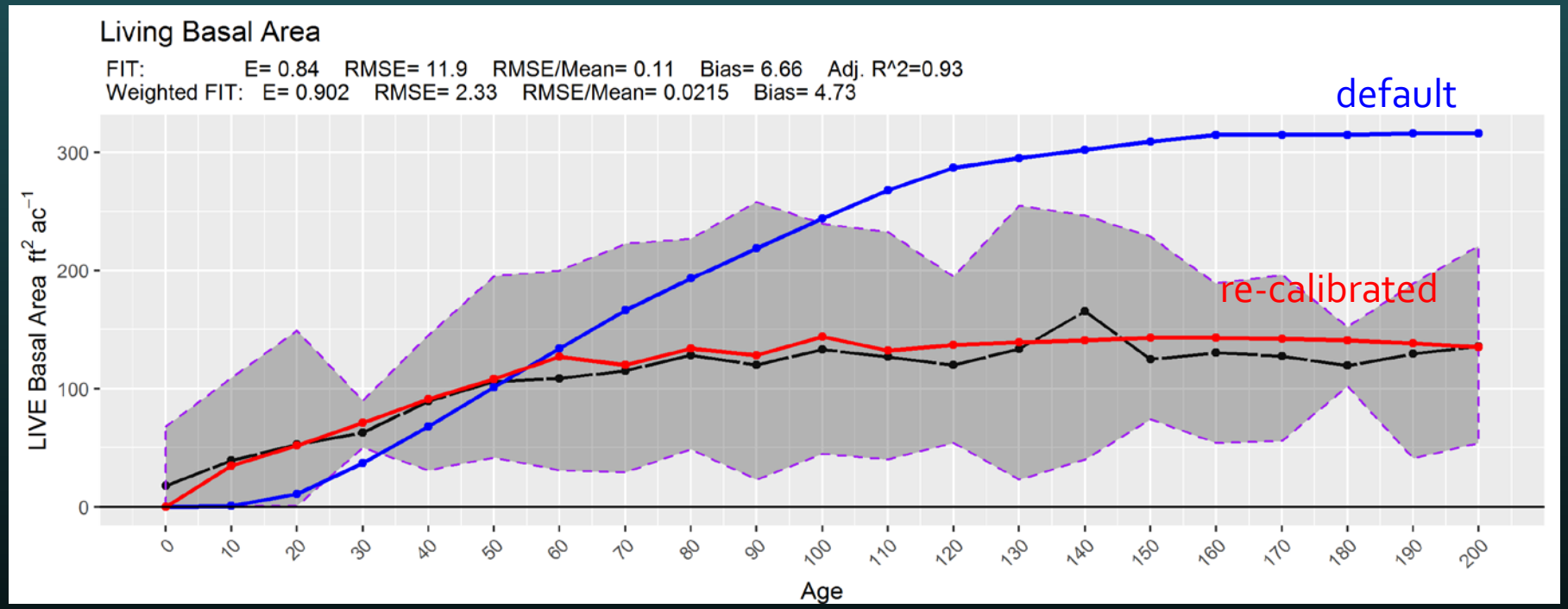


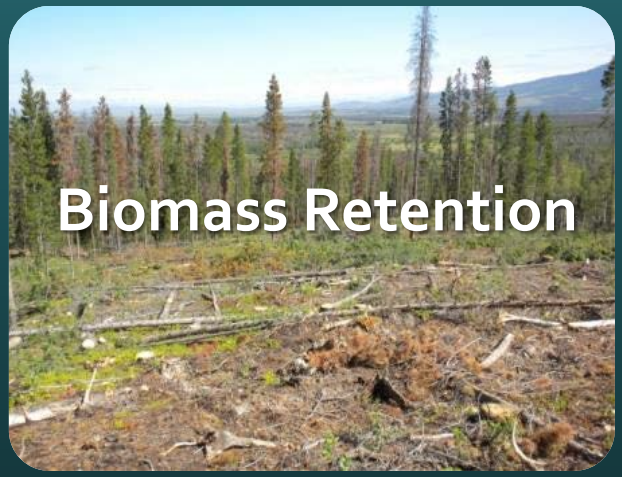




Regeneration & Carbon Cycling

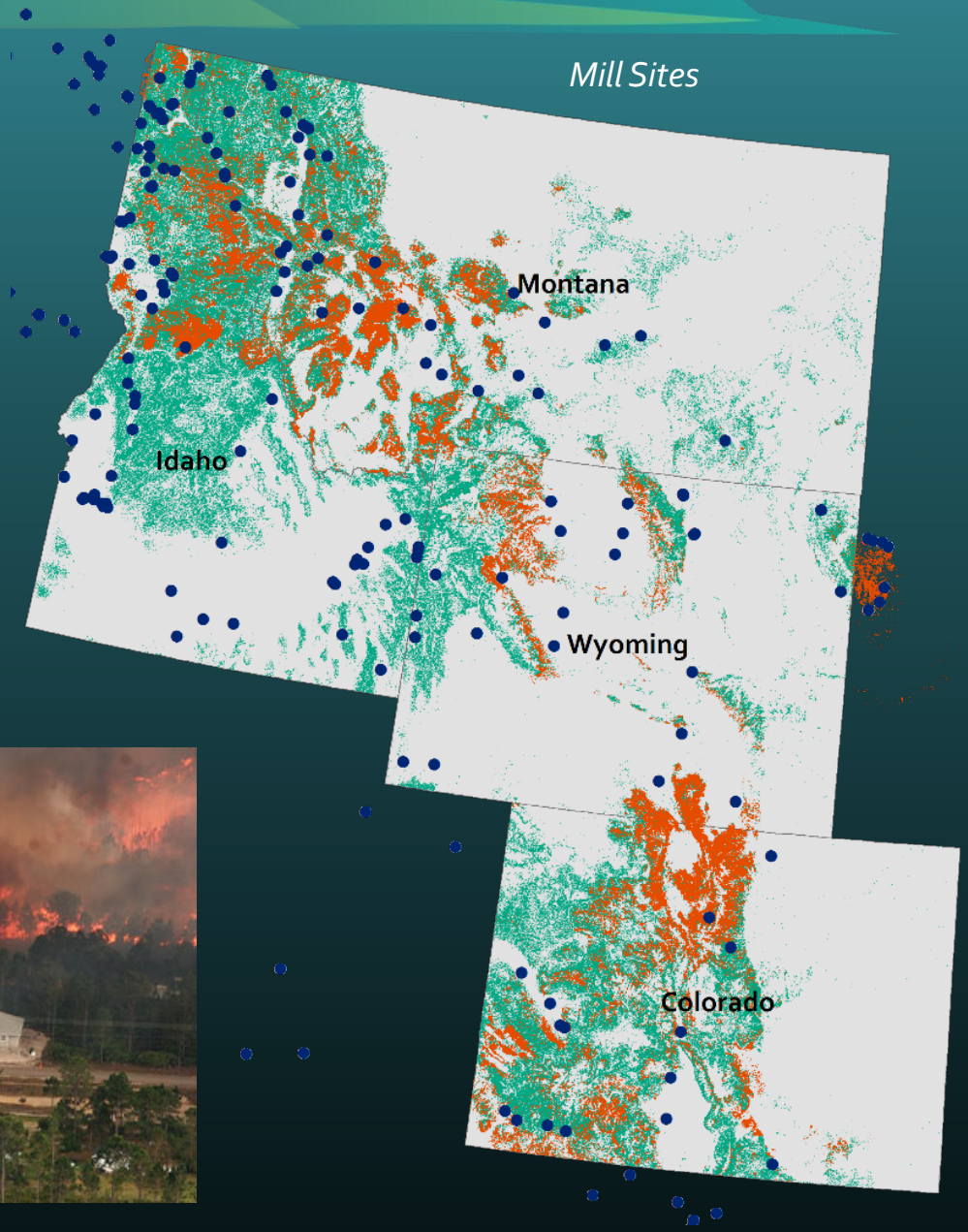
- Sampling: post-infestation stand inventory, post-harvest seedling regeneration
- FSV modeling -> stand C deficit -> LCA accounting





Social & Policy barriers

- Survey work – Positive attitudes toward decentralized restoration/energy/climate
- Capacity – existing harvest infrastructure, USFS admin constraints, NEPA cost analysis
- ASCENT collaboration on social capital & facility siting analysis



Thank You!

To learn more:

- Website: http://banr.colostate.edu
- Twitter: @BANR_Bioenergy
- YouTube: https://www.youtube.com/user/banrbioenergy

SPARC: Making the Southeast Carinata Supply Chain a Reality

Scaling carinata in the Southeast United States

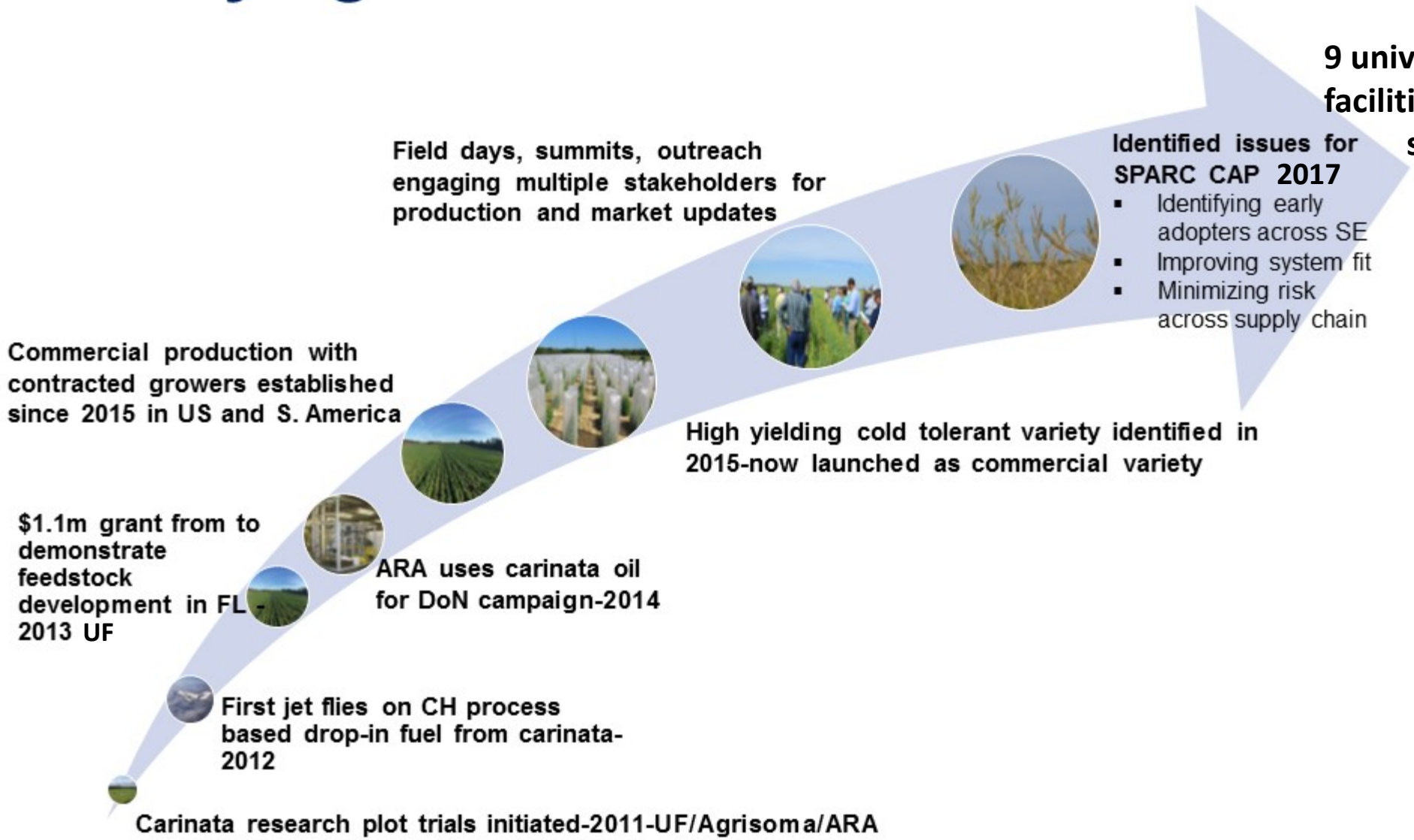
David Wright

CAAFI Biennial General Meeting, December 4-6, 2018
Washington DC

United States Department of Agriculture
National Institute of Food and Agriculture

CAP Grant # 2016-11231

Laying the foundation for SPARC



9 universities, 4 USDA facilities, over 60 scientists

SPARC in a nutshell (seed pod)

Carinata oilseed

Producer, grain handler

Crush & refine

Transportation/Storage

Deliver oil, meal, value add products

- Germplasm improvement earliness, cold tolerance
- Adaptability to various SE geographies

- Shift in mindset
- Focus on profitability
- Availability of infrastructure
- Help producer succeed

- Incentives
- Infrastructure

- Infrastructure
- Optimization

- Product testing & compatibility
- Regulatory boundaries
- Market access/demand for green products

SPARC

Research, Extension, Education, partnering with industry to overcome challenges

An example of the work of SPARC: Working within the framework of Sustainability

Selection of germplasm for SE

- Earliness
- Cold tolerance
- Oil and seed yield

Improved soil quality

- Build residue; increase organic matter
- Reduce soil erosion

Enhanced nutrient use efficiency

- Reduce nutrient leaching
- N, P, K scavenger
- Increase nutrient cycling in a rotation system (year round cropping)

Pest reduction

- Suppress weeds
- Reduce nematodes

SPARC

SE regional partners bring in experience working on winter oilseed BMPs and sustainable cropping systems

How SPARC Educates

- Establish Carinata Community of Practice with early adopters
- Stakeholder needs assessment
- Develop Extension Tools-Learning modules, fact sheets, pubs and apps
- Field days, webinars and workshops

Coordinating events with partners

Regional Production Meetings

Research and Production Summits

Plot Tours

Field Days/Tours

SPARC Engagement- Facilitating Commercial & Economic Development

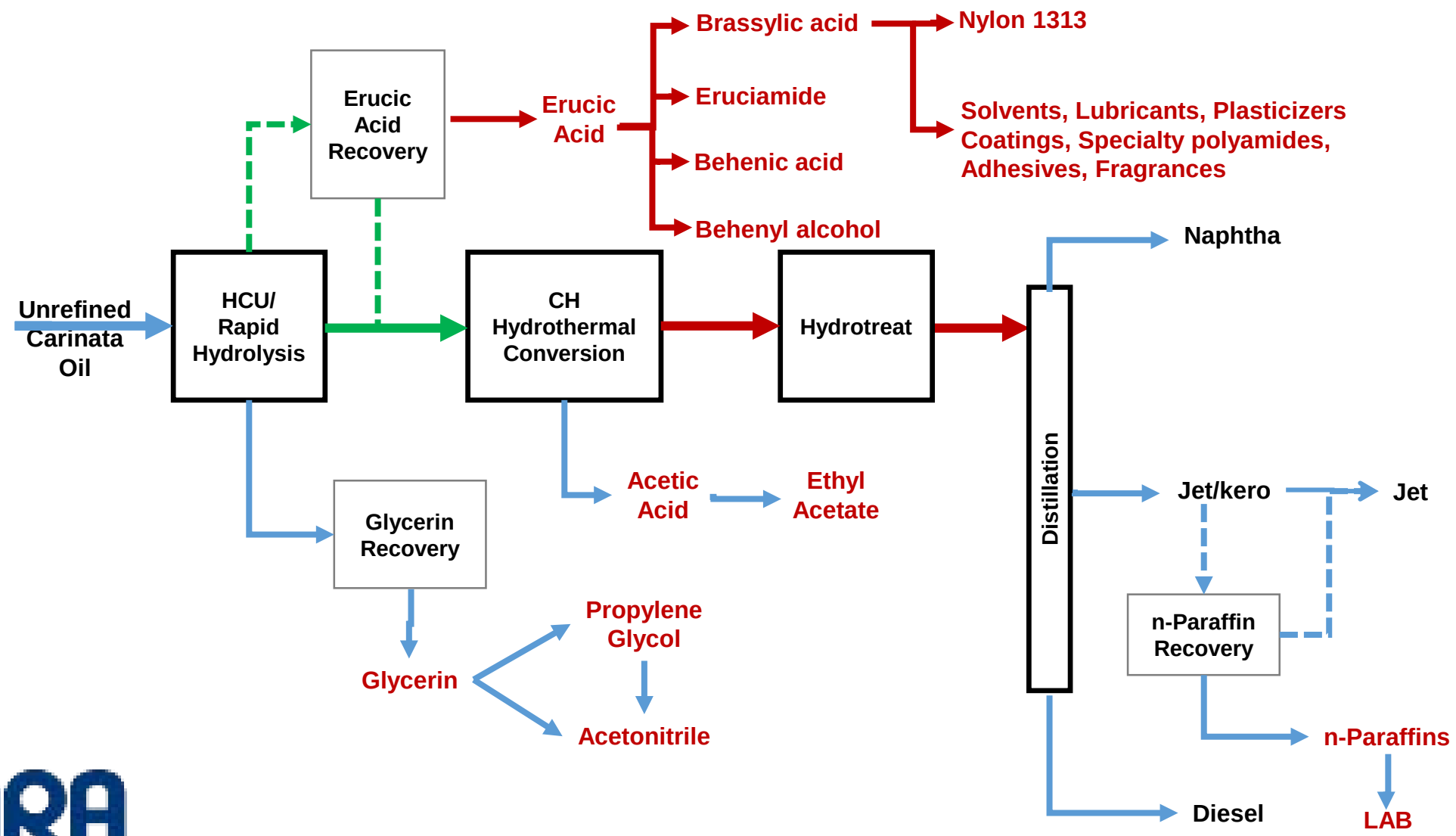
Why Carinata?

AGRISOMA

Sustainable Energy Founded in Agriculture

- Cover Crop – non iLUC (winter grown in SE)
- Seamless fit into existing agriculture production and supply chain systems
- Standard oil seed solvent crush – no waste
- Non-food oil highly suitable for drop in biofuels
- High Protein Non GMO meal
- Purposely grown crop that competes with wastes on GHG reduction w/soil health benefits.

SPARC: Maximizing value through multiple product development



Success stories- **100% ‘drop-in’ carinata jet fuel**

On October 29, 2012, ReadiJet was flown in the world’s first ever 100% biofuel flight using fuel that meets petroleum specifications without blending. (Agrisoma and partners)

ARA

Other Carinata Alternative Jet Fuel Events

QANTAS

Destinations Flight deals Plan Book

World first USA to Australia biofuel flight

In January 2018 we operated the world's first dedicated biofuel flight between the United States and Australia: QF96 from Los Angeles to Melbourne. The historic trans-Pacific 15-hour flight operated with approximately 24,000kg of blended biofuel, saving 18,000kg in carbon emissions.

Qantas used biofuel processed from Brassica Carinata, a non-food, industrial type of mustard seed, developed by Canadian-based agricultural-technology company, Agrisoma Biosciences. Carinata is planted in the off-season so it provides landholders supplementary income and doesn't interfere with a farm's primary production. The plant is water efficient, reduces erosion and nutrients.

BiofuelsDigest

The world's most widely read biofuels daily

Agrisoma, United Airlines and World Energy complete longest transatlantic biojet flight

September 16, 2018 | Helena Tavares Kennedy

Tweet Share 2 Mail Share

Carinata is proving that it is a feedstock to be reckoned with, a compelling catalyst for change, with the latest news that Agrisoma, United Airlines and World Energy came together for the longest transatlantic biojet flight yet.

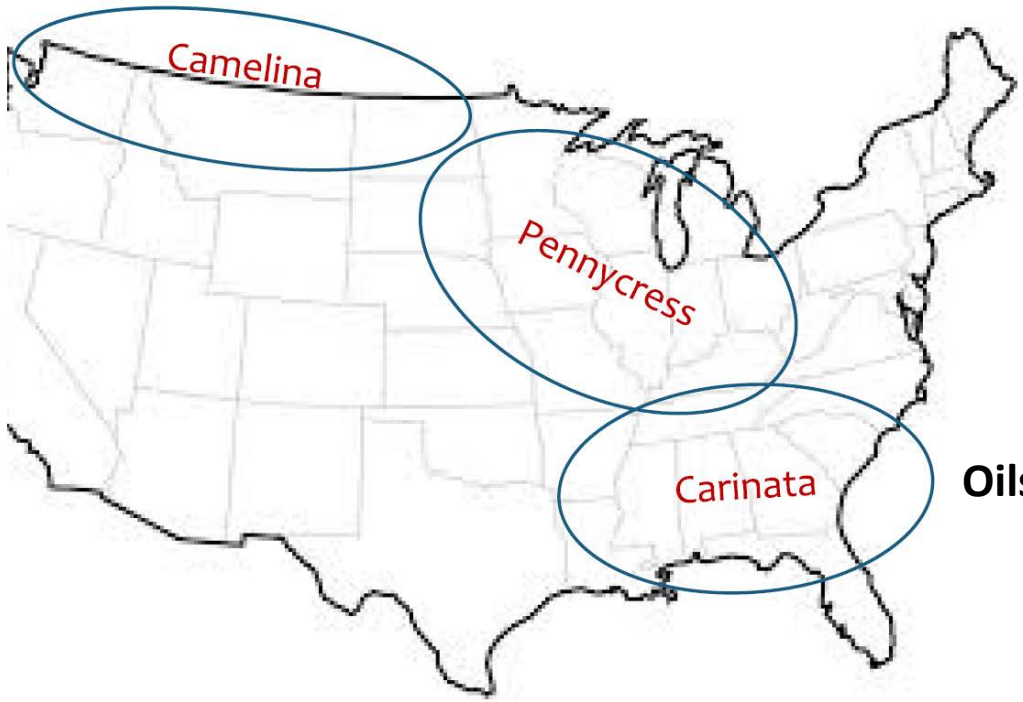
Industry partners are demonstrating successful flights and aviation commitment resulting in pull for the carinata product

AGRISOMA

Winter “cover” oilseeds
Huge production potential without ILUC…

* Carinata below freeze line
  * 12-20 M acres

Targeting most sustainable solutions:
Low, or Zero, impact LUC/ILUC & F-v-F solutions;
Environmental Services a plus.



Oilseed network

CAAFI®
FUELING SOLUTIONS FOR
SECURE & SUSTAINABLE AVIATION

Showing aviation providing market pull for sustainable alternative jet fuel

CAAFI®

SPARC: Intensifying Production within the framework of Sustainability (modeling)

- Site Suitability
  - Locations for growing carinata relative to environmental constraints
  - Estimate probability of growing carinata

- Life Cycle Assessment
  - Carbon emissions per gallon of jet fuel
  - Percentage carbon savings
  - Water quality and quantity

- Techno-Economic Analysis
  - Whole farm financial optimization
  - $ per gallon of carinata-based jet fuel
  - Carbon abatement cost
  - The role of current and needed policy initiatives
  - Resiliency Evaluation

- Distribution optimization-FTOT (working with DOT Volpe through ASCENT)

Establishing path to acceptable business case for all stakeholders in the supply chain, all co-products

Research translated to initiation of commercialization

Dedicated to increasing efficiency in every aspect of the supply chain from growers to end users

SPARC

Combine harvesting of commercial carinata

First shipment of carinata loaded at Cargill's port facility in Tampa from SE production

AGRISOMA USA

AUBURN UNIVERSITY

ARA

CAAFI

PURDUE UNIVERSITY

COLORADO STATE UNIVERSITY

UNIVERSITY OF GEORGIA

UF IFAS UNIVERSITY of FLORIDA

FLORIDA A&M UNIVERSITY

NC STATE UNIVERSITY

MISSISSIPPI STATE UNIVERSITY

RCB ALTMAN Assoc. LLC

GLADES crop care Inc.

RDL Ag Services LLC

USF UNIVERSITY OF SOUTH FLORIDA

USDA Agricultural Research Service

SPARC a regional effort

Thank you!

SPARC

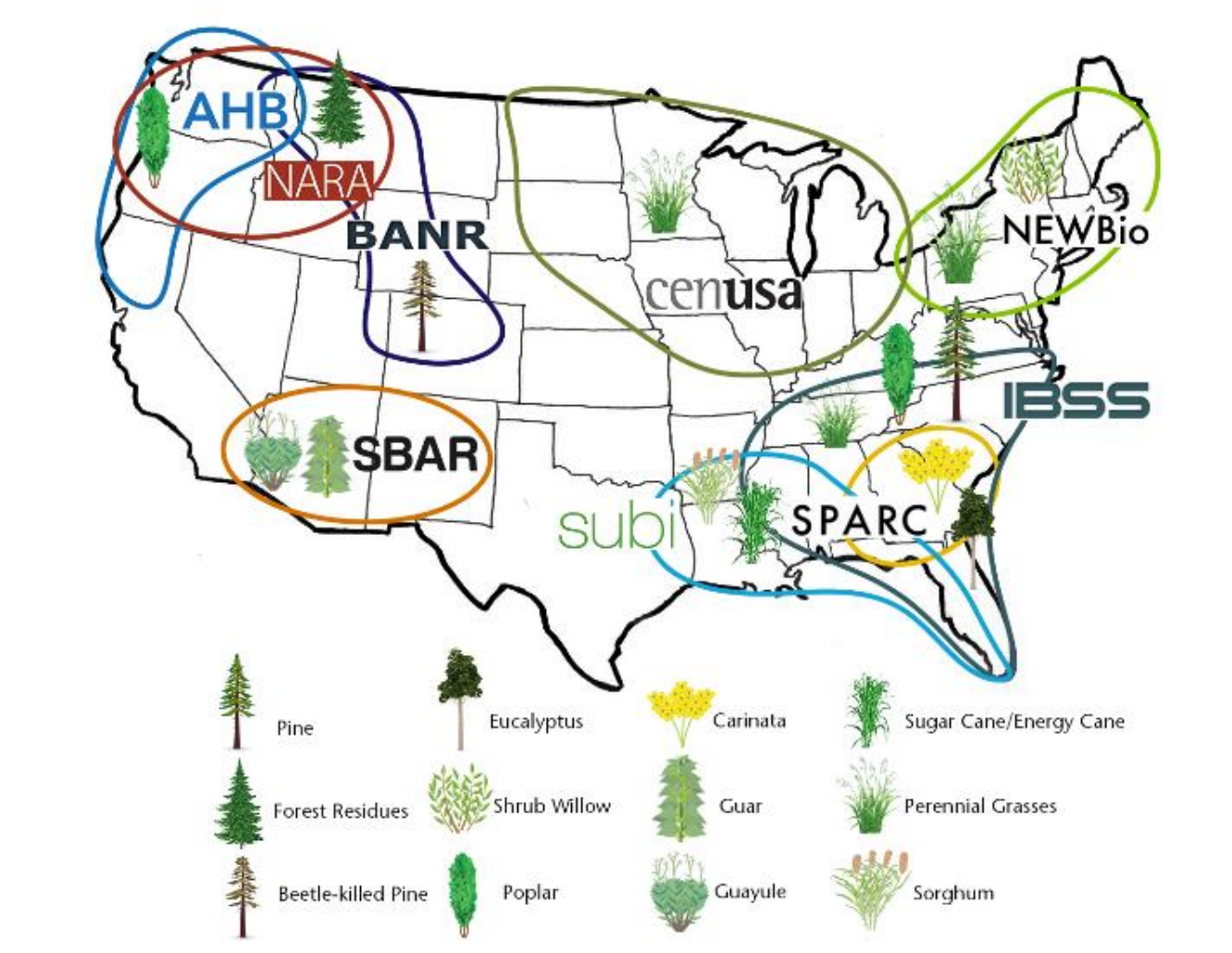
SBAR OVERVIEW

(SUSTAINABLE BIO-ECONOMY FOR ARID REGIONS)

Alix Rogstad

USDA-NIFA Network

(CAP coordinated agriculture projects)



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Project Mission

Build a sustainable bio-economy for arid regions to improve quality of life in rural communities and Native Nations.


Guayule flower


Guar flower

We Achieve This by:

- Optimize production of guar and guayule as a viable source for biofuel and bioproducts in arid regions of the Southwest
- Engage growers, producers, and industry in new crop production within the region
- Training the next generation of scientists, producers, and researchers to accept and generate jobs in bioproduct and biofuel fields

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SBAR

USDA United States Department of Agriculture | National Institute of Food and Agriculture

Partners

ARIZONA

BRIDGESTONE

NM STATE UNIVERSITY

COLORADO STATE

COLORADO SCHOOL OF MINES

USDA Agricultural Research Service

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Management Team

- Kim Ogden – Principal Investigator & Project Director
- Alix Rogstad – Project Director (Operations)
- Colleen McMahan – Associate Project Director
- Dennis Ray – Feedstock Development & Production
  - *Pete Waller*
- Catie Brewer – Post-Harvest Logistics & Co-products
- Jason Quinn – System Performance & Sustainability
- Sara Chavarria – Education
- John Idowu – Extension & Outreach (NM)
- Blase Evancho – Extension & Outreach (AZ)

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Major Accomplishments

- Updated Major Project Goals
- Finalized Management Team – hired outstanding people
- Developed Reporting and Evaluation Plans
  - *First round of project evaluation occurred Aug 2018*
- Advisory Board – initial board formed; secondary products in process
- Successful Outreach
  - *Directly through workshops/presentations (971 ppl)*
  - *Tabling events (1,457 ppl)*
  - *Website visits since July-September 2018 (575)*
  - *Summer youth camps and internships (22)*
- Initiated all aspects of research plan – 5 Components

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Highlights: Feedstock Development & Production

- Field trial methodology was finalized
- Guayule and guar field experiments were established in 7 locations
- Irrigation field experiments were established in 3 locations
- 4 preemergence and 5 postemergence herbicide studies were initiated
- 28 unique candidate guayule genes were identified as promising targets for genetic modification


Guar field measurements

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Highlights: Post-Harvest Logistics & Co-Products

- Completed initial literature review of possible bagasse-to-fuel conversion routes
- Preliminary mixed-integer harvest and economic models completed (base for future large-scale algorithms)
- Isolated and characterized major metabolites of guayule
- Initiated chemical characterization of guayule resin; identified 17 major terpenes in the resin
- Established protocols for guar and guayule bagasse characterization


Guar bagasse

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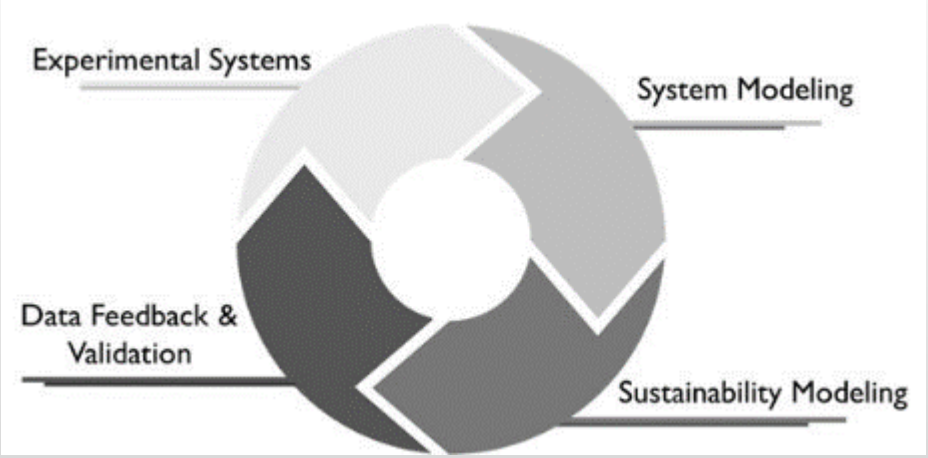
Highlights: System Performance & Sustainability

- Literature review completed; info gathered formulates the Comprehensive Life Cycle dataset
- High fidelity engineering process modeling is under way
- Presentation of results at conferences
- Increased understanding of economics affecting guar and guayule production
- Initial data integration; established process for data feedback to SBAR Team



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Highlights: Education

- Comprehensive review of existing classroom lessons and activities completed
- Dry-run completed in an agricultural (high school) class for all selected lessons
- Developed and hosted a summer professional development workshop
- Recruited 1st cohort of SBAR Fellows and Teacher Mentors
- Teaching/Learning evaluation tools generated to facilitate future implementation adjustments

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Highlights: Extension & Outreach

- Deployed grower needs assessment in AZ and NM
- Developed 3 fact sheets to inform the public about guar and guayule
- Presented at Extension Field Days and various conferences; staffed tabling events to answer questions
- Established Extension Advisory Committee in NM
- First cohort of *Project Puente* interns completed summer session
- Designed and hosted a one-week biofuel summer camp for 4-H participants in Tucson, AZ

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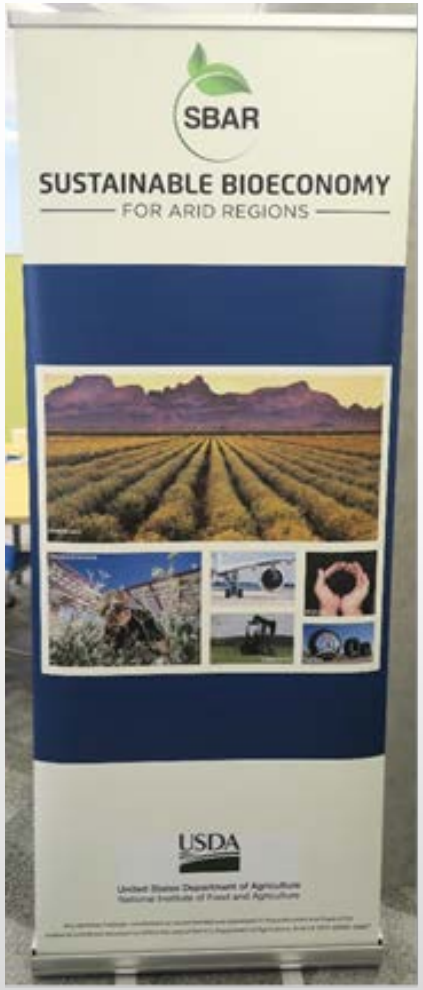
Next Steps & Future Plans

- On-going Research
  - *Year 1 field trial results anticipated this summer (AZ & NM)*
  - *Potential co-products identified within guayule resin*
  - *Preliminary integration of sustainability models completed*
- Education and Extension & Outreach
  - *Phase 2 of Teacher Professional Development (Jun 2019)*
  - *8-10 interns supported this summer (2019)*
  - *4-H Train-the-Trainer workshops hosted in NM*
- Annual SBAR Retreat
  - *Hosted in Tucson area, September 2019*
  - *Collaboration with Association for the Advancement of Industrial Crops (AAIC)*



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