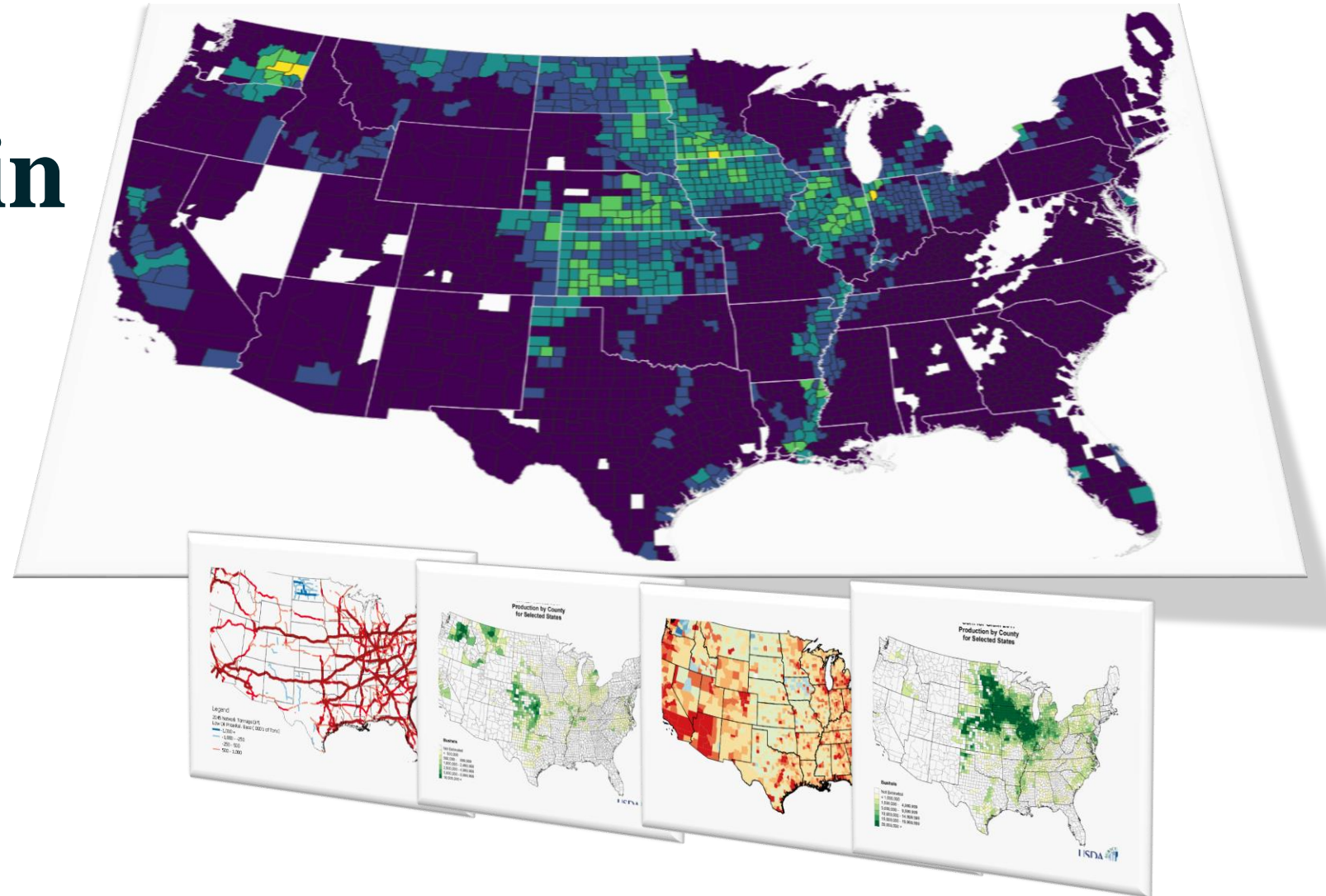


TRB Innovations in Freight Data

Accounting for uncertainty in future goods movement: Processes for generating more granular, higher volume data to support planning



Derek Cutler, EDR Group

April 9-10, 2019

Supporting Planning by Leveraging Distinct Data Sources

Organic (Expected) Change

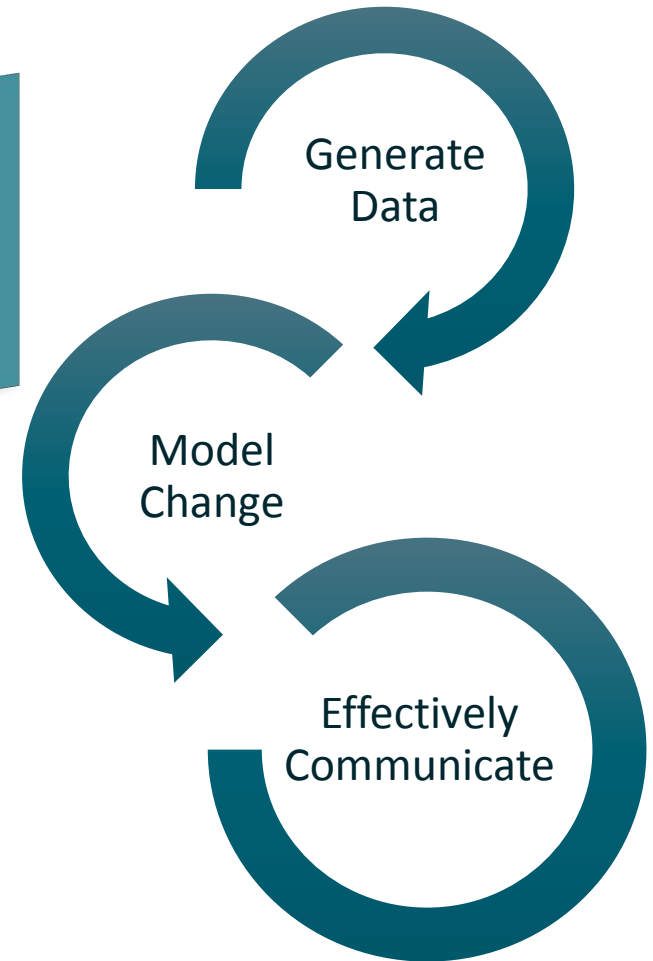
- Evolving Economic Growth Pattern
- Evolving Population Growth Pattern
- Evolving Tech Efficiency (Productivity)

Disruptive Change

- Global Economy + Trade
- Weather + Seismic Events
- Technology Innovation

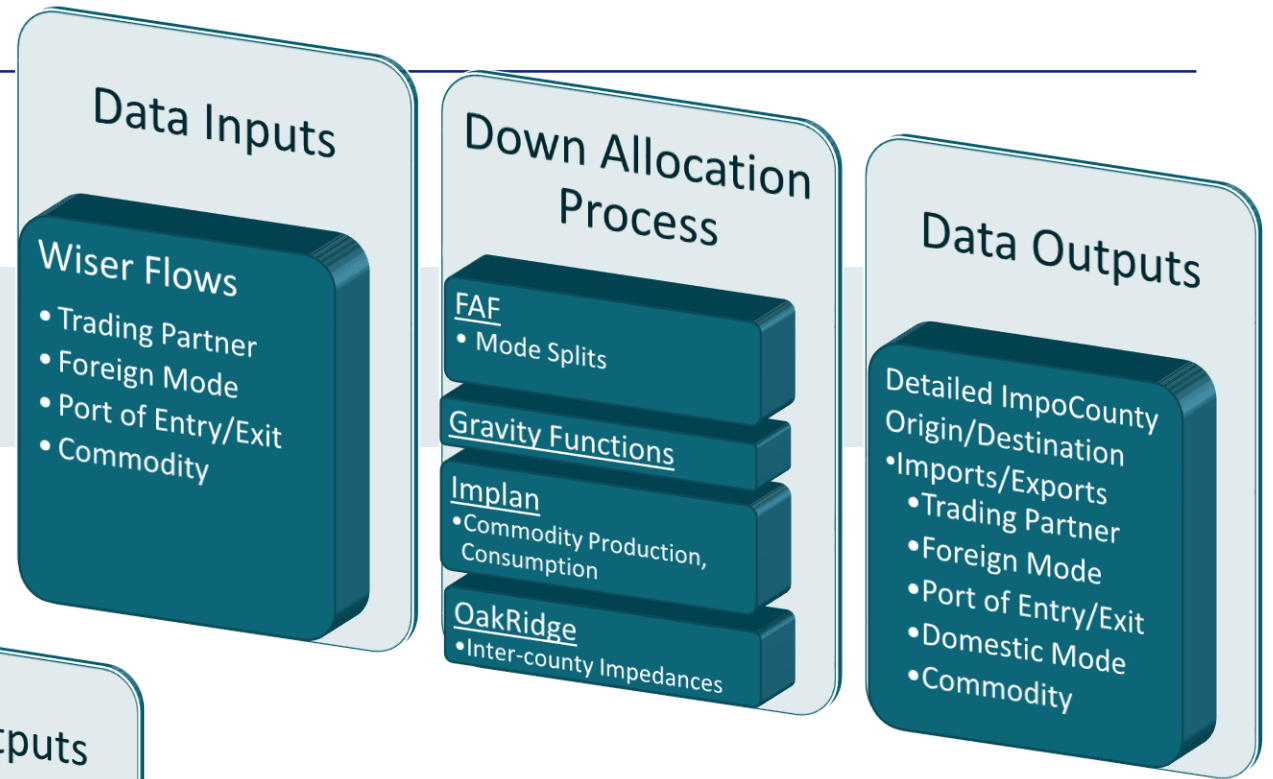
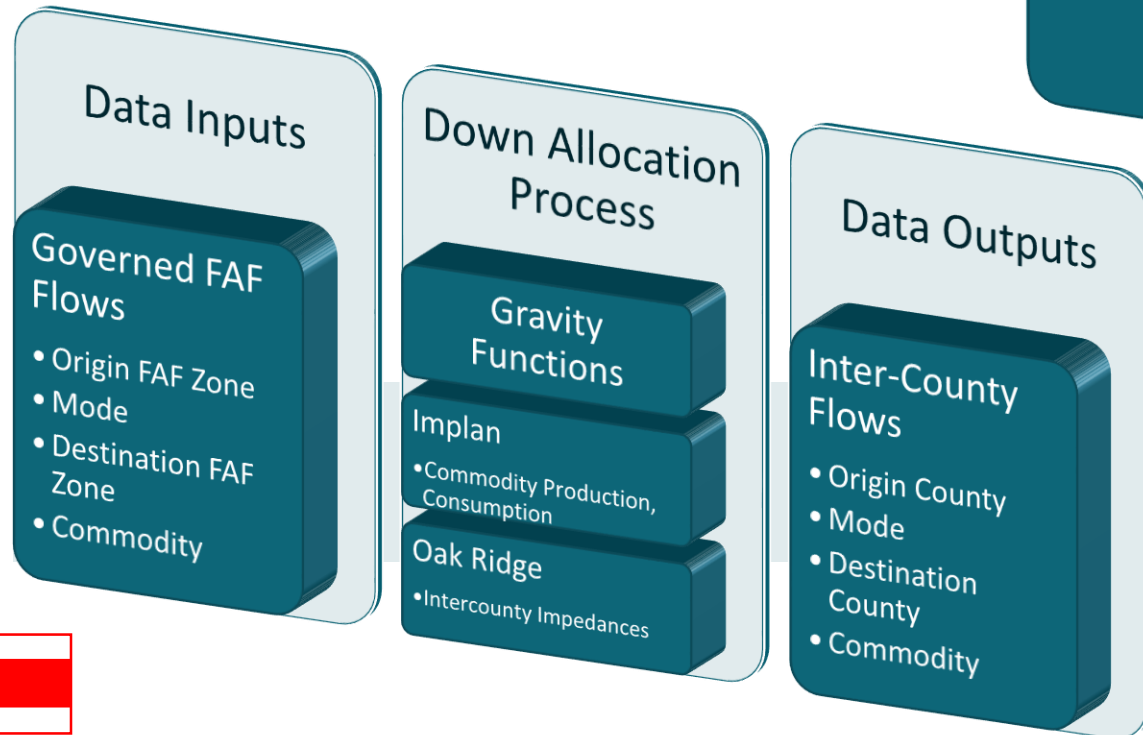
Alternative Futures

- Δ Pattern of population +economy
- Δ Commuting, Personal + Freight Flows
- Δ Transportation Investment Needs



Generation of Freight Data

Foreign Database Generation

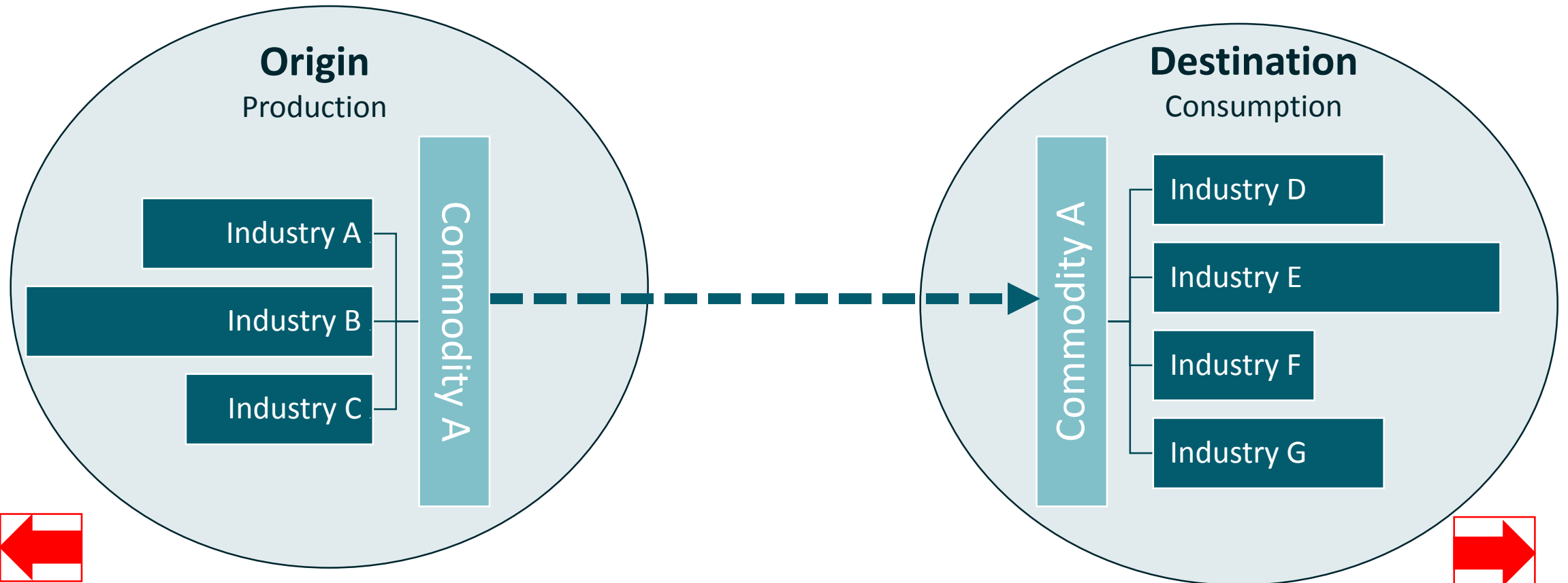


Domestic Database Generation



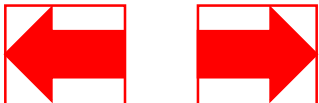
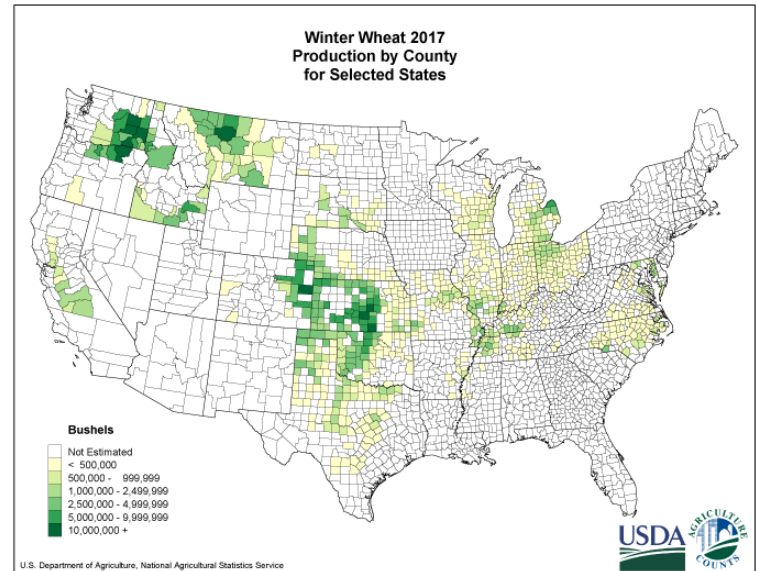
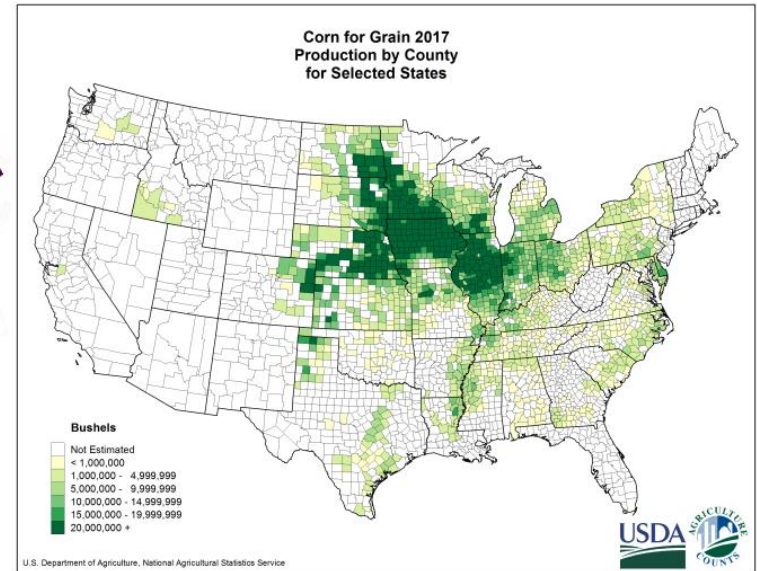
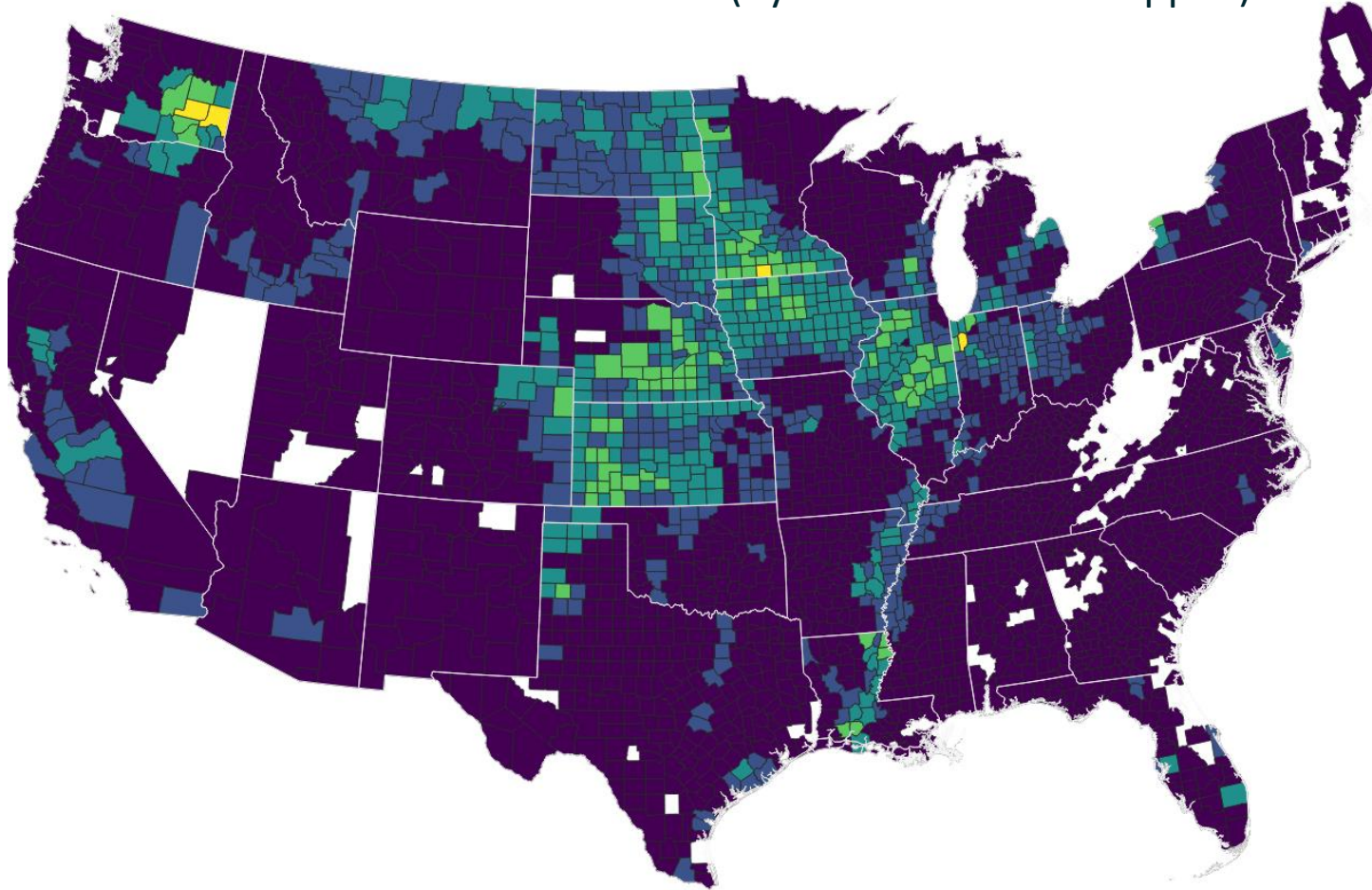
Its about the Economy

- Freight is the physical enactment of inter-industry transactions
- Use understanding of the Economy to drive patterns in freight
- Flexible – works with data of any geography

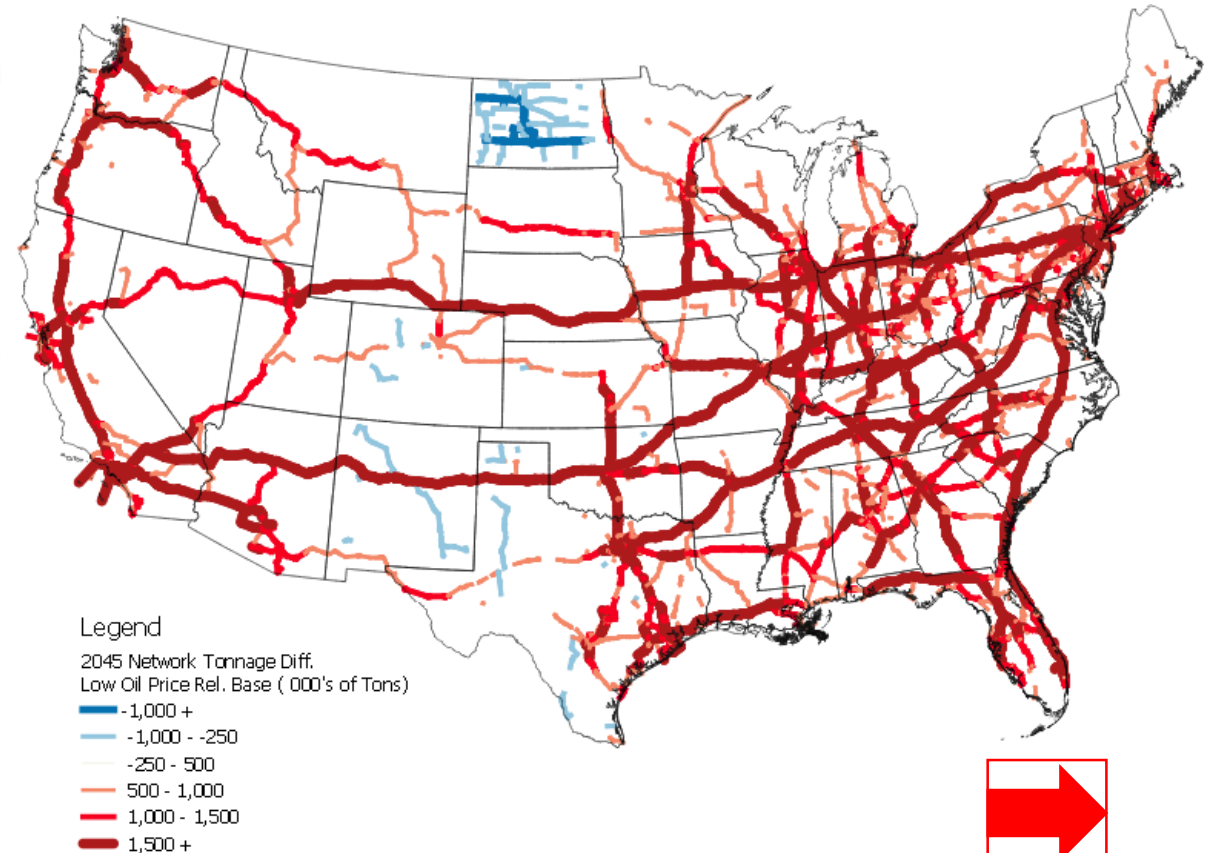
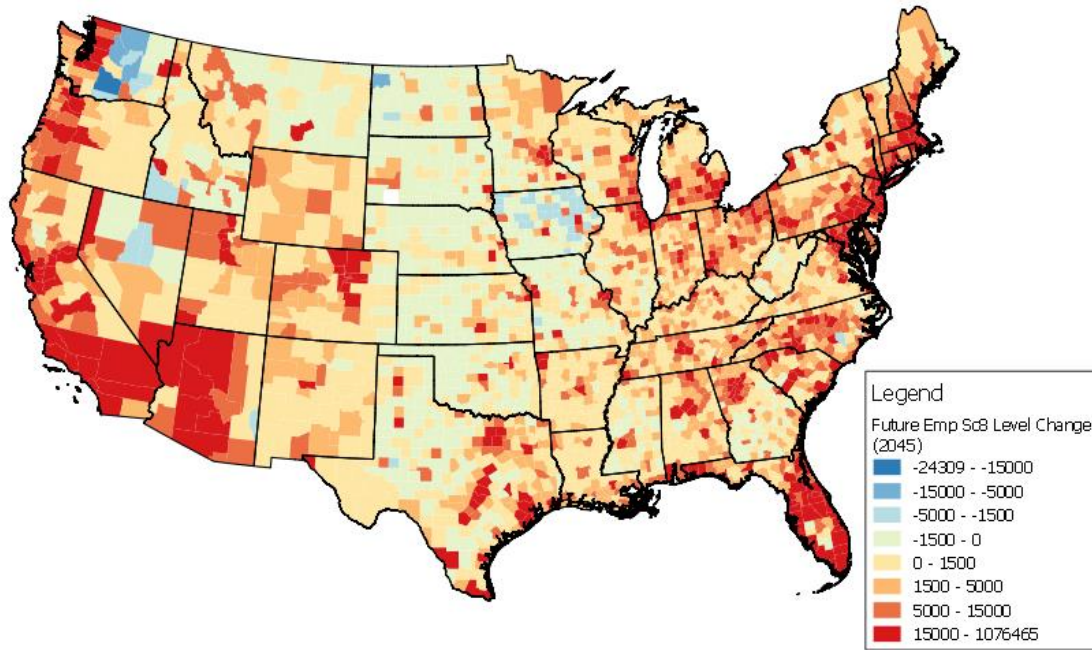


Validation of Results Against Available Data

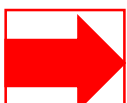
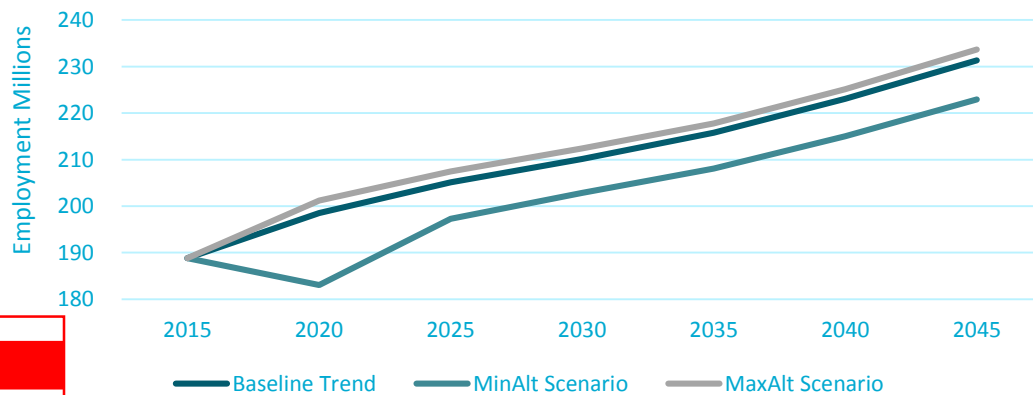
SCTG 02 – Grain Products (By Value of Goods Shipped)



Using Regional Economic Expectations to Redraw Freight



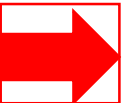
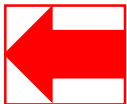
Comparison of Scenario Employment Trend Extremes



Challenges with Data

- ❖ Building linkages to generate insight makes for exploding volumes of data
 - Increased geographical detail
 - Multiple scenarios
 - Relationship to commodities, facilities, countries
- ❖ Volume makes screening all records difficult

- ✓ Develop system to provide ability to find and summarize trends and behaviors
- ✓ Provide robust capabilities to allow for dynamic deep dives for exploration of drivers of trends



TREDPLAN-Regions

Settings

Freight & Transportation

Economics

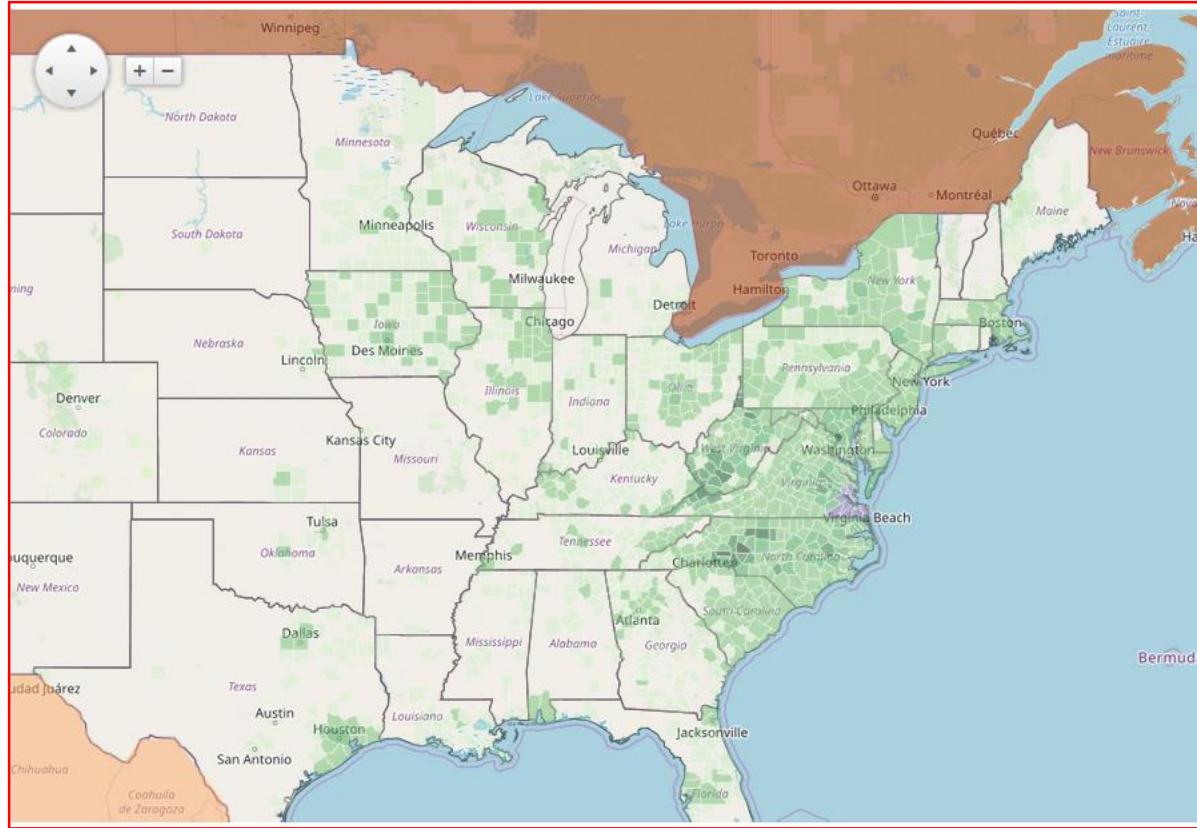
Scenario Analysis



SINGLE REGION TONS 2045

INBOUND

- REGIONAL FLOWS
 - Inbound
 - Outbound
 - Internal
 - Regional Comparison: Inbound
 - Regional Comparison: Outbound
- TRADE DEPENDENCE
 - Ports - Imports
 - Ports - Exports
 - Ports - Imports Comparison
 - Ports - Exports Comparison
 - Countries - Imports
 - Countries - Exports
 - Countries - Regional Comparison
- YOUR PORTS
- MODAL DEPENDENCE
 - Truck
 - Rail
 - Air
 - Water
 - Multiple Modes & Mail
- COMMODITIES
- SUB-COUNTY

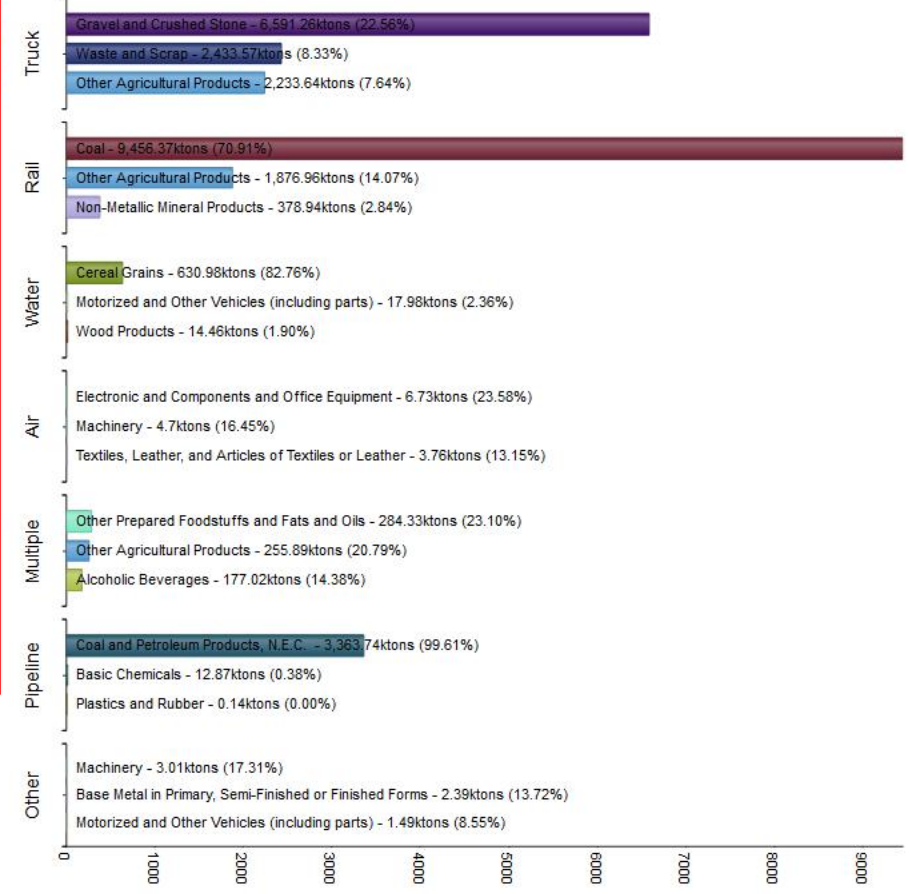


Show US



- Balance of Trade
- Top Commodities by Year
- Detailed Commodities
- Commodities by Mode
- Top Geographies

Top Inbound Commodities by Domestic Modes (ktons) in 2045



TREDPLAN-Regions

Settings

Freight & Transportation

Economics

Scenario Analysis



SINGLE REGION TONS 2045

INBOUND

REGIONAL FLOWS

- Inbound
- Outbound
- Internal
- Regional Comparison: Inbound
- Regional Comparison: Outbound

TRADE DEPENDENCE

- Ports - Imports
- Ports - Exports
- Ports - Imports Comparison
- Ports - Exports Comparison
- Countries - Imports
- Countries - Exports
- Countries - Regional Comparison

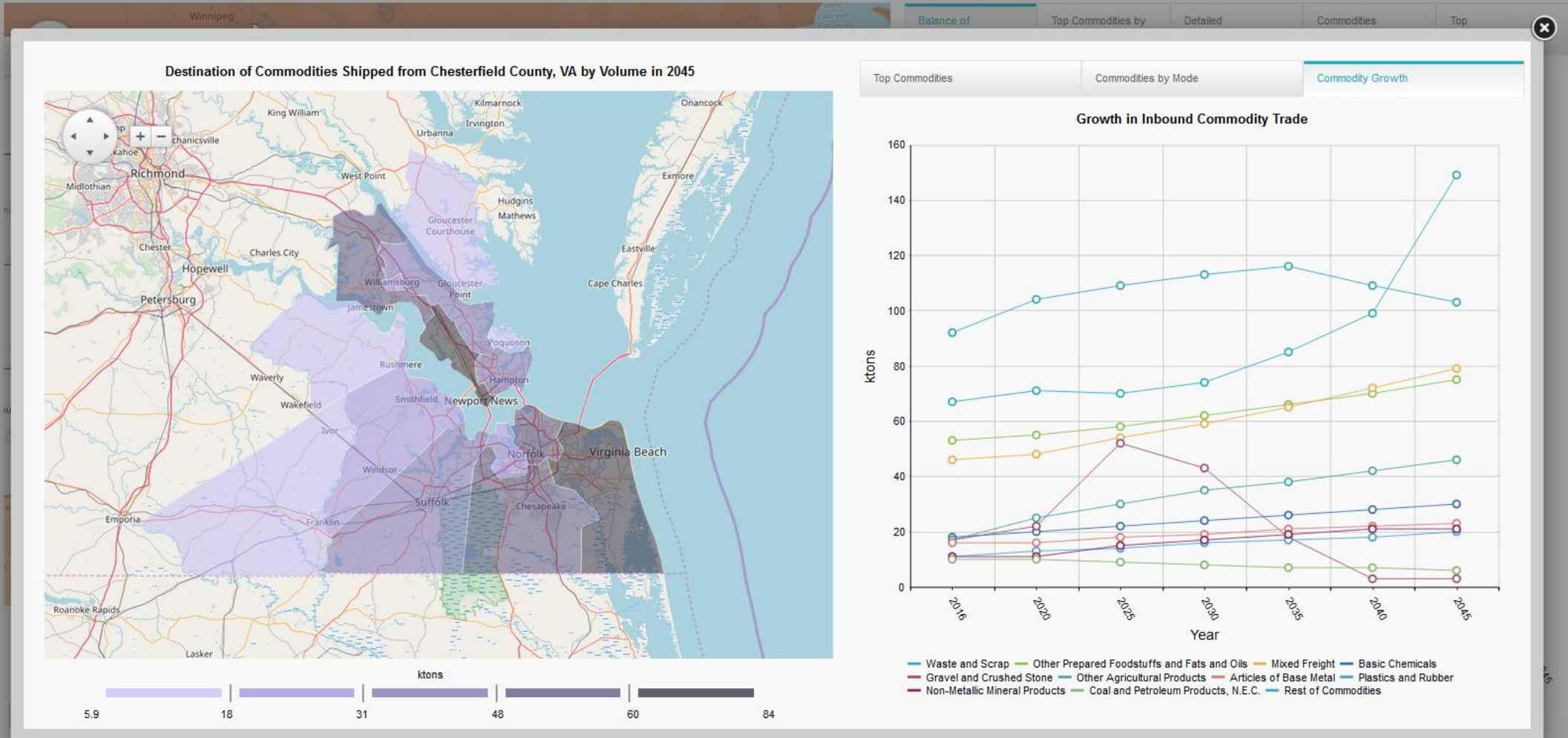
YOUR PORTS

MODAL DEPENDENCE

- Truck
- Rail
- Air
- Water
- Multiple Modes & Mail

COMMODITIES

SUB-COUNTY



TREDPLAN-Regions

Settings

Freight & Transportation

Economics

Scenario Analysis



SINGLE REGION TONS 2045

INBOUND

REGIONAL FLOWS

- Inbound
- Outbound
- Internal
- Regional Comparison: Inbound
- Regional Comparison: Outbound

TRADE DEPENDENCE

- Ports - Imports
- Ports - Exports
- Ports - Imports Comparison
- Ports - Exports Comparison
- Countries - Imports
- Countries - Exports
- Countries - Regional Comparison

YOUR PORTS

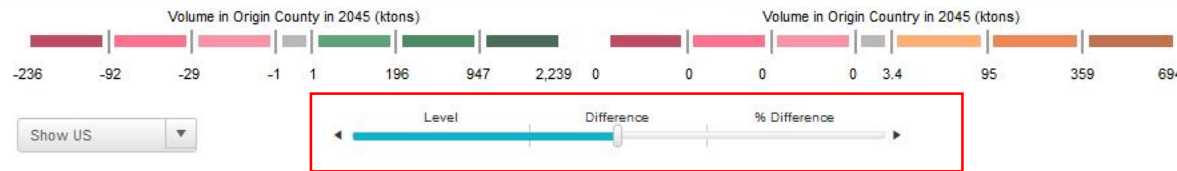
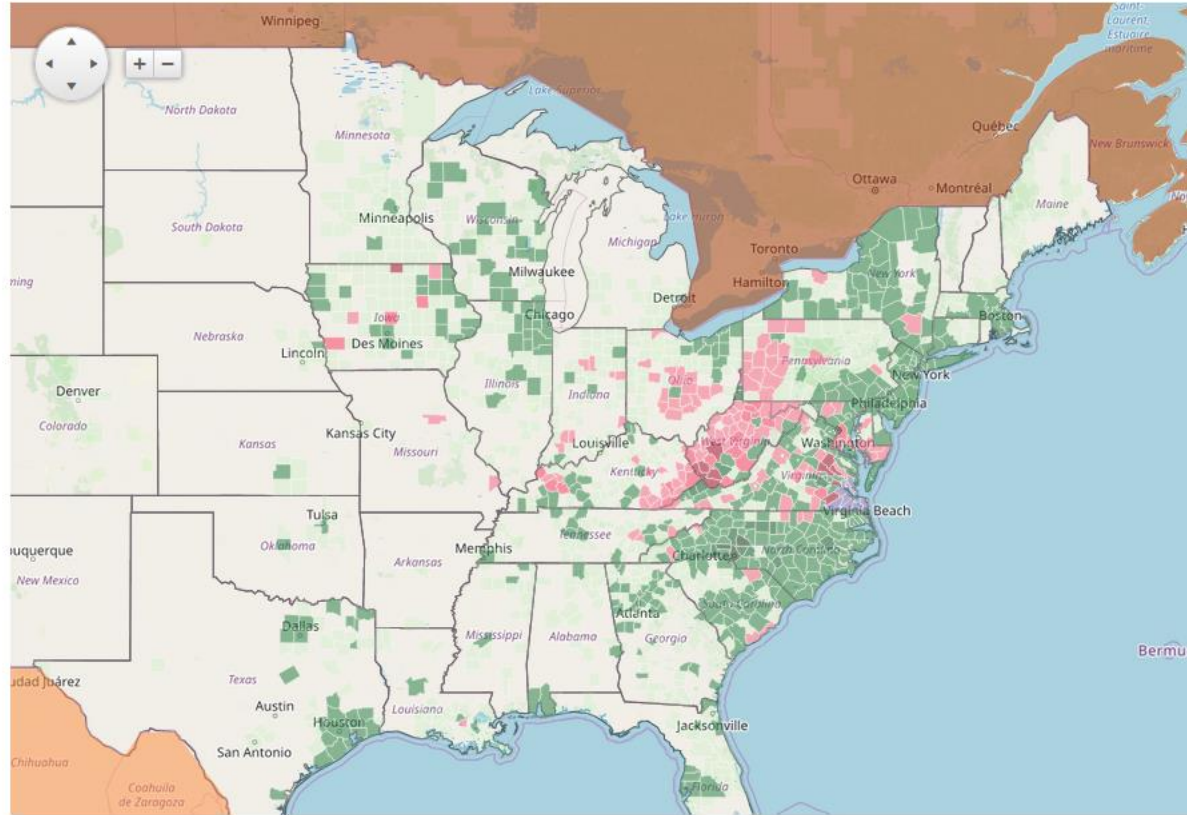
MODAL DEPENDENCE

- Truck
- Rail
- Air
- Water

Multiple Modes & Mail

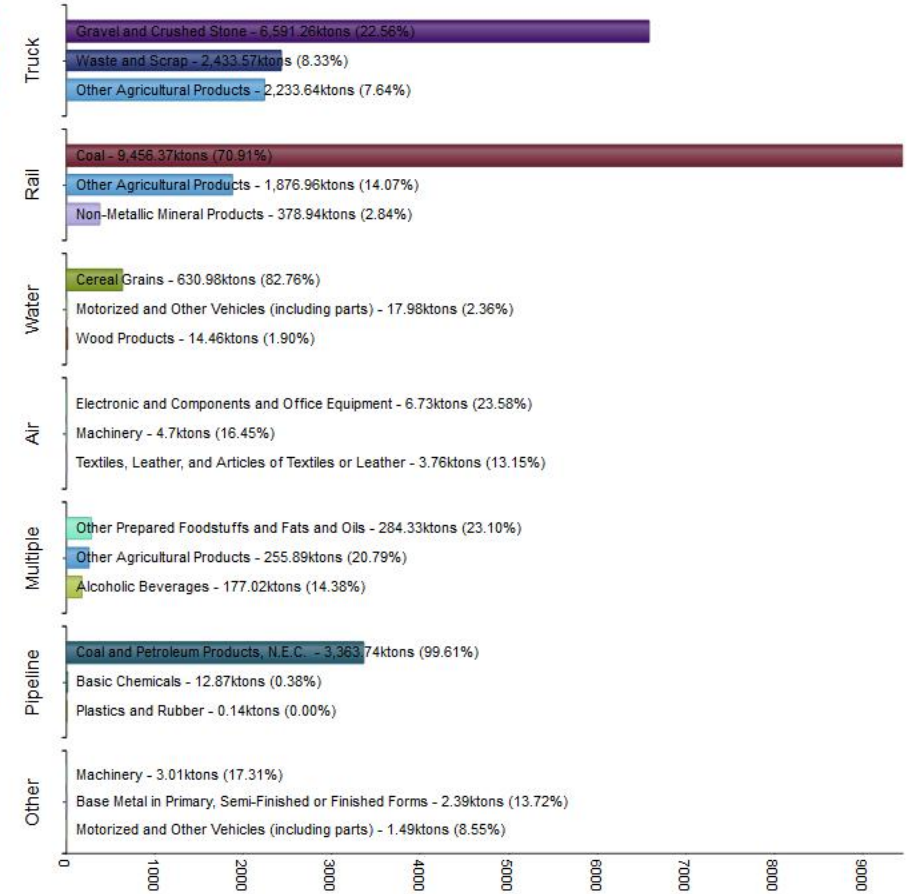
COMMODITIES

SUB-COUNTY



- Balance of Trade
- Top Commodities by Year
- Detailed Commodities
- Commodities by Mode
- Top Geographies

Top Inbound Commodities by Domestic Modes (ktons) in 2045



TREDPLAN-Regions

Settings

Freight & Transportation

Economics

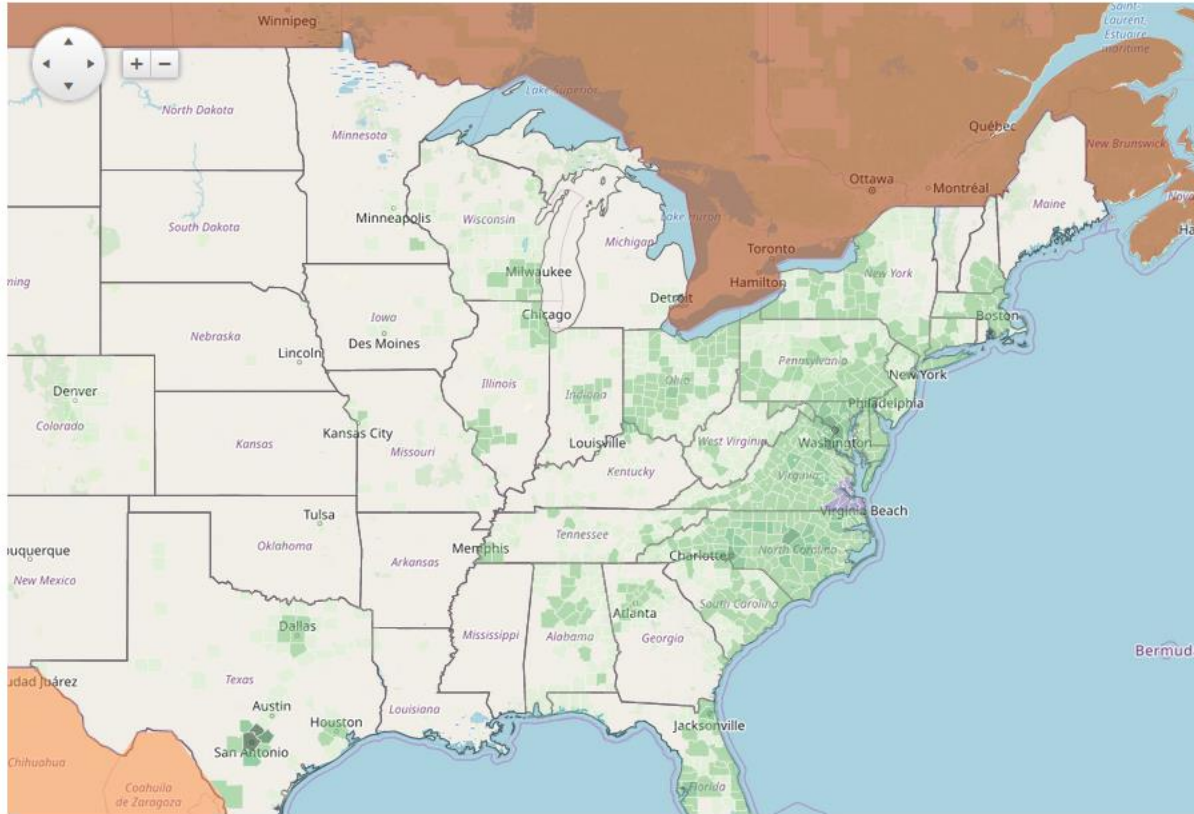
Scenario Analysis



SINGLE REGION TONS 2045

OUTBOUND

- REGIONAL FLOWS
 - Inbound
 - Outbound
 - Internal
 - Regional Comparison: Inbound
 - Regional Comparison: Outbound
- TRADE DEPENDENCE
 - Ports - Imports
 - Ports - Exports
 - Ports - Imports Comparison
 - Ports - Exports Comparison
 - Countries - Imports
 - Countries - Exports
 - Countries - Regional Comparison
- YOUR PORTS
- MODAL DEPENDENCE
 - Truck
 - Rail
 - Air
 - Water
 - Multiple Modes & Mail
- COMMODITIES
- SUB-COUNTY

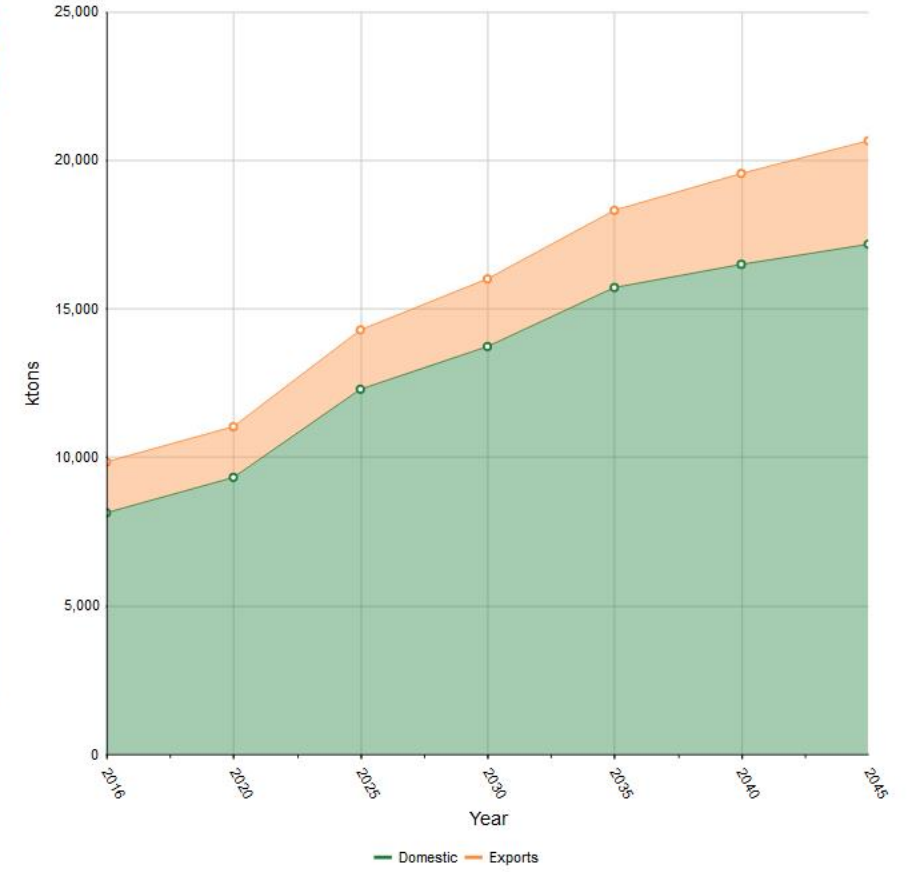


Show US

Level Difference % Difference

- Balance of Trade
- Top Commodities by Year
- Detailed Commodities
- Commodities by Mode
- Top Geographies

Balance of Outbound Freight Domestic Vs International (ktons)



SINGLE REGION TONS 2045

REGIONAL COMPARISON: INBOUND



REGIONAL FLOWS

- Inbound
- Outbound
- Internal
- Regional Comparison: Inbound
- Regional Comparison: Outbound

TRADE DEPENDENCE

- Ports - Imports
- Ports - Exports
- Ports - Imports Comparison
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- Countries - Regional Comparison

YOUR PORTS

MODAL DEPENDENCE

- Truck
- Rail
- Air
- Water
- Multiple Modes & Mail

COMMODITIES

SUB-COUNTY

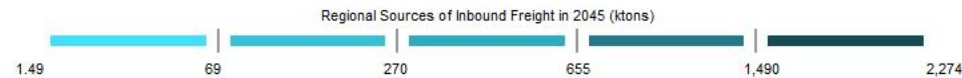
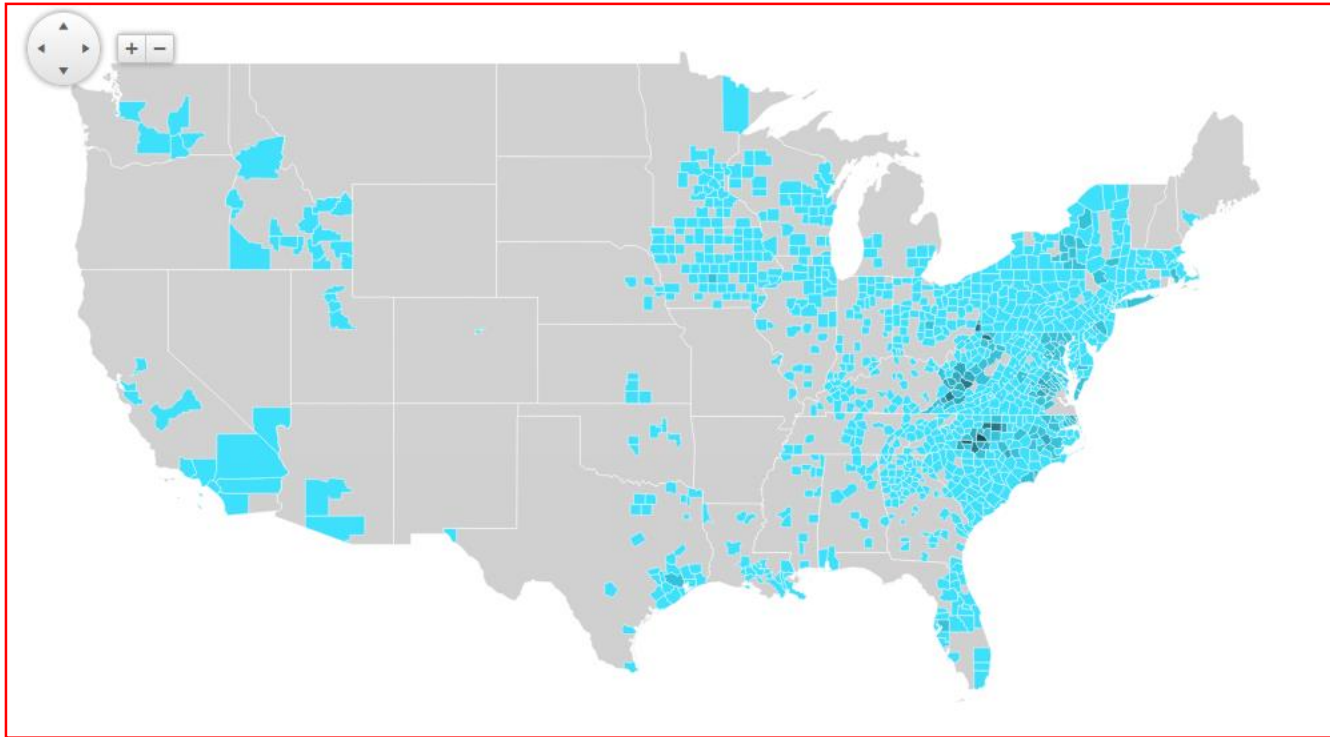
Market Shares

Comparison of Top Counties

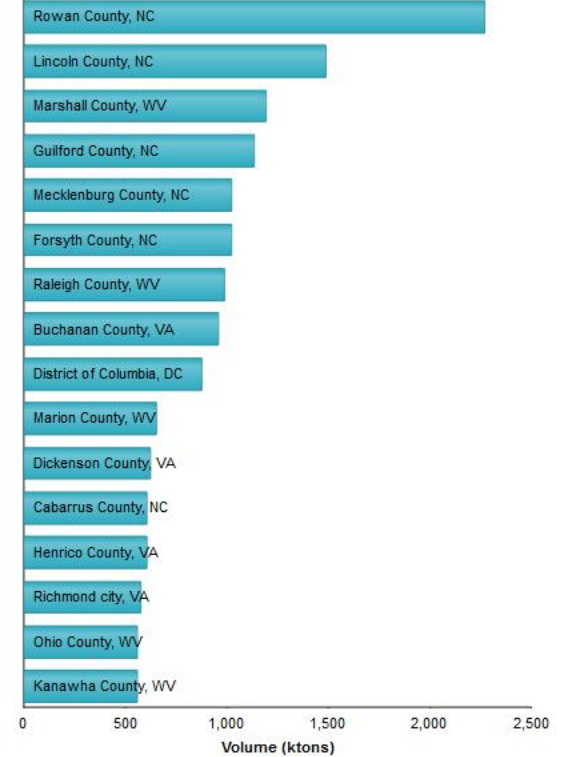
Comparison of Top Commodities

Inter-Regional Trade

Inter-Regional Commodities



Top Counties for Study Region (By 2045 Volume)



TREDPLAN-Regions

Settings

Freight & Transportation

Economics

Scenario Analysis



SINGLE REGION TONS 2045

REGIONAL COMPARISON: INBOUND

REGIONAL FLOWS

Inbound

Outbound

Internal

Regional Comparison: Inbound

Regional Comparison: Outbound

TRADE DEPENDENCE

Ports - Imports

Ports - Exports

Ports - Imports Comparison

Ports - Exports Comparison

Countries - Imports

Countries - Exports

Countries - Regional Comparison

YOUR PORTS

MODAL DEPENDENCE

Truck

Rail

Air

Water

Multiple Modes & Mail

COMMODITIES

SUB-COUNTY

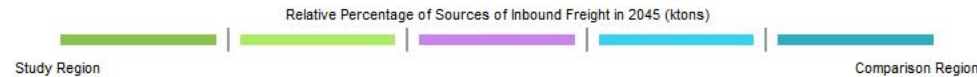
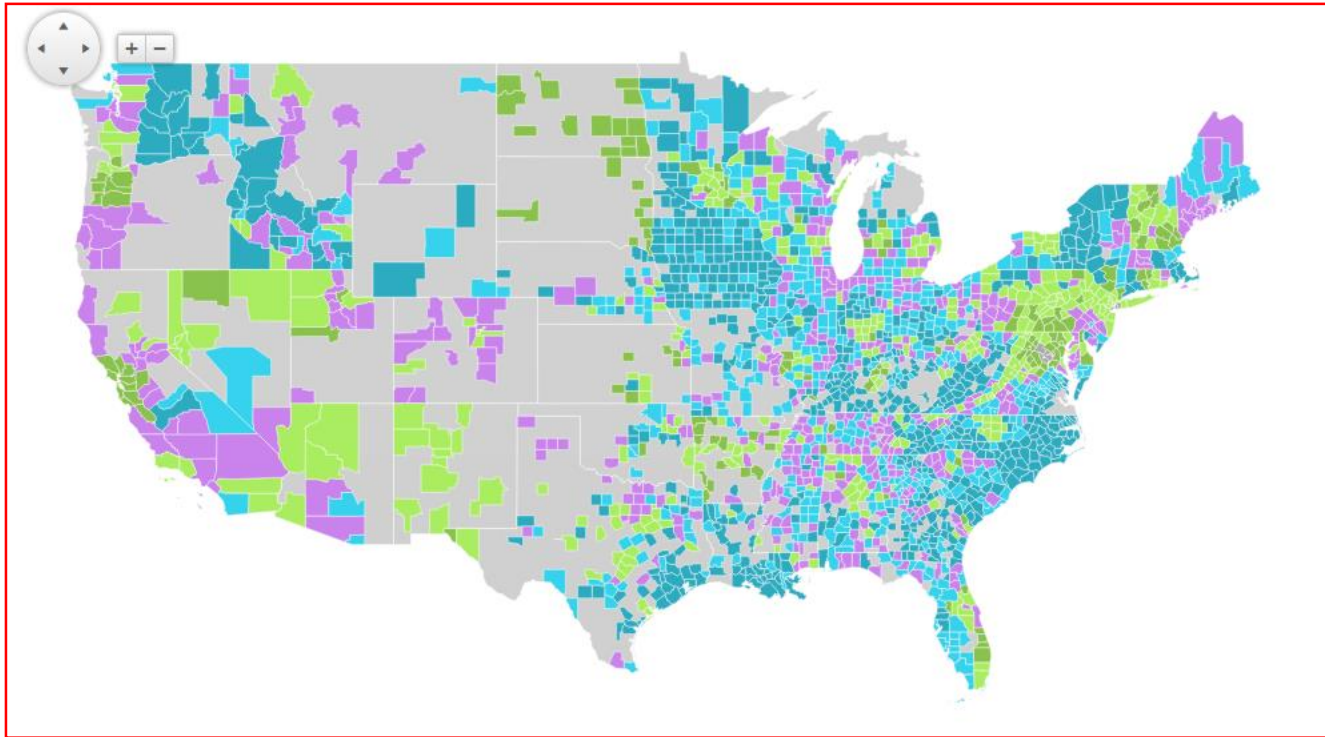
Market Shares

Comparison of Top Counties

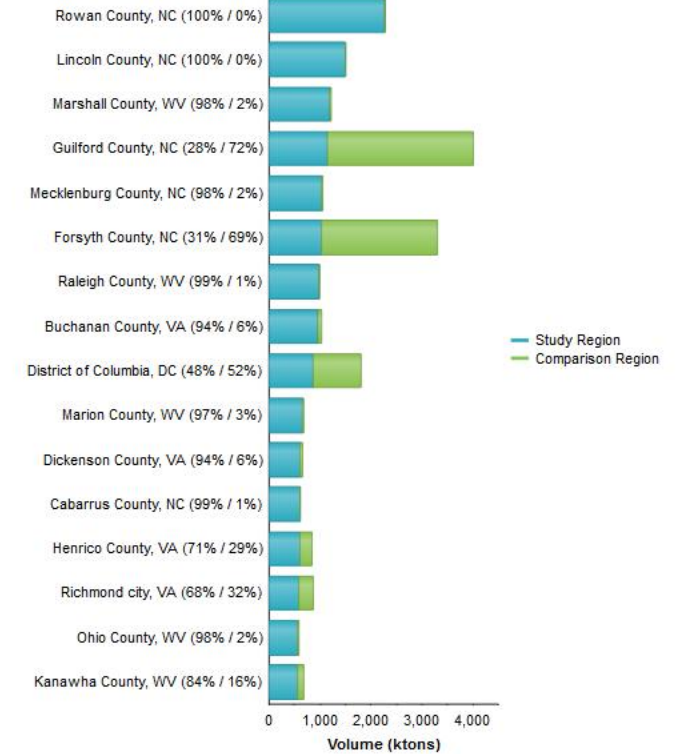
Comparison of Top Commodities

Inter-Regional Trade

Inter-Regional Commodities



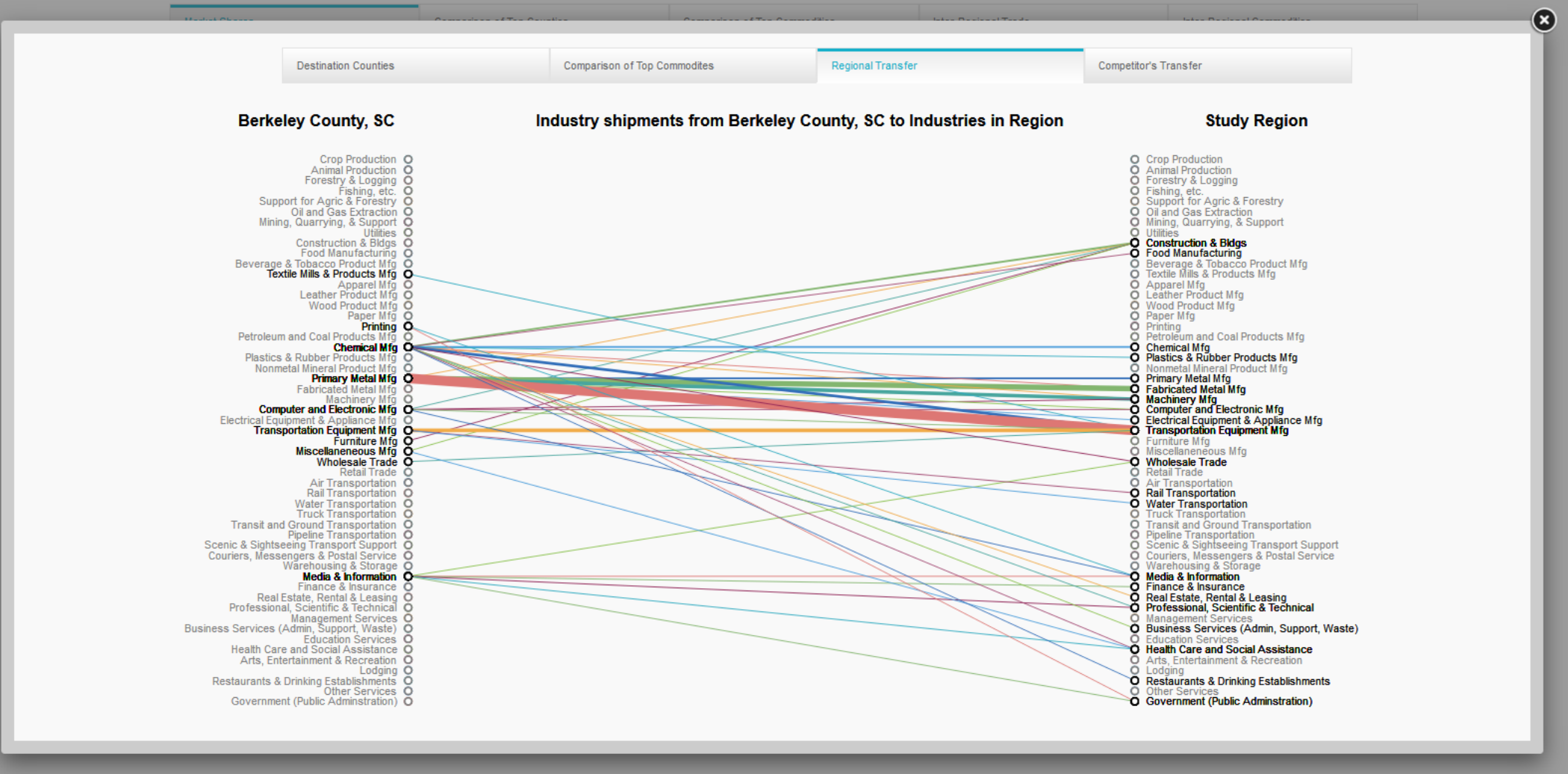
Relative Concentration of Counties (By 2045 Volume)



SINGLE REGION TONS 2045

REGIONAL COMPARISON: INBOUND

- REGIONAL FLOWS
 - Inbound
 - Outbound
 - Internal
 - Regional Comparison: Inbound**
 - Regional Comparison: Outbound
- TRADE DEPENDENCE
 - Ports - Imports
 - Ports - Exports
 - Ports - Imports Comparison
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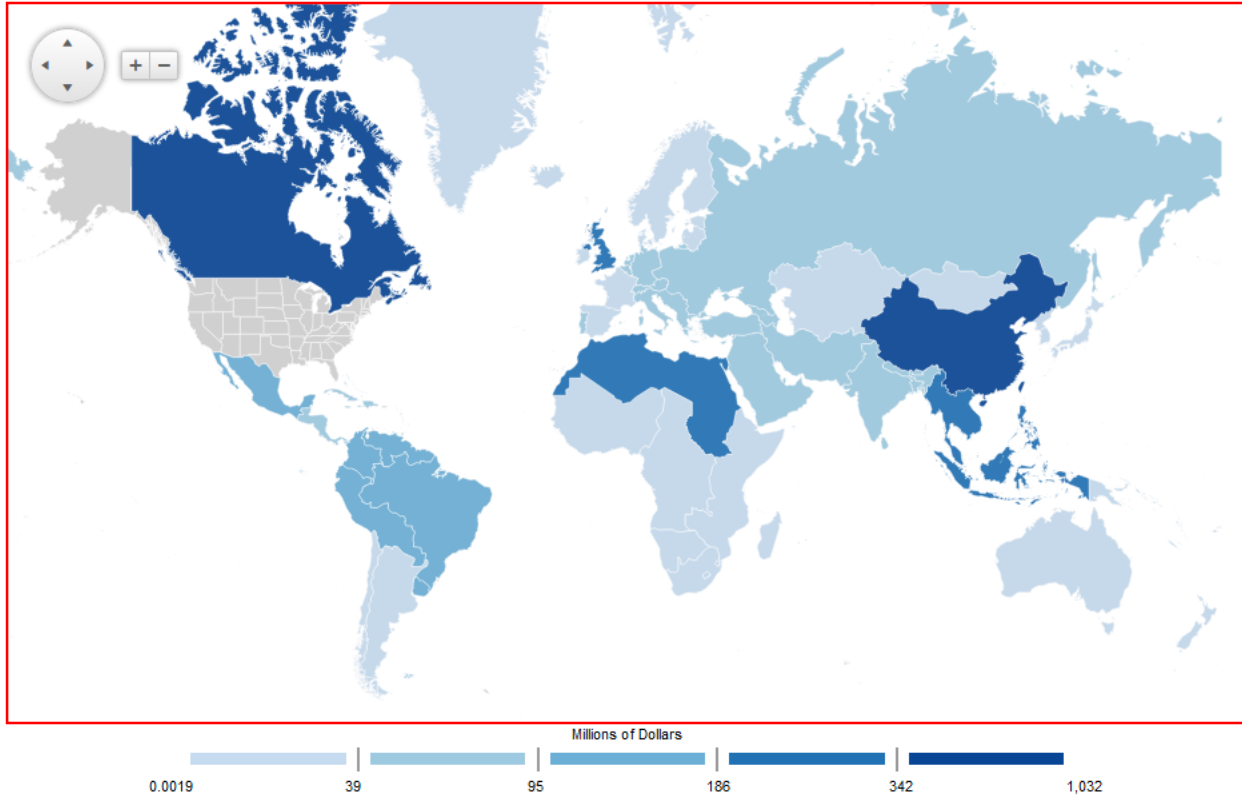


SINGLE REGION TONS 2045

COUNTRIES - EXPORTS

- REGIONAL FLOWS**
- Inbound
- Outbound
- Internal
- Regional Comparison: Inbound
- Regional Comparison: Outbound
- TRADE DEPENDENCE**
- Ports - Imports
- Ports - Exports
- Ports - Imports Comparison
- Ports - Exports Comparison
- Countries - Imports
- Countries - Exports
- Countries - Regional Comparison
- YOUR PORTS**
- MODAL DEPENDENCE**
- Truck
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- COMMODITIES**
- SUB-COUNTY**

International Sources of Regional Exports in 2045 by Volume of Goods Shipped



Countries of Export Exported Commodities

Exported Commodities

Commodity	Value (\$M)			Volume (ktons)		
	2016	2045	% Change	2016	2045	% Change
Other Ag Prods.	267.99	526.27	96.38	519.27	1,033.65	99.06
Waste/Scrap	32.86	150.30	357.37	103.91	479.04	361.02
Fertilizers	26.83	40.69	51.69	212.15	323.70	52.58
Wood Prods.	17.29	50.26	190.66	92.06	283.26	207.69
Newsprint/Paper	91.75	169.14	84.34	106.68	196.47	84.17
Animal Feed	59.25	62.34	5.22	138.77	143.59	3.47
Cereal Grains	13.22	22.53	70.48	72.47	127.29	75.64
Other Foodstuffs	71.02	113.15	59.32	73.03	116.50	59.53
Meat/Seafood	153.96	158.11	2.69	108.14	109.27	1.04
Machinery	606.36	1,375.39	126.83	44.43	94.92	113.65
Non-Metal Min. Prods.	43.17	102.32	137.02	27.20	65.67	141.40
Base Metals	46.38	121.79	162.60	25.09	64.52	157.17
Textiles/Leather	78.33	326.81	317.23	12.30	51.58	319.45
Motorized Vehicles	155.29	423.50	172.71	18.12	48.89	169.75
Articles-Base Metal	60.13	195.69	225.46	15.14	48.20	218.39
Gasoline	9.91	17.07	72.30	28.03	46.68	66.55
Logs	4.09	13.00	217.95	12.59	39.91	217.12
Fuel Oils	8.44	17.15	103.22	19.84	39.61	99.64
Chemical Prods.	103.40	227.72	120.24	16.35	34.86	113.25
Basic Chemicals	38.63	62.20	61.03	17.64	27.88	58.00
Plastics/Rubber	29.62	78.50	165.03	8.07	21.23	163.05
Coal	0.70	0.63	-10.49	14.57	13.23	-9.18
Printed Products	23.84	101.68	326.42	3.53	12.67	258.48
Alcoholic Beverages	3.46	8.02	131.60	5.28	12.23	131.53
Electronics	168.97	878.54	419.95	2.48	11.99	383.46
Furniture	16.54	59.37	259.06	3.14	10.60	237.48
Transport Equip.	78.00	184.71	136.80	2.80	6.03	115.09
Precision Instruments	92.74	642.66	592.98	0.70	4.65	565.48
Misc. Mfg. Prods.	32.30	129.35	300.42	1.10	4.29	291.72

TREDPLAN-Regions



SINGLE REGION TONS 2045

COUNTRIES - EXPORTS

REGIONAL FLOWS

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- Outbound
- Internal
- Regional Comparison: Inbound
- Regional Comparison: Outbound

TRADE DEPENDENCE

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- Ports - Exports
- Ports - Imports Comparison
- Ports - Exports Comparison
- Countries - Imports
- Countries - Exports**
- Countries - Regional Comparison

YOUR PORTS

MODAL DEPENDENCE

- Truck
- Rail
- Air
- Water
- Multiple Modes & Mail

COMMODITIES

SUB-COUNTY



TREDPLAN-Regions

Settings

Freight & Transportation

Economics

Scenario Analysis



SINGLE REGION TONS 2045

SUB-COUNTY

REGIONAL FLOWS

- Inbound
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- Internal
- Regional Comparison: Inbound
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TRADE DEPENDENCE

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YOUR PORTS

MODAL DEPENDENCE

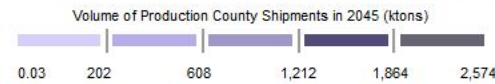
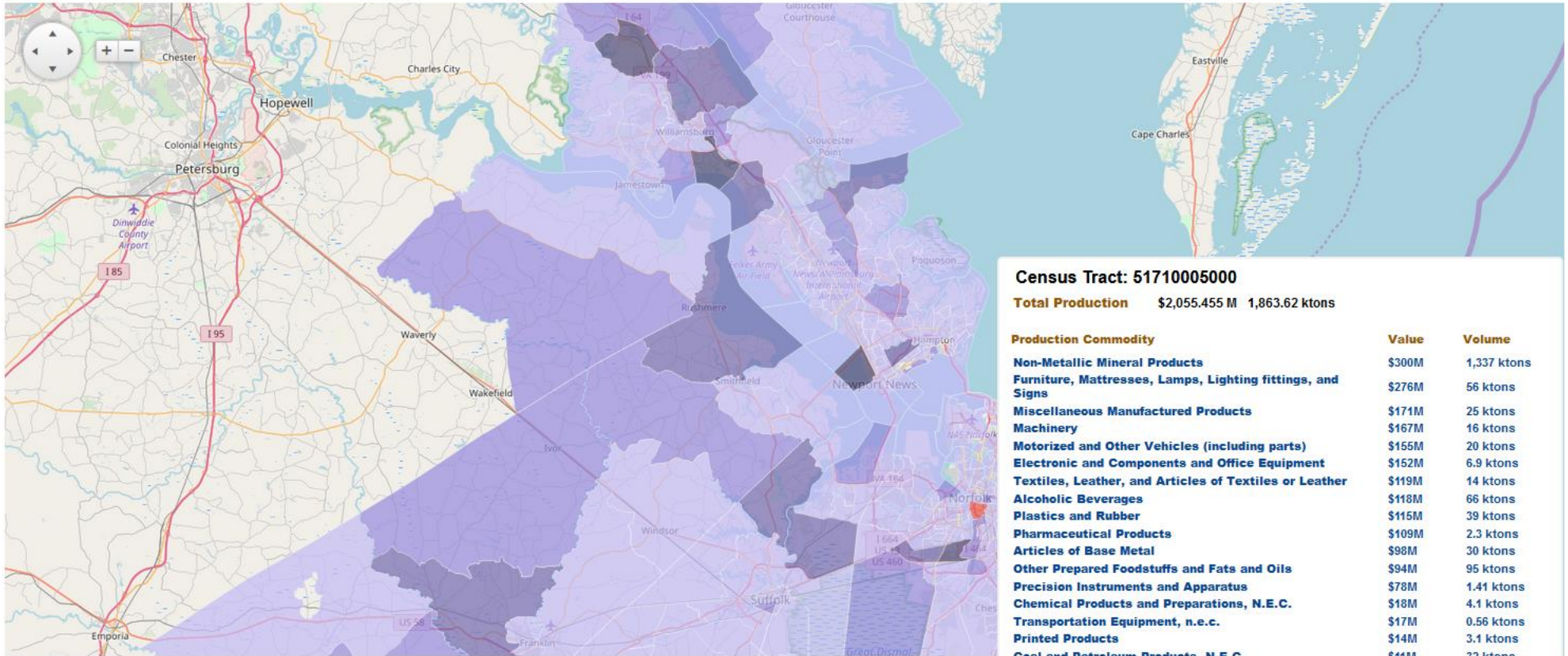
- Truck
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COMMODITIES

SUB-COUNTY

Production

Consumption



Census Tract: 51710005000

Total Production \$2,055.455 M 1,863.62 ktons

Production Commodity	Value	Volume
Non-Metallic Mineral Products	\$300M	1,337 ktons
Furniture, Mattresses, Lamps, Lighting fittings, and Signs	\$276M	56 ktons
Miscellaneous Manufactured Products	\$171M	25 ktons
Machinery	\$167M	16 ktons
Motorized and Other Vehicles (including parts)	\$155M	20 ktons
Electronic and Components and Office Equipment	\$152M	6.9 ktons
Textiles, Leather, and Articles of Textiles or Leather	\$119M	14 ktons
Alcoholic Beverages	\$118M	66 ktons
Plastics and Rubber	\$115M	39 ktons
Pharmaceutical Products	\$109M	2.3 ktons
Articles of Base Metal	\$98M	30 ktons
Other Prepared Foodstuffs and Fats and Oils	\$94M	95 ktons
Precision Instruments and Apparatus	\$78M	1.41 ktons
Chemical Products and Preparations, N.E.C.	\$18M	4.1 ktons
Transportation Equipment, n.e.c.	\$17M	0.56 ktons
Printed Products	\$14M	3.1 ktons
Coal and Petroleum Products, N.E.C.	\$11M	32 ktons
Meat, Fish, Seafood, and their Preparations	\$10M	3.3 ktons
Wood Products	\$9.1M	19 ktons
Milled Grain Products and Preparations, Bakery Products	\$7.6M	5.7 ktons
Base Metal in Primary, Semi-Finished or Finished Forms	\$4.3M	2.8 ktons

TREDPLAN-Regions

Settings

Freight & Transportation

Economics

Scenario Analysis



SINGLE REGION TONS 2045

INDUSTRIES

REGIONAL ECONOMIES

- Industries
- Industry Growth
- Shift Shares
- National Location Quotient
- Competitor Location Quotient

FREIGHT DEPENDENCE

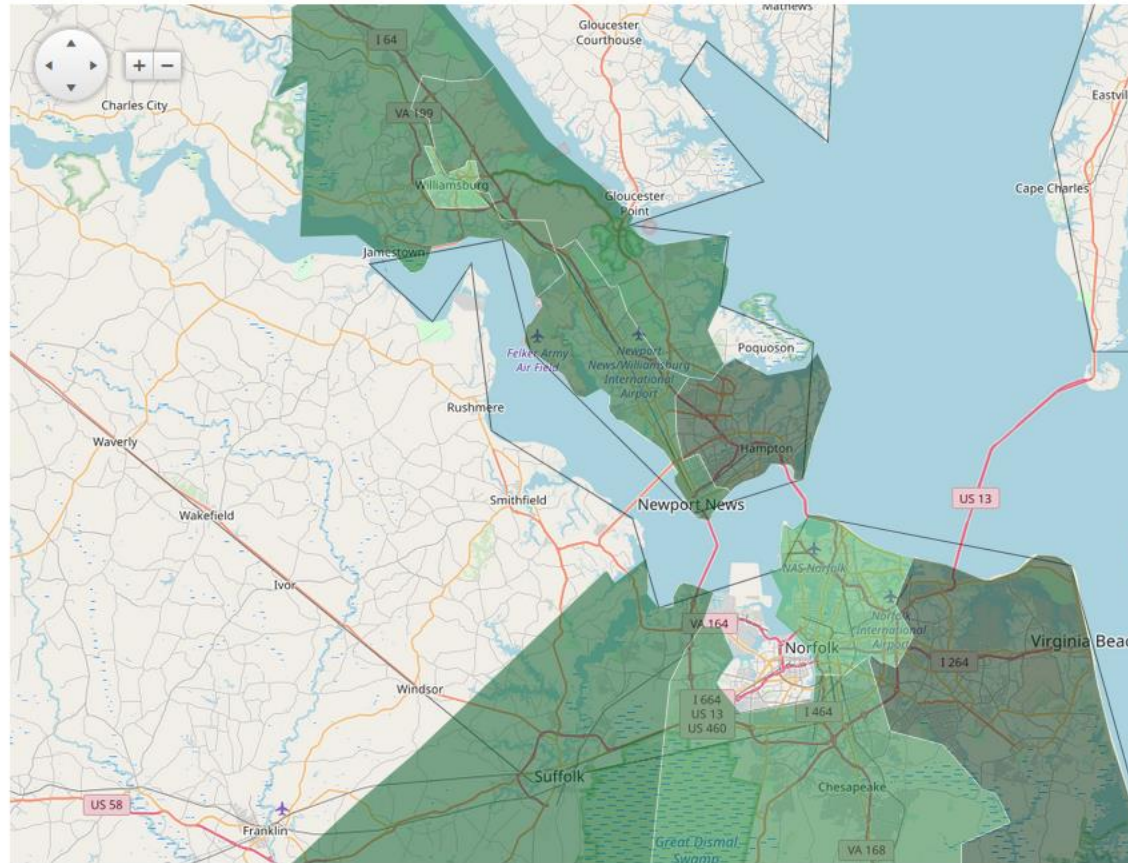
OCCUPATIONAL CHANGE

Computer and Electronic Mfg

EMPLOYMENT

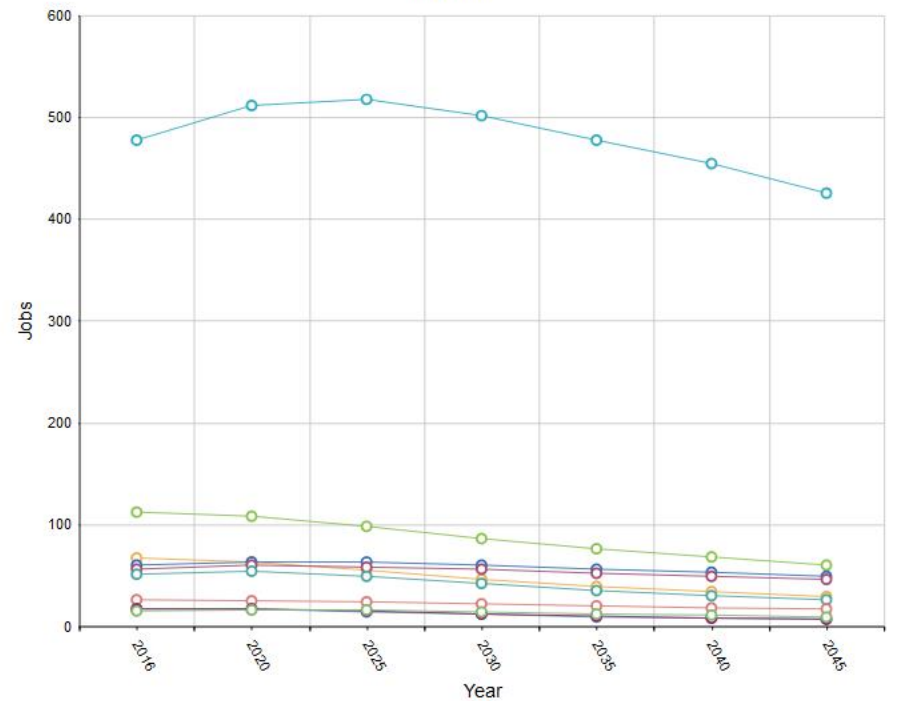
OUTPUT

SUBMIT



Map Data Industries Series Commodities Production Commodities Consumption

Industries



- Search, detection, and navigation instruments manufacturing
- Industrial process variable instruments manufacturing
- Broadcast and wireless communications equipment manufacturing
- Capacitor, resistor, coil, transformer, and other inductor manufacturing
- Automatic environmental control manufacturing
- Other electronic component manufacturing
- Semiconductor and related device manufacturing
- Electronic computer manufacturing
- Other communications equipment manufacturing
- Irradiation apparatus manufacturing

CLIMATE EFFECTS

PORTS DISRUPTION

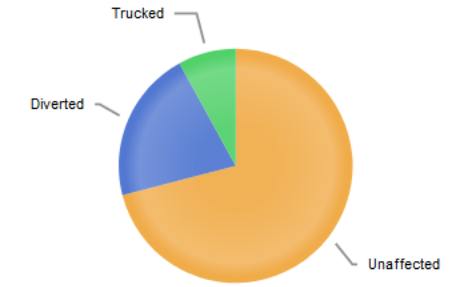
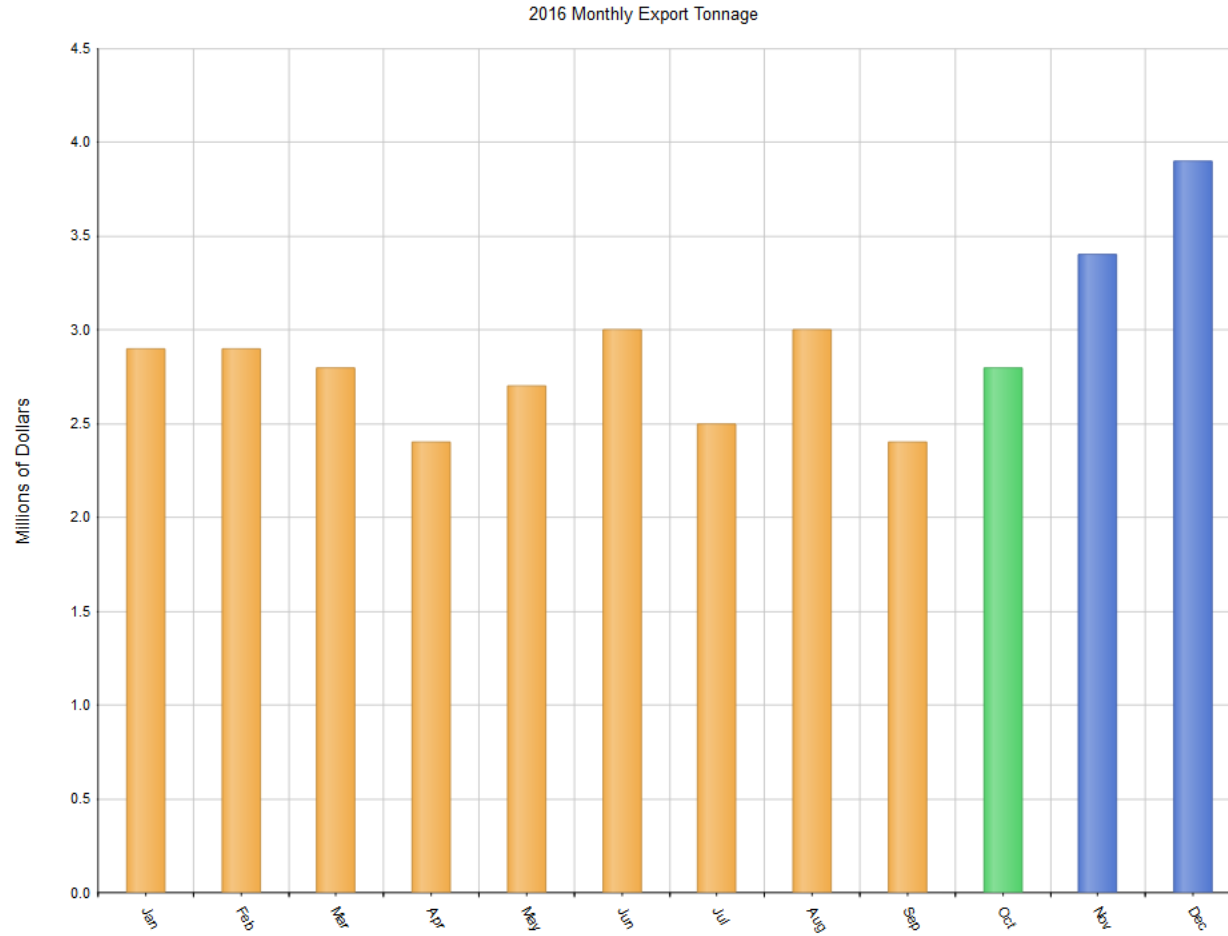
Seasonality

Impacts

TRADE SUBSTITUTION

IMPORT TARIFF

Affected Volume: Port of Norfolk



Affected Volume by Commodity

Commodity	Unaffected		Trucked		Diverted	
	Tons	%	Tons	%	Tons	%
Coal	16,286,028	72 %	1,574,837	7 %	4,835,676	21 %
Other ag prods.	1,587,589	51 %	348,912	11 %	1,155,561	37 %
Wood prods.	1,795,004	74 %	226,040	9 %	404,740	17 %
Animal feed	1,138,940	73 %	125,162	8 %	288,191	19 %
Newsprint/paper	1,073,035	75 %	123,853	9 %	229,415	16 %
Waste/scrap	920,756	73 %	113,284	9 %	223,232	18 %
Cereal grains	366,498	69 %	147,236	28 %	21,230	4 %
Other foodstuffs	439,801	73 %	59,107	10 %	101,349	17 %
Plastics/rubber	492,765	76 %	51,306	8 %	104,901	16 %
Fertilizers	283,130	72 %	81,495	21 %	30,998	8 %
Basic chemicals	403,456	79 %	34,988	7 %	70,965	14 %
Logs	240,079	71 %	32,606	10 %	66,663	20 %
Chemical prods.	263,613	74 %	32,161	9 %	61,565	17 %
Coal-n.e.c.	389,468	82 %	2,347	0 %	82,014	17 %
Meat/seafood	229,988	76 %	24,308	8 %	49,848	16 %
Rest of Commodities	1,145,190	75 %	141,373	9 %	241,110	16 %

TREDPLAN-Regions

Settings

Freight & Transportation

Economics

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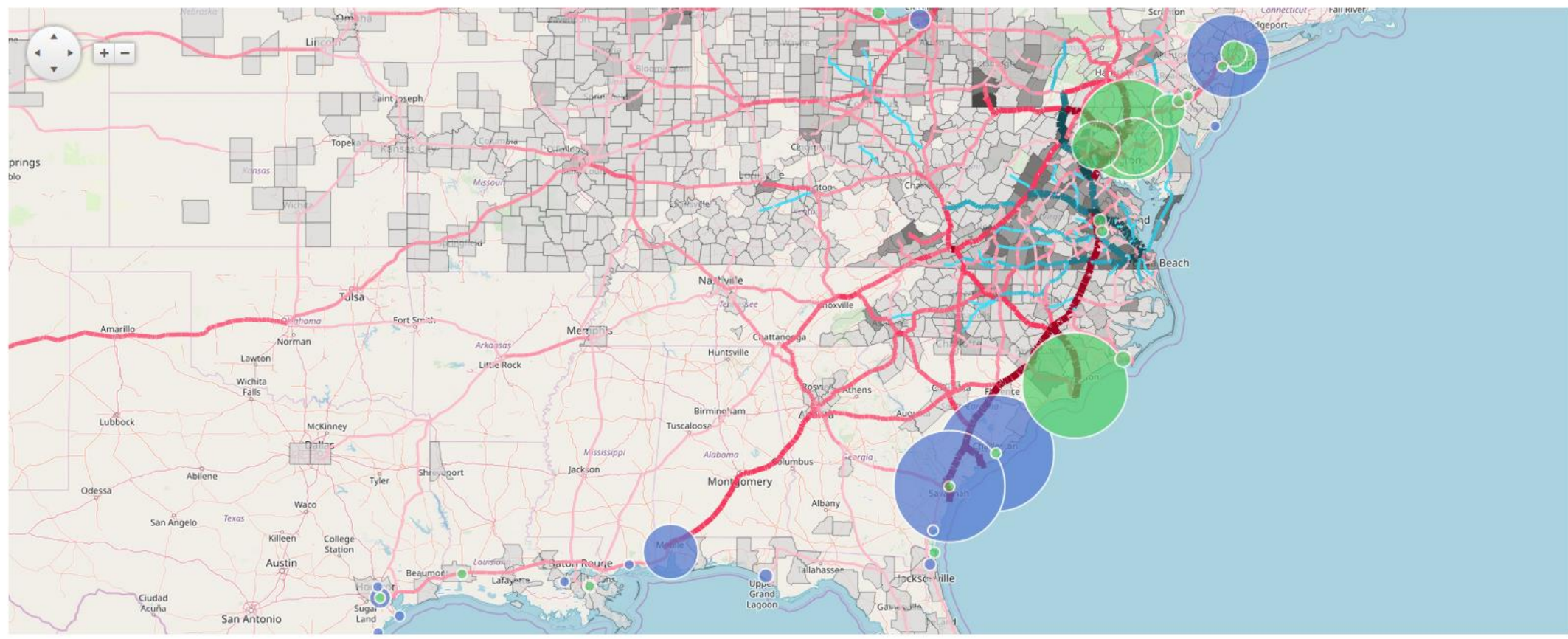
SINGLE REGION TONS 2045

IMPACTS

- CLIMATE EFFECTS
- PORTS DISRUPTION
 - Seasonality
 - Impacts
- TRADE SUBSTITUTION
- IMPORT TARIFF

Show Maps Show Routes Show Ports

Effect of Temporary Closure: Port of Norfolk



SINGLE REGION TONS 2045

TRADE SUBSTITUTION

CLIMATE EFFECTS

PORTS DISRUPTION

Seasonality

Impacts

TRADE SUBSTITUTION

IMPORT TARIFF

Show Maps Show Routes Show Ports

Effect of Temporary Closure: Port of Norfolk

