Innovating Resilient US Fruit & Vegetable Supply Chains: Exploring Climate Adaptation & Mitigation Opportunities

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Marty Matlock (University of Arkansas)
Alison Edwards (Stewardship Index for Specialty Crops)

Sustainable Agriculture Summit
16 November 2017 | Kansas City
Breakout Session Agenda

- Overview of new F&V project (Dave)
- Key role of LCA modeling (Marty)
- Stewardship Index for Specialty Crops (Alison)
- Facilitated discussion (all)
Key Challenges & Drivers

01 | Increased demand for highly nutritious food grown in domestic production regions

02 | Climate change & increased competition for natural resources

03 | Cost & availability of labor in the US. Rise of protected & peri-urban production

04 | Consumer preference for fresh F&V grown locally
New F&V Project Just Launched

• Enhance the productivity, resilience, and sustainability of domestic produce supply chains

• Use integrated (crop, economic, environmental) modeling to identify and test adaptation & mitigation strategies for these systems

• Four-year project, initiated on July 1, 2017
Multi-Disciplinary Project Team

Crop Modeling
Economic Modeling
LCA Modeling
Stakeholders & Extension

Project Kickoff Workshop (June 2017)
<table>
<thead>
<tr>
<th>Year</th>
<th>Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Potatoes, Tomatoes, Oranges</td>
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<tr>
<td>Year 2</td>
<td>Green Beans, Strawberries, Sweet Corn</td>
</tr>
<tr>
<td>Year 3</td>
<td>Carrots, Spinach, Grapes*</td>
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<tr>
<td>Year 4</td>
<td>Broccoli*, Melons*, Onions*</td>
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</tbody>
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* Inclusion of Broccoli, Grapes, Melons, & Onions all contingent on additional funding
Project Advisory Committee (AC)

Role
- Supply chain experts invited to provide input
- Serve on a volunteer basis
- Meet by 2 hour telecons ~3X per year

- Sergio Alvarez (Florida DACS)
- Bill Dean (AgriNorthwest)
- Hank Giclas (Western Growers)
- Kris Johnson (The Nature Conservancy)
- Wendy Reinhardt Kapsak (Produce for Better Health Foundation)
- Shaun Lough (Westbridge)
- Kevin Morgan (FL Farm Bureau)
- Steven Ostoja (USDA Climate Hub)
- Sambhav Sambhav (Driscolls)
- Victor Verlage (Walmart)
- Kevin Walsh (Seminis)
September 2017
AC Feedback

Incorporate expected trend for production sites to move much closer to the point of consumer purchase

Confirm that planned modeling methodologies will be appropriate for current and new protected production systems (e.g. hydroponics, non-soil substrates, etc.)

Address the growing impact of imports, now filling domestic production gaps caused by climate, disease, and the cost/availability of labor
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Objective: Use Life Cycle Assessment (LCA) modeling of current and potential future fruit and vegetable supply chains to identify and evaluate cost-effective adaptation and mitigation opportunities (as informed by crop modeling linked with economic models).

Status: Established initial supply chain process diagrams for all F&V of interest, now selecting LCA system boundaries, impacts to track, and functional unit for comparative analysis.
LCA Modeling Methodology

- Flow of product, at/after it leaves the farm
- Fresh products at farm gate
- Fresh products at retailers/sales gate
- F&V products at the processing market

Based on (Tamasese, 2009)
LCA Modeling of Climate Effects

Climate Impacts
- soil quality
- pest infestations
- yield changes
- evaporative water losses
- droughts

- quality deteriorations
- demand of processed product increase
- more storage infrastructures
- heat stress and immaturity

- water demand
- chemicals
- cost of processing

- spatial production
- quality deterioration
- losses increase

- variations on the choice
- losses
- shifting of production zones
- price increase

Adaptation & Mitigation
- conservation practices
- IPM
- rescheduling
  - sowing/planting
  - irrigation
  - fertigation
- mulching
- tolerant species
- crop rotations
- cover crops, residues incorporation
- tree based mixed farming
- relocations/protected farms

- logistics management
- refrigerated storage
- integrated production system
- ripening agents

- more processing facilities
- logistics and distribution management

- refrigerated transportation
- logistics management
- reduce import dependency
- energy and farm management

- supply diversification
- consumer awareness
- recycling

Agricultural production

Human inputs
Natural inputs

Agro-ecosystem

Products
Waste

Consumption/waste

Supply Chain

Emissions

Collection and storage

Processing

Transport

Consumption
Quantifying Impacts in LCA

Upstream processes
- Breeding and Growing
  - Farm machineries
  - Pesticides
  - Fertilizers
  - Fuel/Energy
  - Water
  - Transport
- Processing and Packaging
  - Energy
  - Water
  - Chemicals (e.g. ripening agents)
  - Materials
  - Equipment
  - Transport
- Sellers/Buyers
  - Energy
  - Water
  - Equipment
  - Transport

Downstream processes
- On-farm Processing
- Off-farm Processing
  - Sorting
  - Bagging/ Packaging
- Storage/chilling
- Treatment
- Distribution
- Retail Outlet
- Final Consumer

Emissions
- Waste
- Air emissions
- Aquatic emissions

Product substitutions
- Yard compost substitutes - Synthetic fertilizer
- Compost substitutes - Synthetic fertilizer

System Boundary

Per functional unit, e.g.
1 kg product
1 USDA serving unit
1 ha land area, etc.
Importance of LCA Metrics

- Quantifying supply chain “performance” implies availability of widely-accepted metrics
- *Field to Market* is a great example, covering the production aspects of row crops
- *Stewardship Index for Specialty Crops* covers the crops of interest to our project
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- **Stewardship Index for Specialty Crops (Alison)**
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Stewardship Index for Specialty Crops (SISC)

• Founded in 2007
• Transparent multi-stakeholder initiative and process
• Develop and maintain open source on-farm metrics to measure sustainability performance for specialty crops
• Metrics developed with growers, and created to serve dual purpose as an internal management tool for growers and a consistent way to communicate about sustainability across the supply chain
Stewardship Index for Specialty Crops (SISC)

• Metrics envisioned as a yardstick for measuring sustainable outcomes over time
  — * asterisks denote metrics TSC has aligned within KPI’s
• Metrics currently in development include: GHG, Simple Irrigation Efficiency
Overall Nitrogen Usage Data: Processor Comparison Report

Yield vs. N Lbs Applied /Acre
2013 Processing Tomatoes - All Fields

- Target Total N applied (lbs per acre)-Del Monte Foods
- Total N applied (lbs per acre)-Others
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Discussion Questions

1. Across current F&V supply chains, where are the highest GHG emissions (both on/off farm)?

2. What are the greatest opportunities for creating GHG efficiencies and mitigation across US F&V supply chains (on and off farm)?

3. How can a robust sustainability program (brand or grower group) help track and mitigate supply chain risks as they evolve?

4. What climate change impacts on F&V supply chains are expected through 2050?

5. How can the players in F&V supply chains collaborate to reduce, mitigate, and track their GHG emissions as well as the associated risks to climate change?
Discussion

Questions (ctd.)

6. What regions might have potential for expansion of F&V production? Are there any specific F&V that will become more important in these emerging regions?

7. Which F&V production systems will become more important in the future and which ones will not be sustainable given economic, environmental, and consumer pressure?

8. Which aspects of F&V supply chains will become more important to consumers and other stakeholders in the future?

9. Will there be more or less diversity of US F&V production in the future?
10. What future role will international trade play in domestic F&V production? Are there specific F&V that will become more dominated by imports?

11. In the face of climate change, what are the biggest challenges ahead for US/North American F&V production?

12. What other research on these topics is on-going, in the US and elsewhere?

13. Where and when are the best opportunities to engage with additional stakeholders on these topics?
THANK YOU!

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