The background features abstract, overlapping green geometric shapes in various shades, including light lime green, medium green, and dark forest green, creating a modern and dynamic look.

USEEIO Model and Georgia SMM Prioritization Tool

Georgia Recycling Coalition Annual Conference

09/17/2018

SMM Model Needs: Comprehensive and Directional

1. Whole system perspective

- ▶ Full economy
- ▶ Supporting (resource) and receiving (release) environments
- ▶ Life-cycle based (cradle-to-grave)
- ▶ Report human health, environmental impact, resource use and economic indicators

2. Provide evidence for directional SMM-related action

Identify opportunities to steer economy towards more effective material use with reduced impact and prosperous economy

SMM Model Needs: Support Multiple Scales

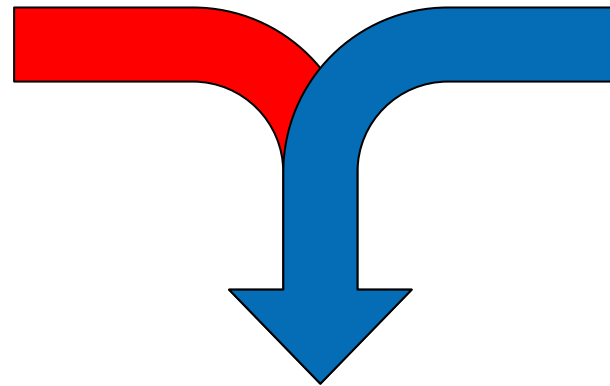
1. National
2. State
3. Organizational

SMM Model Needs: Transparency and Availability

1. Based on public data
2. Support transparency of modeling choices and uses of data
 - ▶ Standardized supporting documentation
3. Report data quality
4. Publicly Accessible
 - ▶ Model and documentation publicly available

SMM Model: Economic- Environmental Model

Economic
Input-Output
Model



Environmental
Extensions

Environmentally-Extended
Input-Output (EEIO) Model

Use of EEIO Models

- ▶ Established, accepted type of environmental-economic model for use at global, national and regional scales
- ▶ Modeling consumption, or production-related life cycle impacts or footprints
- ▶ Can be used for single product supply chain hotspot analysis
- ▶ Prioritization of goods and services, or industry sectors

Benefits and Limitations of EEIO Models

- ▶ Comprehensive (full economy) and data-rich
- ▶ Built with public data
- ▶ Consistent with economic forecasting, and good/service classification
- ▶ Level of resolution limited to national average for a good/service within an aggregated category
- ▶ Units of analysis is in \$ of goods/services

EEIO Models and SMM

- ▶ A proprietary EEIO model was used for ‘The Road Ahead’
- ▶ Need more current, transparent, fully replicable model
- ▶ Need non-expert applications for using the model
- ▶ Needs to be customizable for smaller regions (e.g states)

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the frame, creating a modern, layered effect.

US EPA SMM Model: **USEEIO**



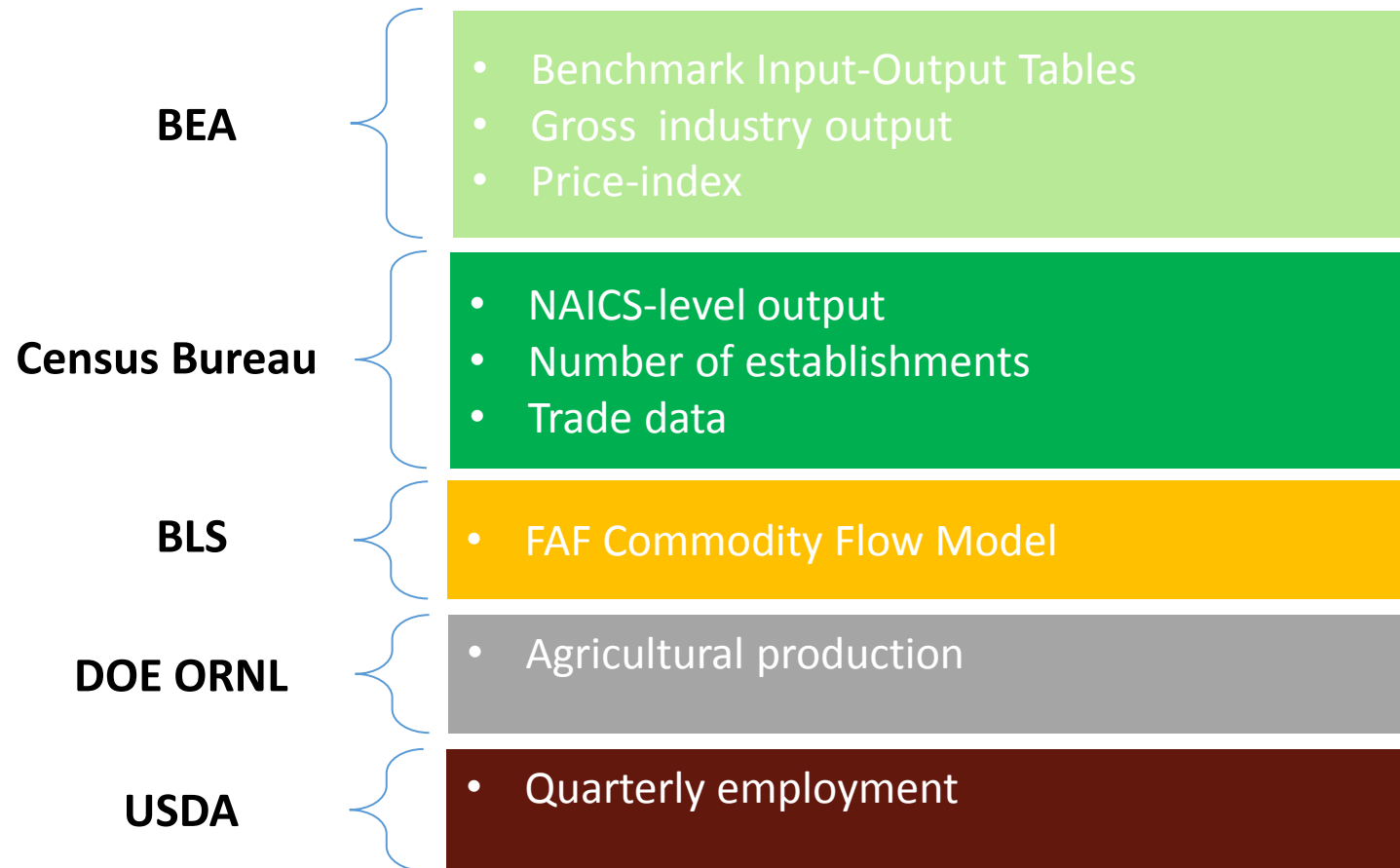
USEEIO

USEEIO: A new and transparent United States environmentally-extended input-output model

Yi Yang ^{a, **, 1}, Wesley W. Ingwersen ^{b, *, 1}, Troy R. Hawkins ^c, Michael Srocka ^d,
David E. Meyer ^b

- ▶ Peer-reviewed EEIO model of the US using most currently available public data
- ▶ **385** goods and services
- ▶ **1,875** unique releases or resource types
- ▶ **20** environmental, resource and socio-economic impact indicators
- ▶ Formal data quality characterization
- ▶ Open source data and modeling framework

USEEIO Economic and Job Data



USEEIO Environmental Extensions

EPA	<ul style="list-style-type: none">• National Emissions Inventory: CAPs and HAPs• Toxics Release Inventory: Toxic substances• Greenhouse Gas (GHG) Reporting Program: GHGs• Discharge Monitoring Report: Nutrients and toxic substances
USDA	<ul style="list-style-type: none">• Agricultural Chemical Use Program: Pesticides and nutrients• Census of Agriculture: Land occupation• Farm and Ranch Irrigation Survey: Water withdrawal and release
USGS	<ul style="list-style-type: none">• Major Uses of Land in the United States• Minerals Commodity Survey• Water Use in the United States
DOE EIA	<ul style="list-style-type: none">• Monthly and Annual Energy Review: Energy use

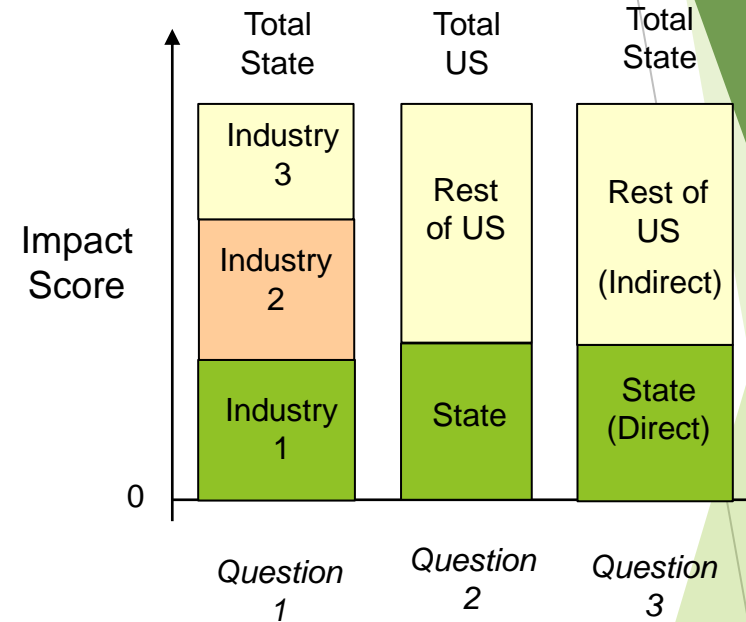
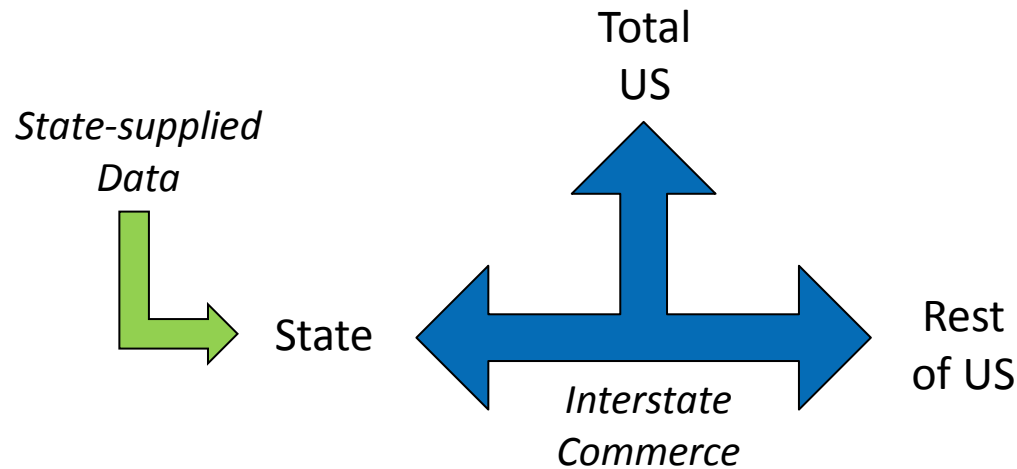
USEEIO Indicators

- ▶ **Potential Environmental Impacts** - acidification, respiratory effects of criteria pollutants, carcinogenic and non-carcinogenic toxicity effects, climate change, eutrophication, freshwater ecotox, smog formation, ozone depletion
- ▶ **Resource Use** - water, land, minerals
- ▶ **Environmental Releases** - HAPs, metals, pesticides
- ▶ **Economic & Social indicators** - value added, jobs
- ▶ **Waste Generated** - Hazardous waste, MSW*, C&D*

** in development*

Customization: State-based USEEIO Models

Create a state model within USEEIO



Unique goods and services profiles from 2 regions

- 1. Where are our hotspots?**
- 2. How do we compare with other states?**
- 3. Where are our impacts?**

A model for GA is the current state model prototype

Ongoing Modeling Challenges

- ▶ Scenario analysis
- ▶ More explicit material and waste tracking
- ▶ Accurately modeling environmental burdens associated with imports
- ▶ Automating updates and creation of state-based models

USEEIO Model Availability

Documentation

Environmental Extensions

- Satellite tables
- Indicators and their factors

Model components and results in matrix format

Full model in openLCA format

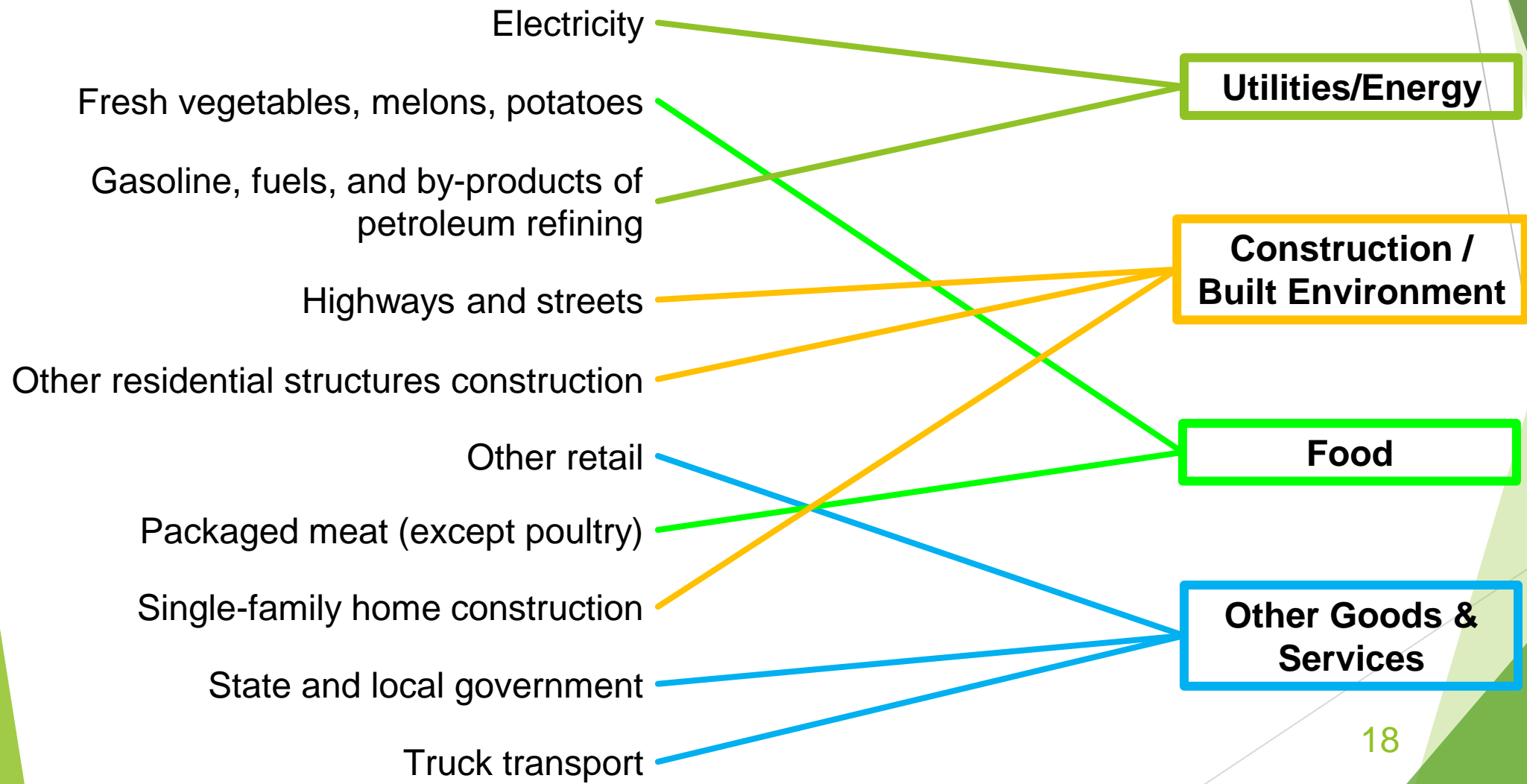
Model code base

Georgia SMM Prioritization Tool Findings

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Top 10 Impactful Goods & Services Consumed in GA



Top 10 Impactful Goods & Services Consumed in GA

Significant Associated Issues

Electricity	→	GCC, ACID, WATR, ENRG, SMOG, HRSP, HTOX, EUTR, MINE
Fresh vegetables, melons, potatoes	→	ETOX, OZON, WATR, EUTR
Gasoline, fuels, and by-products of petroleum refining	→	ENRG, HTOX, SMOG, HAZW, GCC, WATR, ACID, EUTR, MINE
Highways and streets	→	MINE, HRSP
Other residential structures construction	→	MINE, SMOG, LAND, HTOX, HAZW
Other retail	→	MSW, GCC, SMOG, ACID, HTOX, ENRG
Packaged meat (except poultry)	→	LAND, ACID, EUTR, GCC, WATR, ETOX, HRSP
Single-family home construction	→	MINE, SMOG, LAND, HTOX, HRSP, ACID, OZON, ENRG
State and local government	→	HAZW, EUTR, ENRG, HTOX, GCC, SMOG, LAND, WATR, ACID, MINE, HRSP, MSW, ETOX, OZON
Truck transport	→	SMOG, HTOX, ACID, GCC, EUTR

Top 10 Impactful Goods & Services Consumed in GA

Over 50% of these significant associated issues are happening IN-STATE:

Electricity	→	GCC, ACID, WATR, ENRG, SMOG, HRSP, HTOX, EUTR
Fresh vegetables, melons, potatoes	→	<50%
Gasoline, fuels, and by-products of petroleum refining	→	HAZW, WATR
Highways and streets	→	MINE, HRSP
Other residential structures construction	→	MINE, SMOG
Other retail	→	MSW, GCC, SMOG, ACID, HTOX
Packaged meat (except poultry)	→	<50%
Single-family home construction	→	MINE, SMOG, HTOX, HRSP, ACID
State and local government	→	<50%
Truck transport	→	SMOG, HTOX, ACID, GCC, EUTR

Top 10 Impactful Goods & Services Consumed in GA

Over 50% of these significant associated issues are happening in the **SUPPLY CHAIN**:

Electricity	→	HTOX, MINE
Fresh vegetables, melons, potatoes	→	<50%
Gasoline, fuels, and by-products of petroleum refining	→	ENRG, HTOX, SMOG, GCC, ACID, EUTR, MINE
Highways and streets	→	MINE
Other residential structures construction	→	MINE, SMOG, LAND, HTOX, HAZW
Other retail	→	GCC, SMOG, ACID, HTOX, ENRG
Packaged meat (except poultry)	→	LAND, ACID, EUTR, GCC, WATR, ETOX, HRSP
Single-family home construction	→	MINE, LAND, HTOX, HRSP, ACID, OZON, ENRG
State and local government	→	HAZW, EUTR, ENRG, HTOX, GCC, SMOG, LAND, WATR, ACID, MINE, HRSP, MSW, ETOX, OZON
Truck transport	→	<50%

Top 10 Impactful Goods & Services Consumed in GA

Electricity

Fresh vegetables, melons, potatoes

Gasoline, fuels, and by-products of petroleum refining

Highways and streets

Other residential structures construction

Other retail

Packaged meat (except poultry)

Single-family home construction

State and local government

Truck transport

Common purchases that bring the issues

- Truck transport
- Gasoline, fuels, and by-products of petroleum refining
- Electricity
- Wholesale trade

Common hotspots

- **Truck transport**
- **Electricity**
- **Unrefined oil and gas**
- Other basic organic chemicals
- Gasoline, fuels, and by-products of petroleum refining
- Waste management and remediation
- Drinking water and wastewater treatment
- Pipeline transport

Top 10 Impactful Goods & Services Consumed in GA and the US

Georgia

- Electricity
- Fresh vegetables, melons, potatoes
- Gasoline, fuels, and by-products of petroleum refining
- Highways and streets
- Other residential structures construction
- Other retail
- Packaged meat (except poultry)
- Single-family home construction
- State and local government
- Truck transport

United States

- Electricity
- Fresh vegetables, melons, potatoes
- Gasoline, fuels, and by-products of petroleum refining
- Highways and streets
- Hospitals**
- Other residential structures construction
- Packaged meat (except poultry)
- Single-family home construction
- State and local government
- Truck transport

On average, Georgia accounts for ~3% of the environmental and human health issues in the United States.

What does this mean for potential users?

- ▶ The Tool Suite and model(s) can help:
 - ▶ Start thinking holistically about life cycle environmental issues without being a life cycle assessment expert;
 - ▶ Consider environmental performance across a range of indicators;
 - ▶ Develop an understanding of whether issues are happening in a state or not, and in a supply chain or not; and
 - ▶ Identify parts of government and other stakeholders from across the state with whom to collaborate to get the most benefit.

Thanks for your attention!
Any questions?

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