Estimating Freight Flows in WA State: Case studies in data-poor and data-rich environments

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Presented on behalf of Derik Andreoli, Anne Goodchild, Eric Jessup, and Sunny Rose

Research Problem

- Freight supports regional economies
- Desire to justify investments targeting freight
- Evaluate the impacts of network changes
  - Vulnerability to disruptions
  - Improvements and infrastructure needs
- Limited by available data

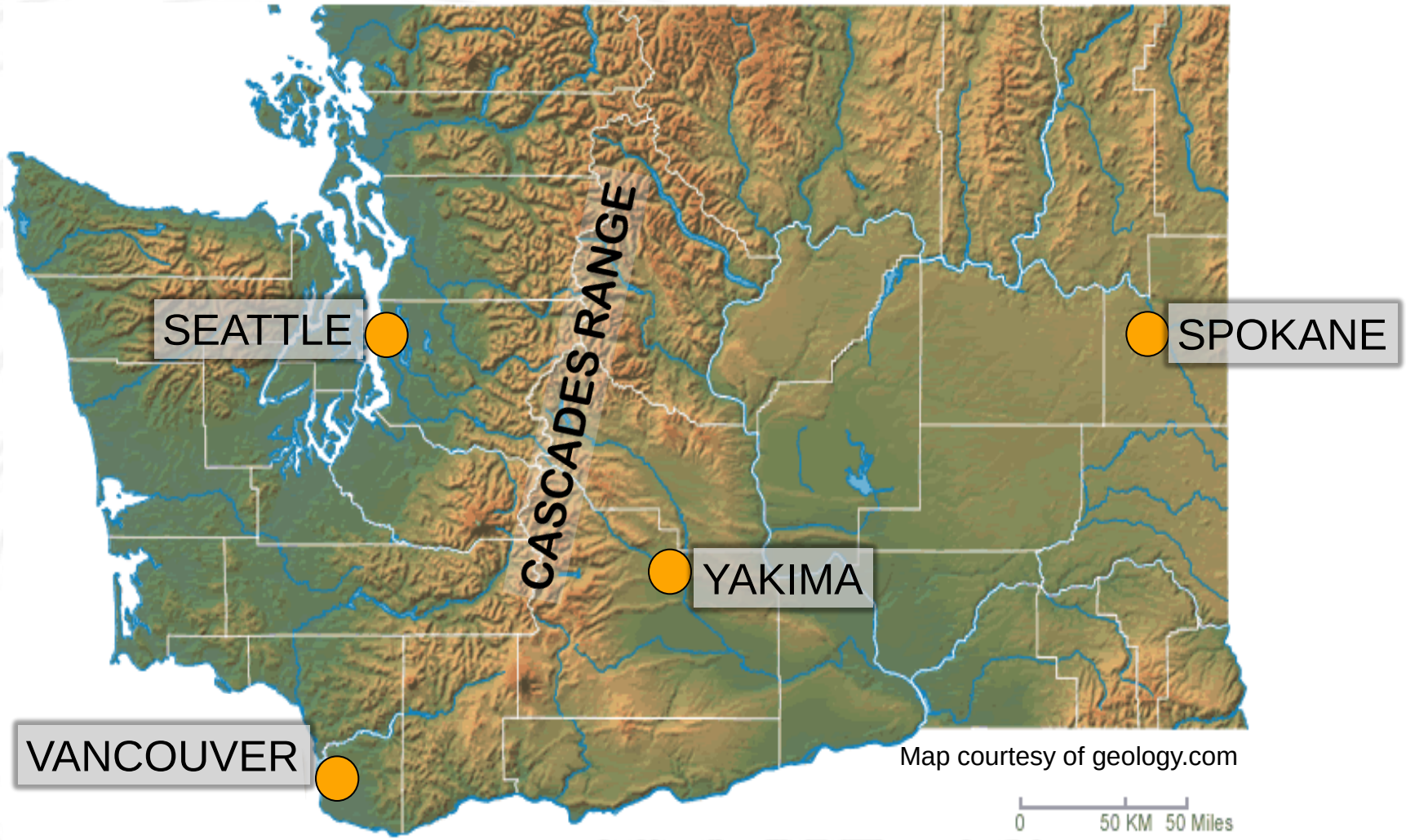
State of Freight Modeling

- Currently two primary modeling sources:
  - Commodity flow data
  - Gross vehicle volumes
  - Assume industries use infrastructure in the same way
- Existing methods are too coarse for needed analysis
  - Commodity flow data spatially aggregate
  - Vehicle estimates are categorically aggregate

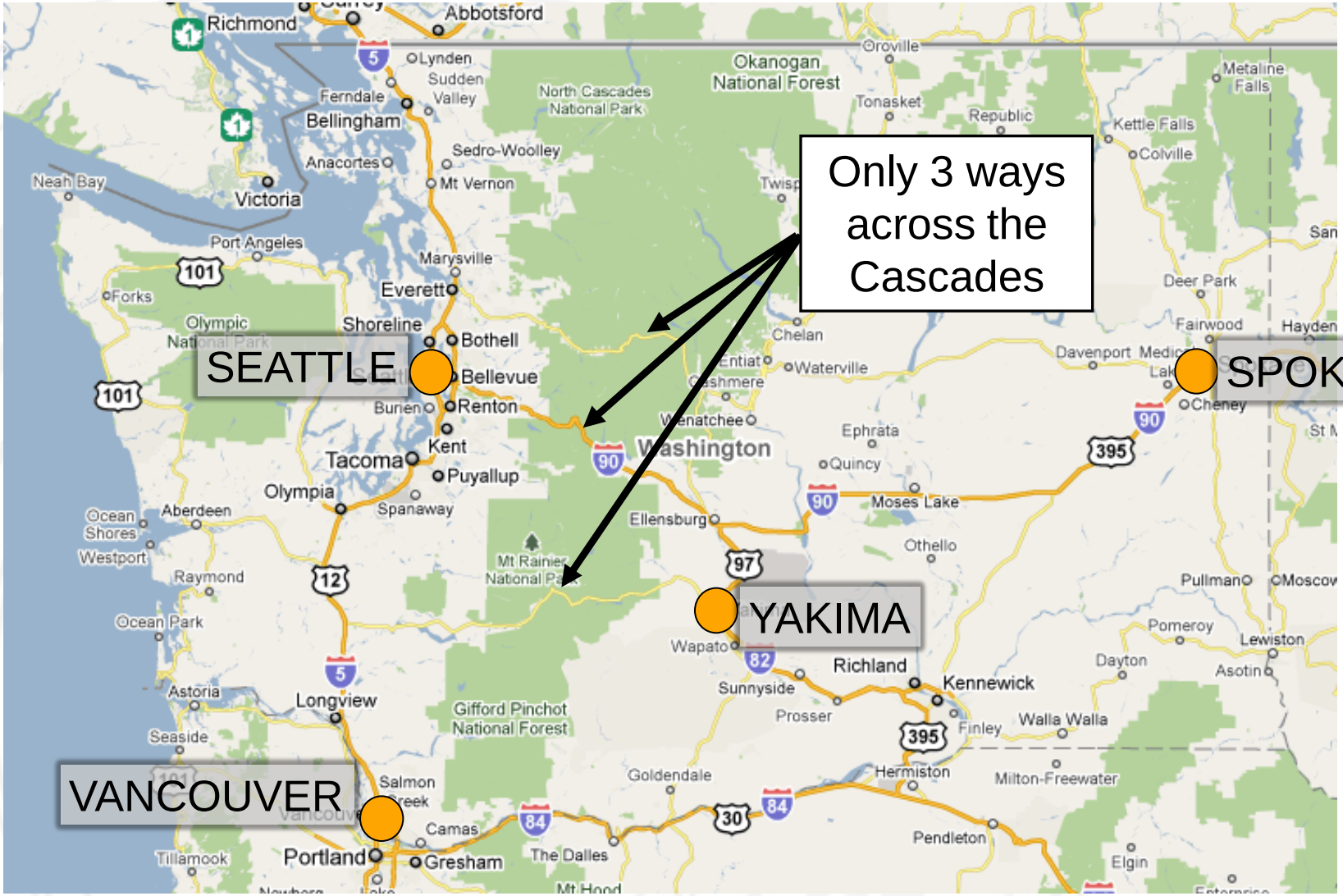
Project Scope

- Improve the representation of freight movement in statewide modeling
- Work within existing data constraints
- Study Washington State due to the frequent disruptions to key freight corridors
  - I-5 (flooding)
  - I-90 (avalanche)

Washington State Topography



Washington State Infrastructure



Map courtesy of Google maps

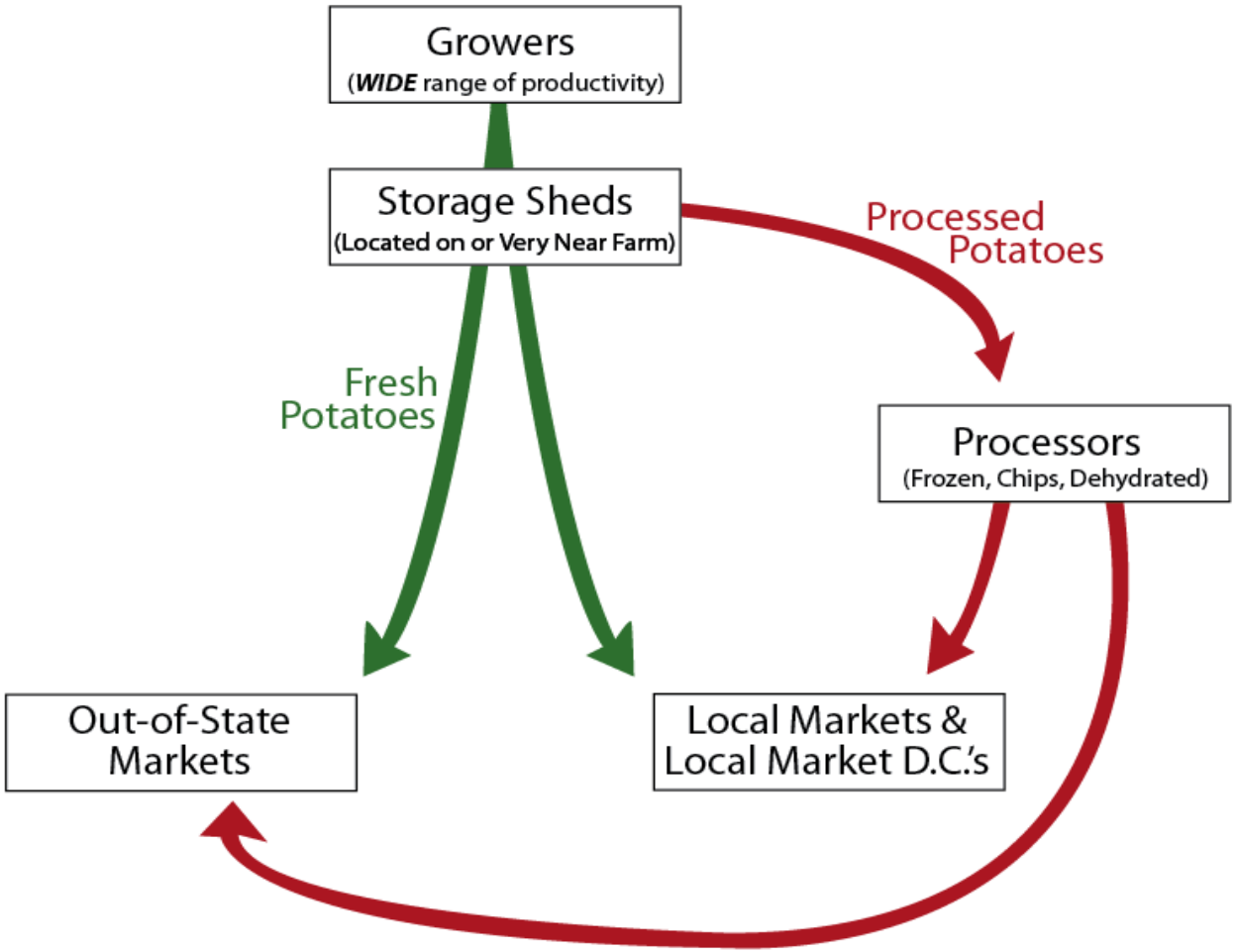
Focus on Two Sample Data Sources

- Estimate statewide truck trips required for the operation of industries within Washington State
- Data-rich industry: potato distribution
  - Production
  - Processing
  - Demand
  - Distribution
  - Capacity Ratios
- Data-poor industry: diesel distribution
  - Use estimated origins & destinations
  - How to model flows?

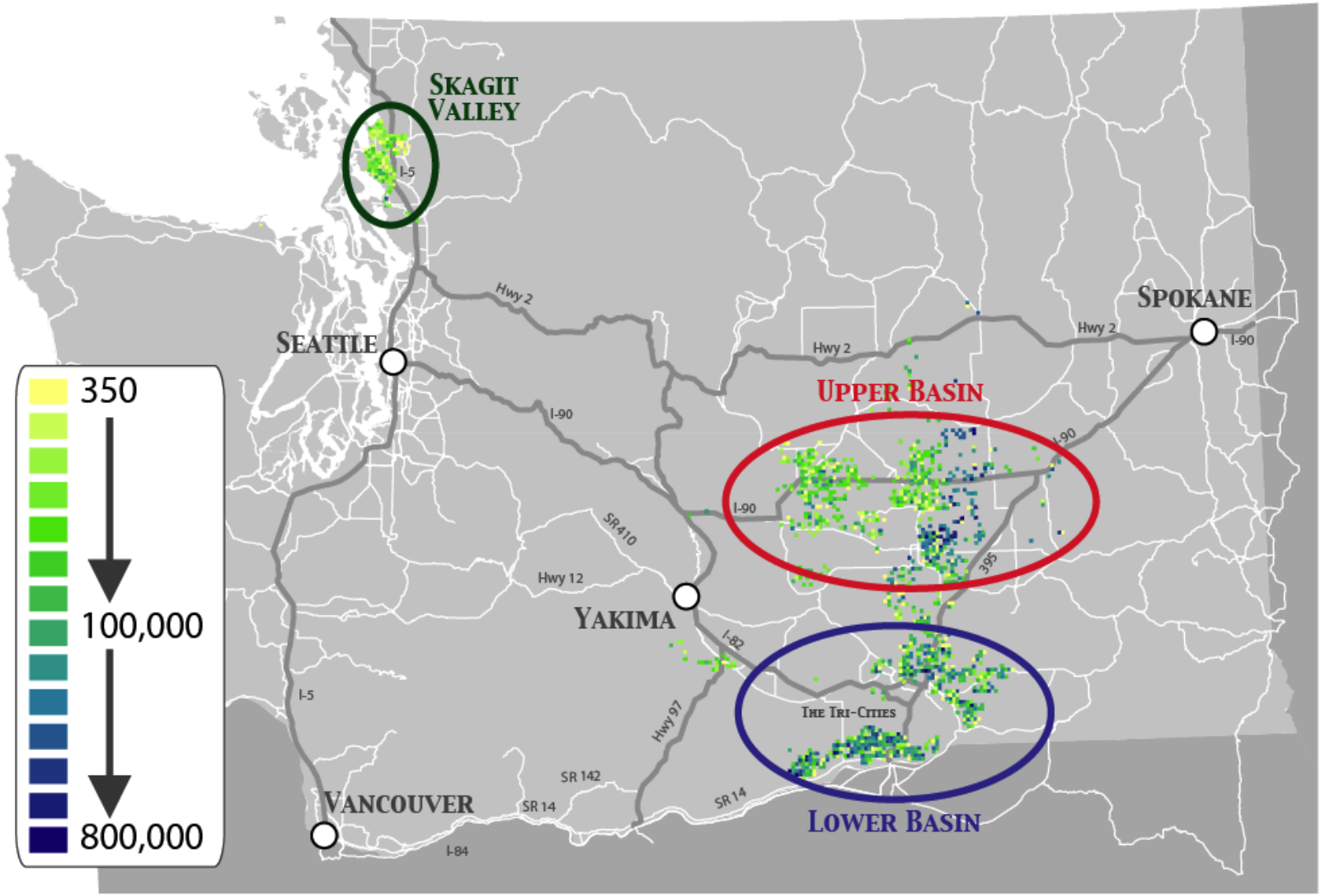
Potato Industry Flow Estimation

Courtesy of the WA State Potato Commission

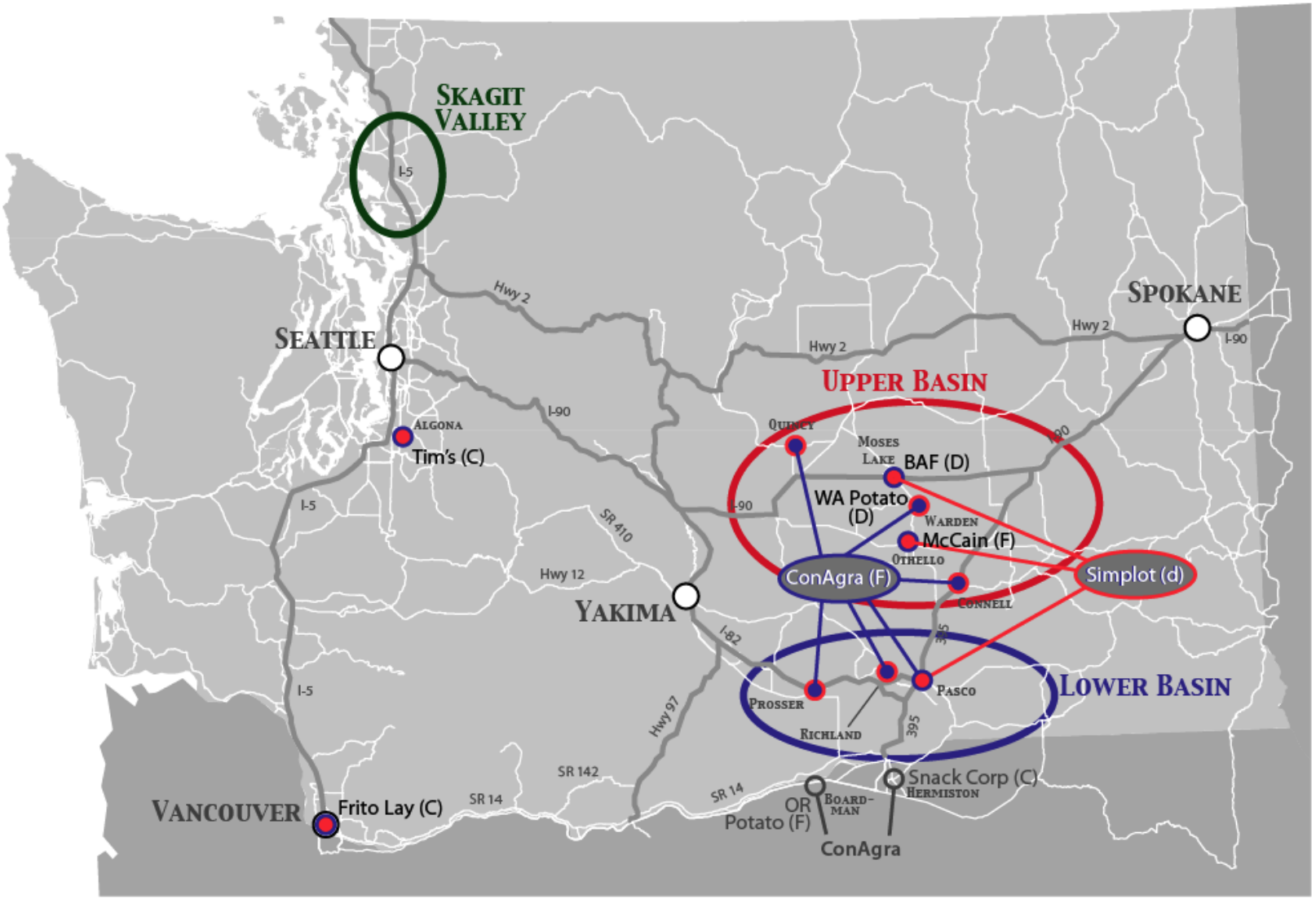
The Potato Value Chain



Washington Potato Production, 2006
Hundredweight by Township and Range

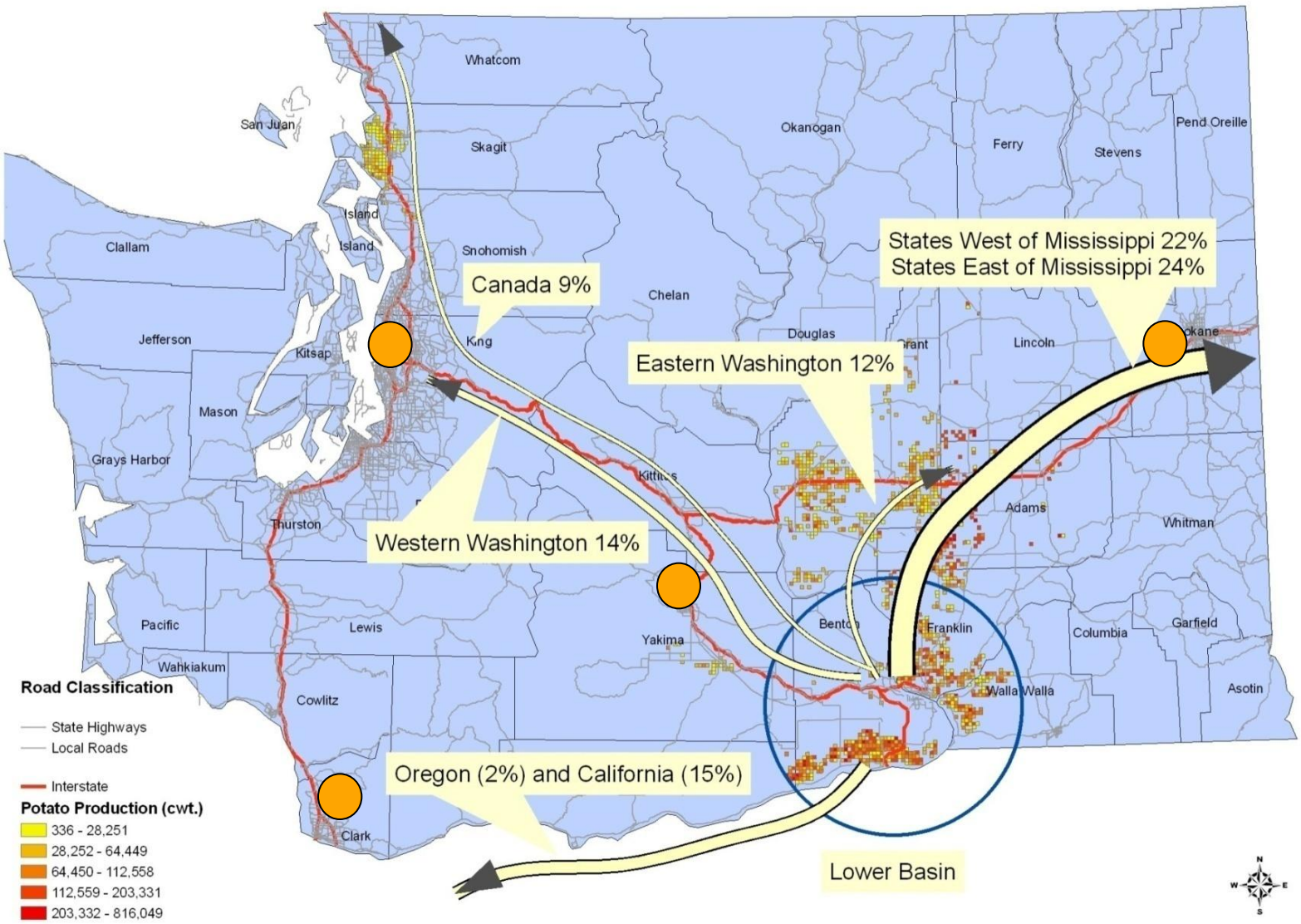


Washington Potato Processors



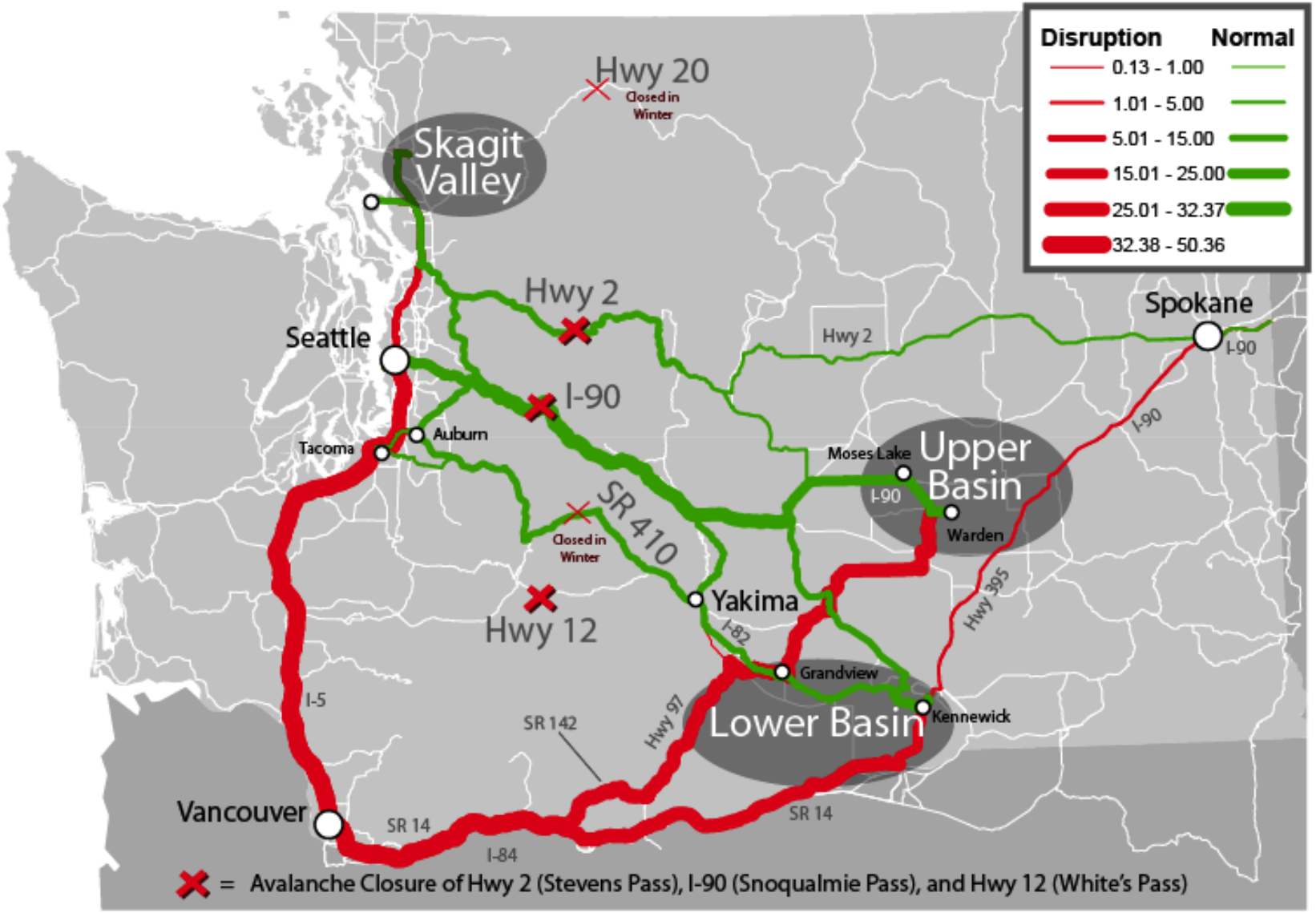
Frozen = (F) --- Dehydrated = (D) --- Some Dehydrated (d) --- Chips = (C)

Shipment Destinations for Lower Basin Potato Production



Washington Potato Movements

Number of Trucks per Day that Traverse WA's Mountain Passes

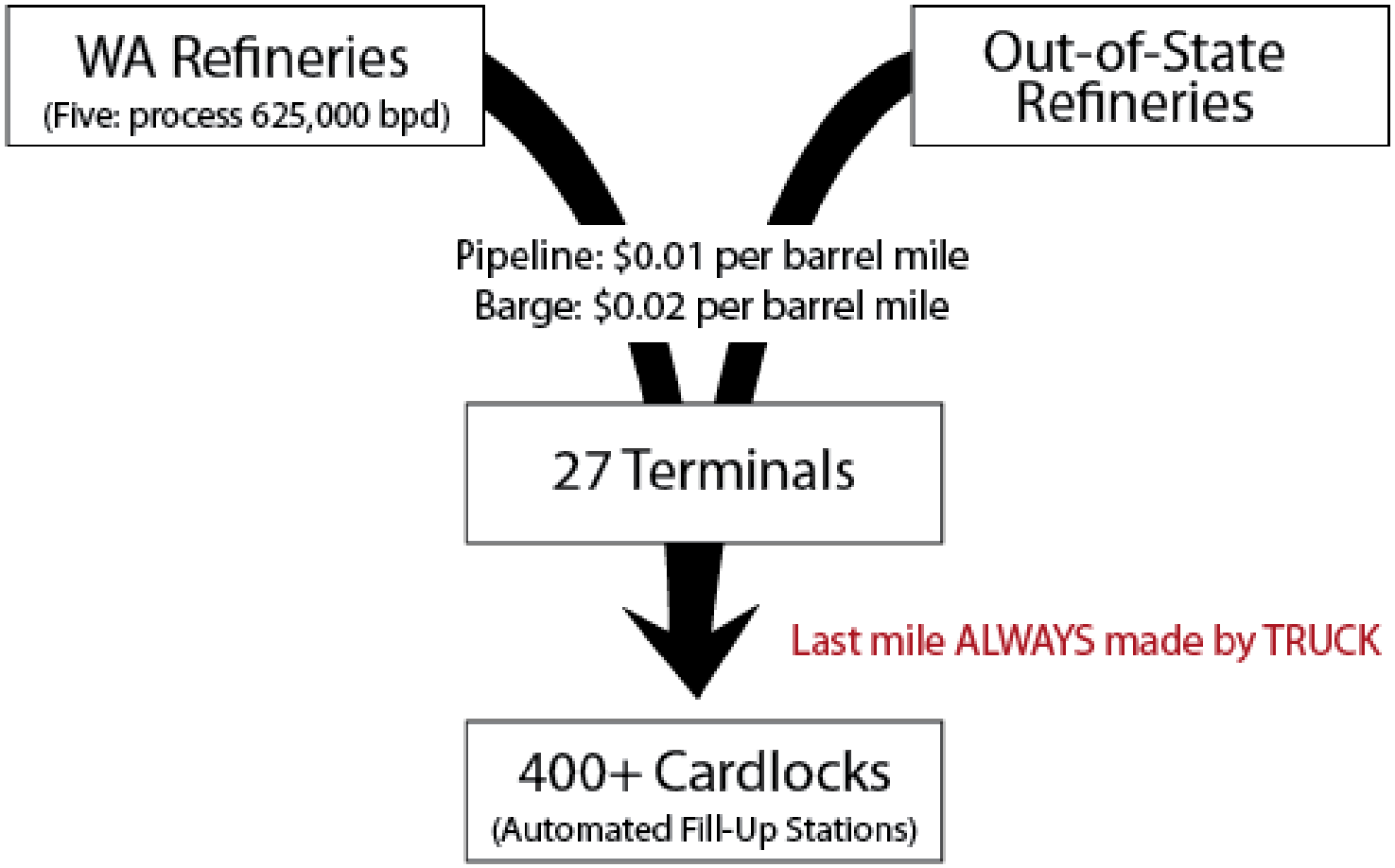


Potato Industry Flows: Summary

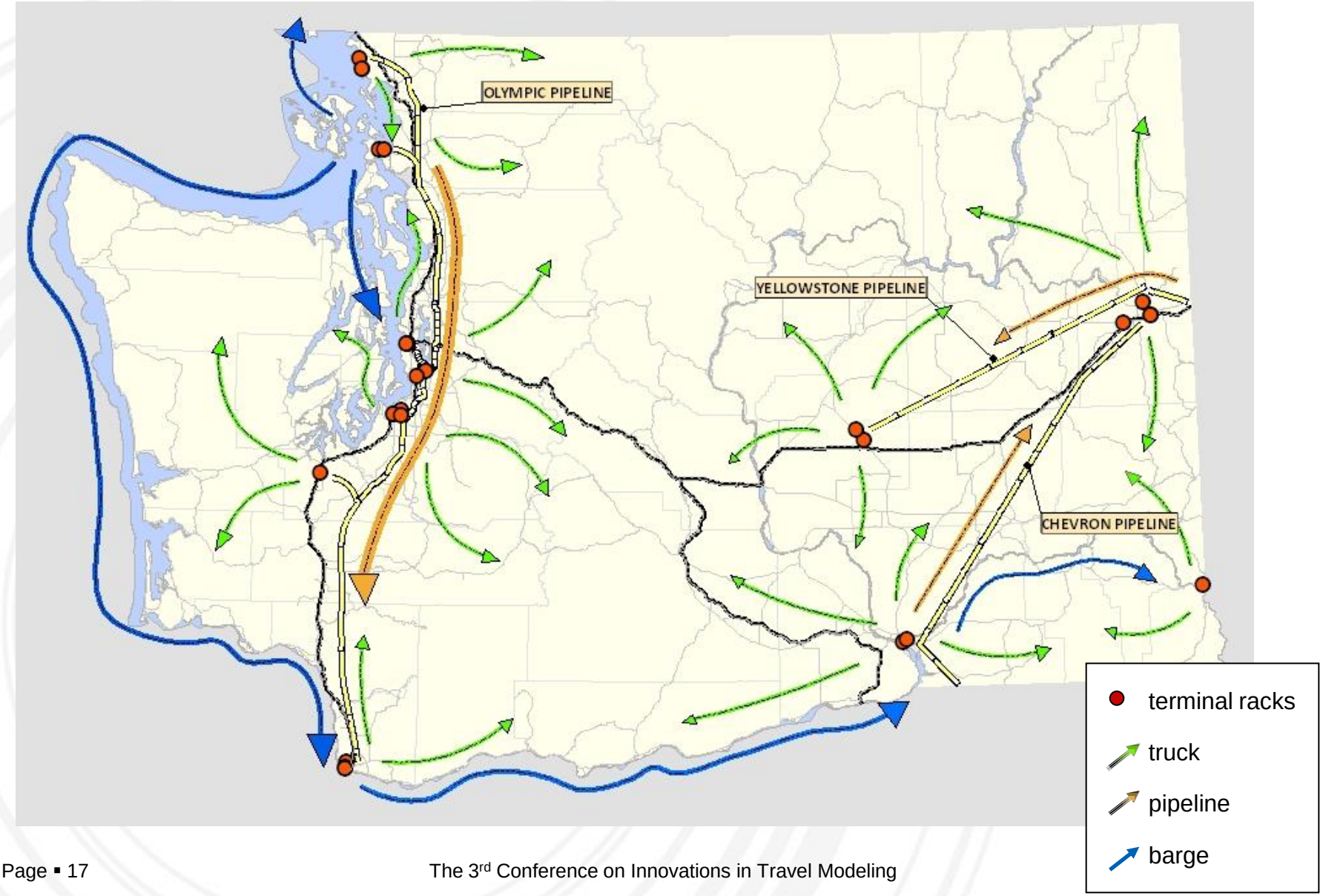
- Significant cross-Cascades travel
- Low profit margins on potato shipments
- Cannot afford to take detours
- Waiting or failure to stock products are expensive
- Very vulnerable to long closures

Diesel Industry Flow Estimation

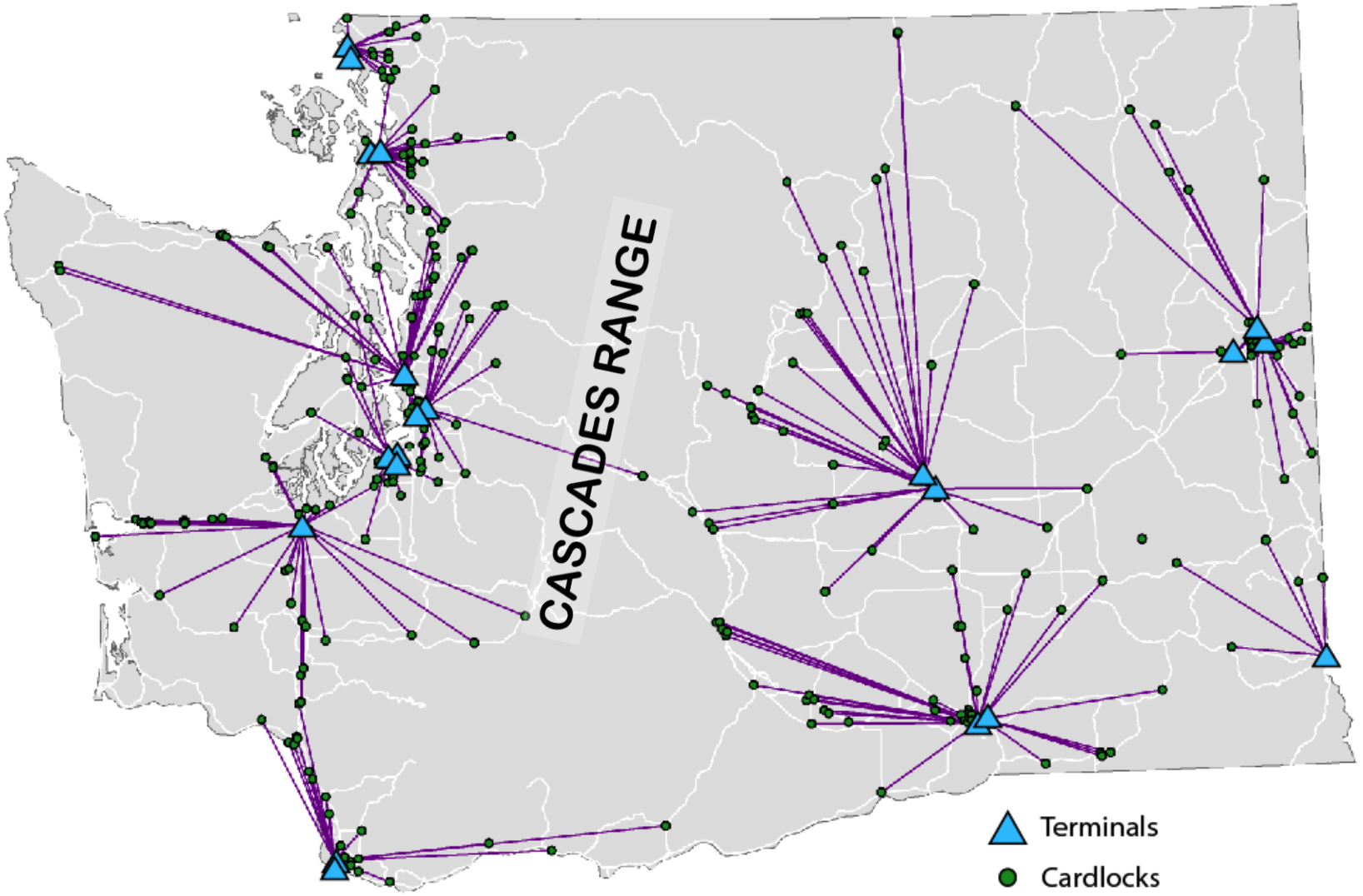
The Diesel Supply Chain



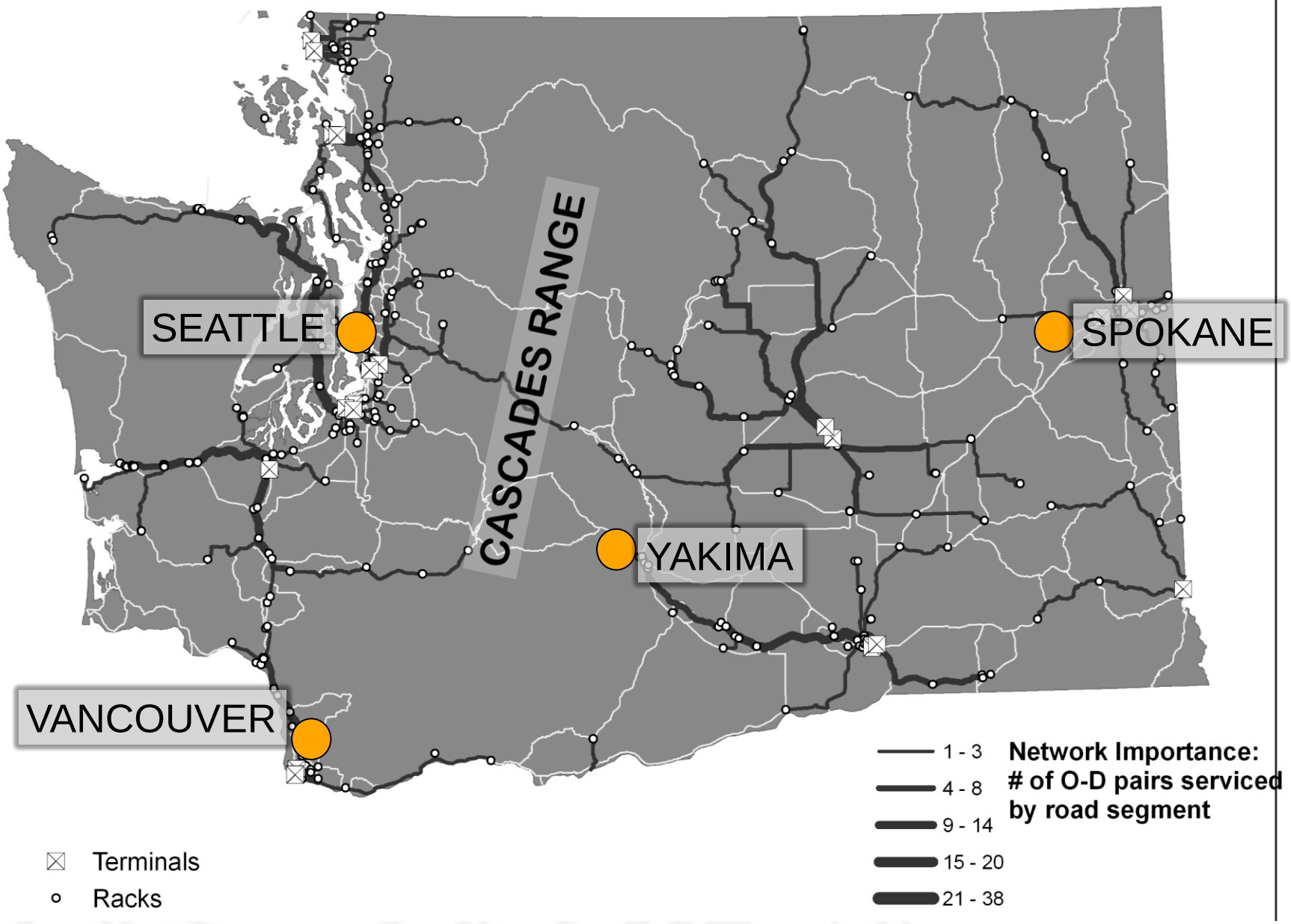
Mapping diesel flows



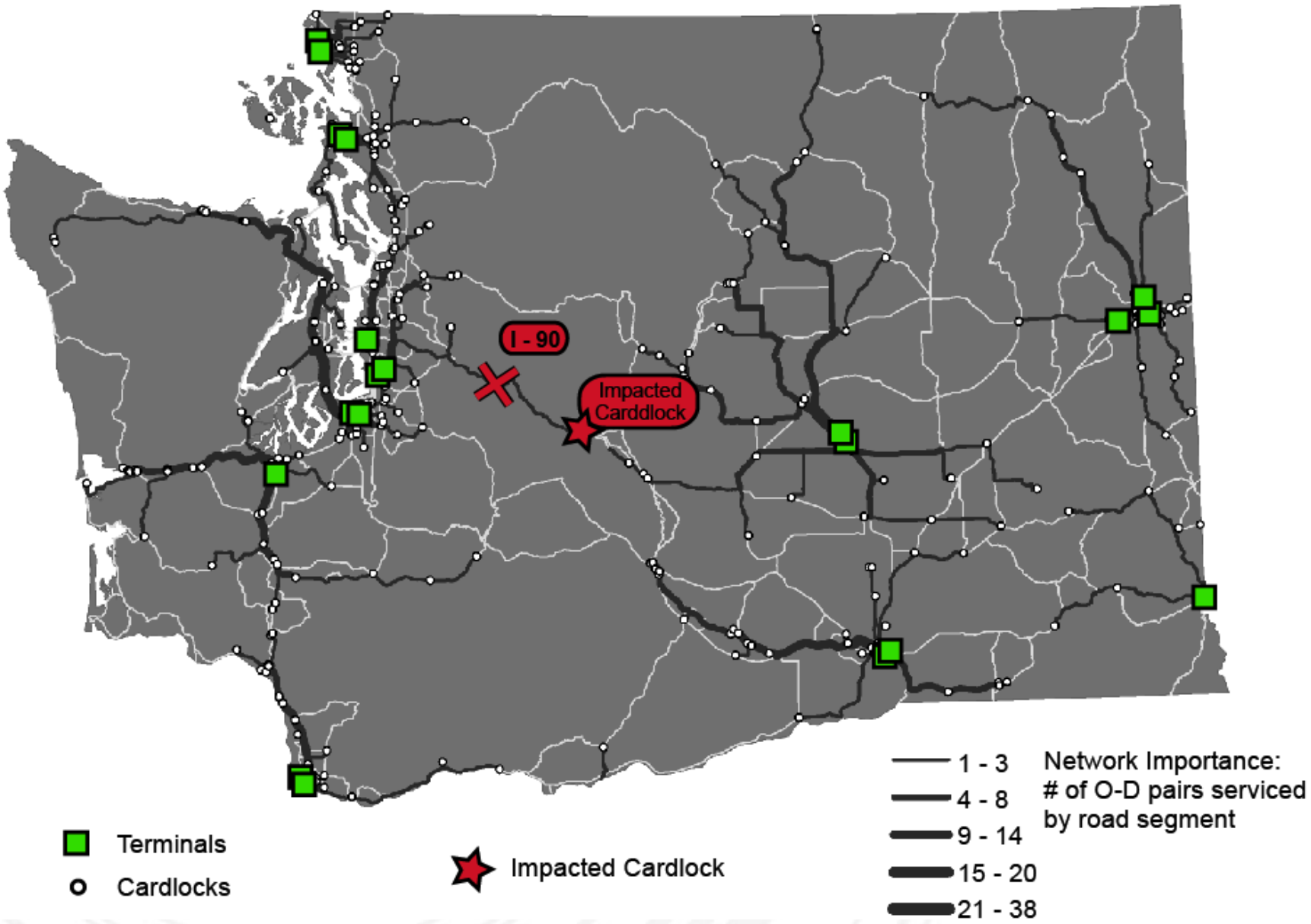
Diesel Terminal Service Areas



Diesel Network Flow Map: Pre-Disruption



Diesel Network Flow Map



Diesel Industry Flows: Summary

- Minimal cross-Cascades travel
- Multimodal network avoids mountain passes
- Distributed terminals provide buffers
- Can estimate network segment importance using known information…
- BUT cannot assess flows because of lack of information

→**Diesel is a higher-value industry, but potatoes are more sensitive to road network disruptions**

(diesel distribution is *HIGHLY* vulnerable to pipeline and/or barge disruption)

Methodological Summary

- Proposed methods evaluate infrastructure use with and without primary flow data
  - Locations of fixed infrastructure are generally available
  - Flow data is much harder to obtain
- Allows evaluation of impact of disruptions
  - Requires two different metrics
- Effectively supplements travel data in a data-poor environment

Photo courtesy of Shell

Thank you

Questions: Anne Goodchild annegood@uw.edu

Data

- Industry Data
  - Potatoes:
    - Washington State Potato Commission data and expertise
    - Previous work by Dr. Jessup and WSDOT
  - Diesel:
    - Washington State Department of Ecology, Environmental Protection Agency, Department of Revenue
    - CFN and Pacific Pride networks
    - Interviews with Marketers and industry experts
- GIS Model
  - Multimodal representation of the state freight infrastructure
  - Includes impedance factors to travel along links in the transportation system