



Maritime Transportation Disruption and Fuel Supply Chains

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MEOPAR

August 2015 NS Fuel Shortage

- Unexpected 3-day fuel outage at Imperial Oil terminal (Dartmouth)
 - ∞ Coincidence of rare events
- Close call
- “No organization... had contemplated a fuel outage of 3 or more days”

(MacNeil, A. and D.J. Keefe. 2015. *The Nova Scotia Fuel Shortage: Report of the Independent Review Panel.*)

Gas shortage in Nova Scotia leads to 'complete insanity' for station owners

Hughie MacEachern says it was 'complete insanity' when his pumps went dry Sunday evening

CBC News - Posted Aug 21, 2015 5:27 PM AT | Last Updated Aug 21, 2015 4:51 PM AT



The manager of the filling station in Pictou said on Sunday there were dozens of other cars deep on either side of the road to get into the station. (Facebook)

www.cbc.ca

Fuel shortage at Halifax-area gas stations

By Julia Wong
Digital Broadcast Journalist Global News

Comments Facebook Twitter Email Print



The Cheapy Tire on Windmill Road was out of gas on Saturday. Julia Wong/Global News

HALIFAX – Several gas stations in the Halifax area are running low or running out of gas, leaving many customers frustrated.

The Cheapy Tire on Windmill Road was out of gas Saturday. Many vehicles drove into the lot only to leave right away after spotting signs stating "Out of fuel."

"We can't exactly tell [customers] when we're going to have fuel," said manager Bill Campbell.

globalnews.ca

Problem

- Transportation infrastructure vulnerable in disasters, just-in-time inventory systems are rendering the system more fragile, and disruption has severe consequences
- Studies on ports, economic loss, relief supplies, global supply chains...
- Gaps: maritime transport systems, regional supply chains, critical commodities (fuel) to communities, emergency response period
- How can we model regional transportation disruption **to support decision-making for system resilience?**



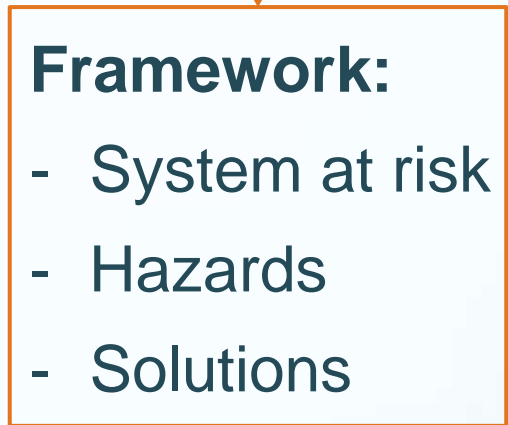
(Photo: EERC, UC Berkeley) (Photo S. Chang)

“Vancouver Island is dependent on ferry services for an estimated 90% of its food and food supply in Victoria is estimated to be sufficient for three days.”

--- Victoria OCP (2012)

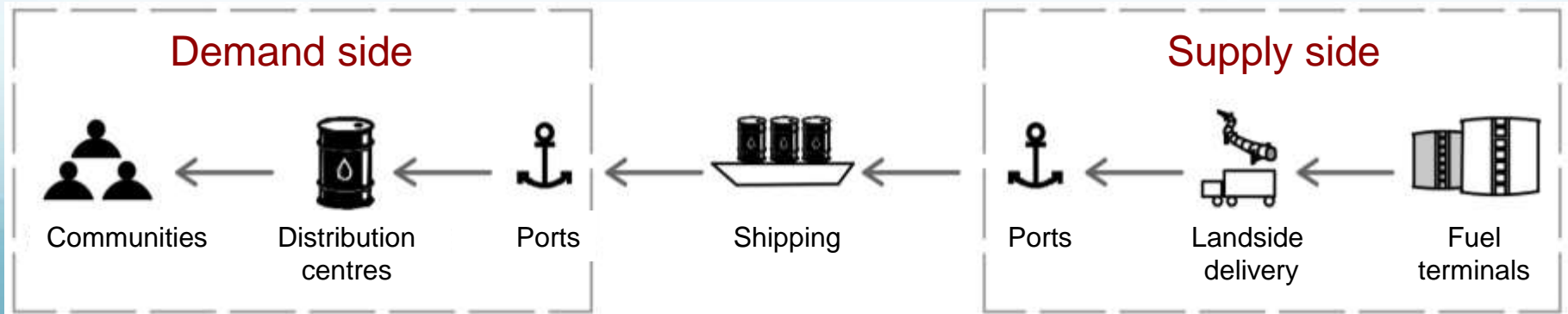
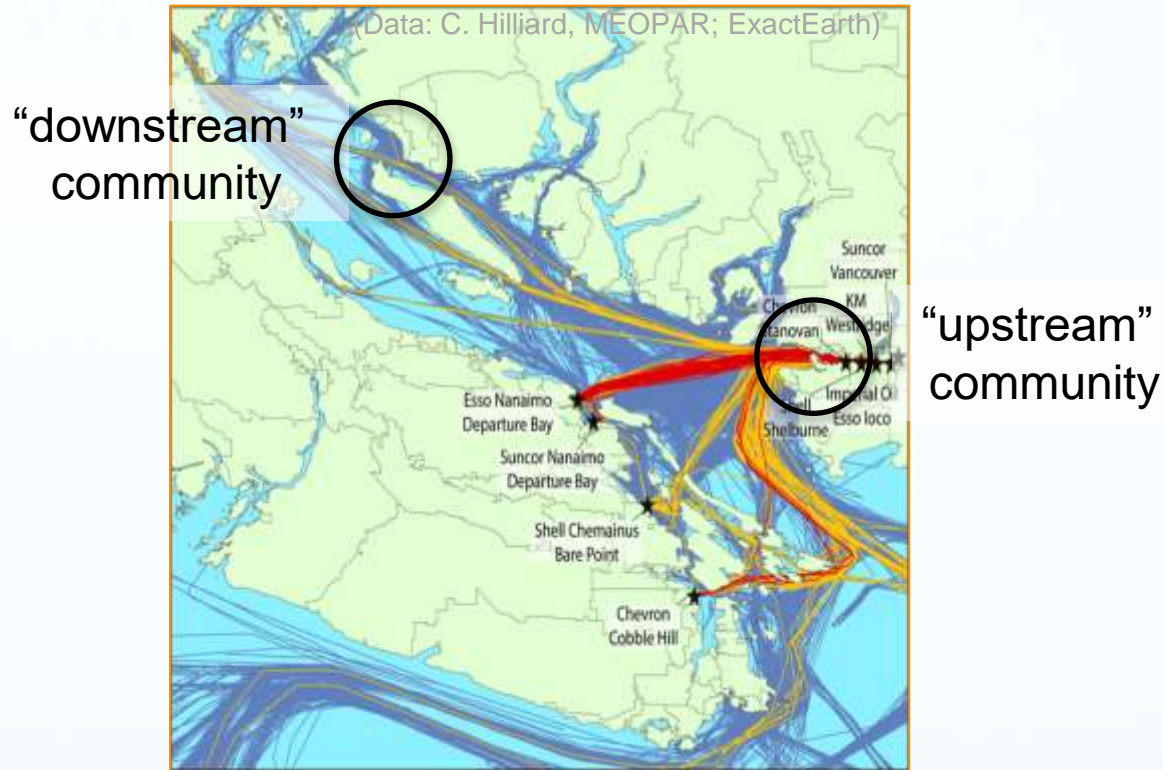
Approach

- Understand the system
 - ∞ Case study: coastal BC
 - ∞ Data and insights from experts:
 - 19 interviews (27 experts)
 - 4 focus groups/workshops
 - Survey (n=31)
 - ∞ Secondary data, incl. AIS ship tracks



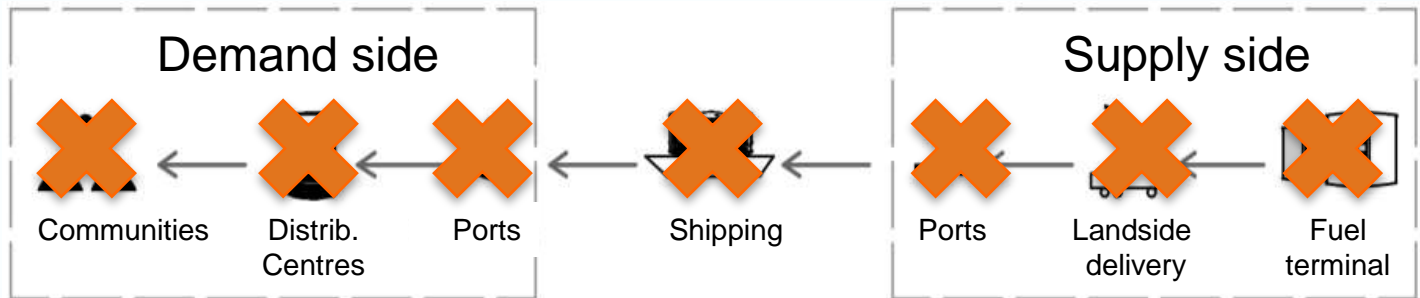
- Model the system
- Simulate disruptions
- Simulate resilience actions

System at Risk – Fuel Transportation



Hazards

Catastrophic earthquake



Local EQ (downstream)



Local EQ (upstream)



Blocked ship channel



Labor strike (truckers)



(etc.)

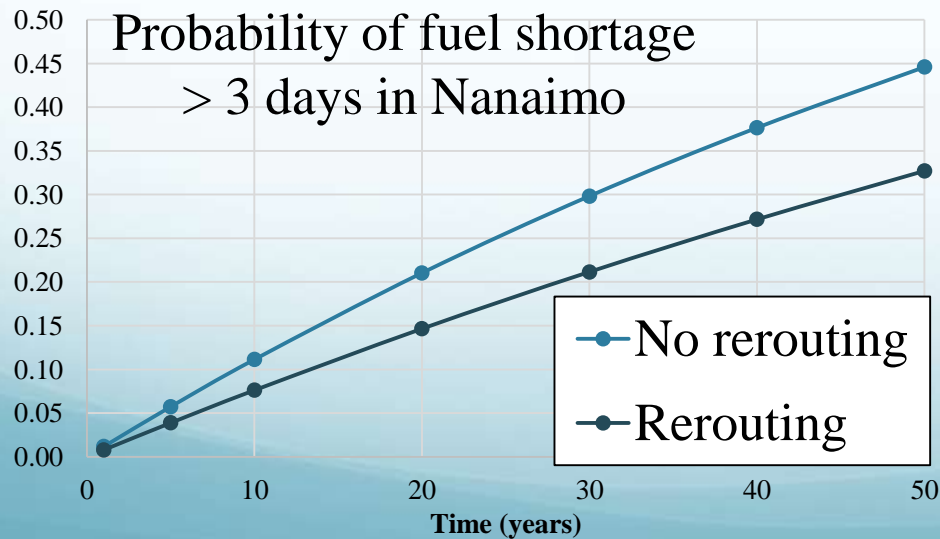
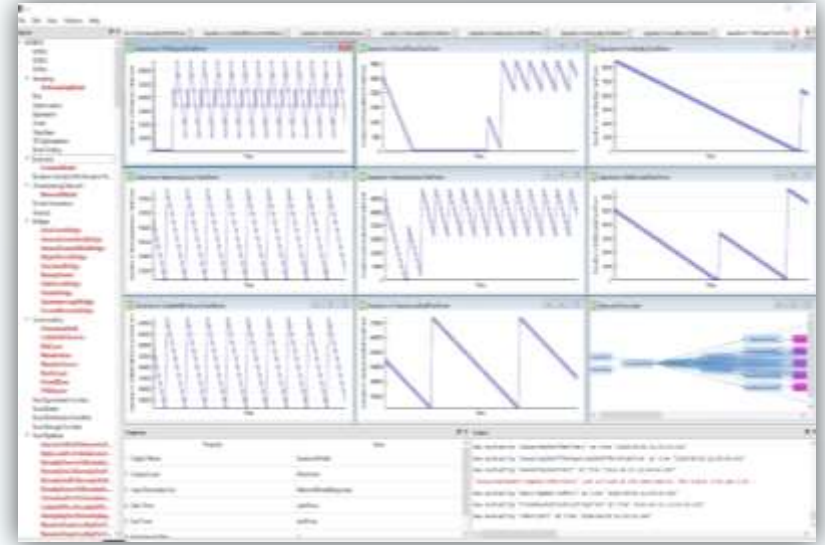
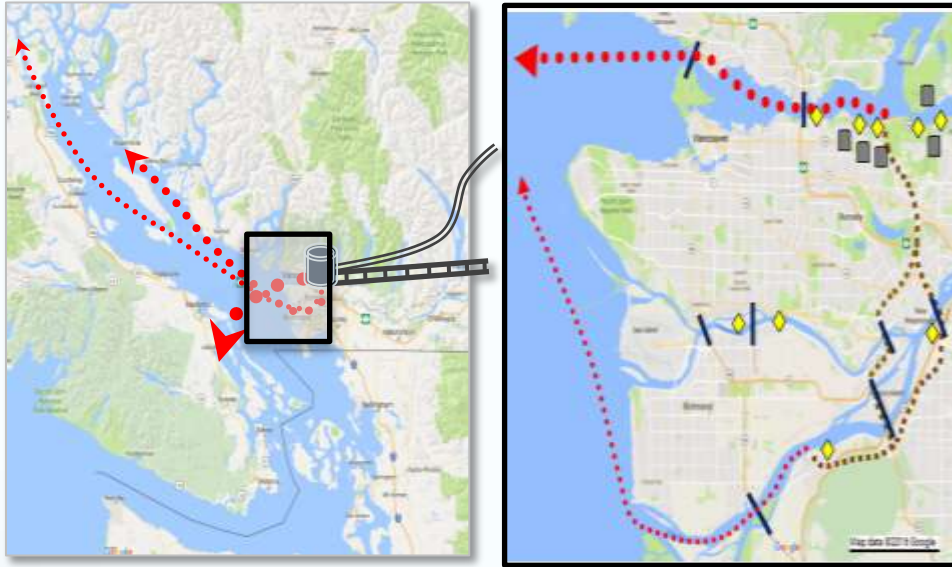
Example Solutions

System element	Objective	
	Minimize initial disruption	Develop capacity to handle disruption
Supply and land side	<ul style="list-style-type: none"> • Seismically retrofit storage tanks • Storage/warehousing 	<ul style="list-style-type: none"> • Protocols for prioritizing cargo
Port	<ul style="list-style-type: none"> • Seismically retrofit wharves • Protocols for harbor evacuation of ships (tsunami) • Warning systems 	<ul style="list-style-type: none"> • Mobile harbor cranes • Backup electric power • Emergency sharing of facilities • Underwater surveillance capacity • Operating longer hours
Route (incl. navigation)		<ul style="list-style-type: none"> • Emergency alternate routes
Ship	<ul style="list-style-type: none"> • Warning systems 	<ul style="list-style-type: none"> • Resource inventories (ships) • Emergency staffing
Regulations		<ul style="list-style-type: none"> • Emergency "rule-breaking"
Demand and local distribution		<ul style="list-style-type: none"> • Household stockpiling • Rationing, prioritizing, conserving

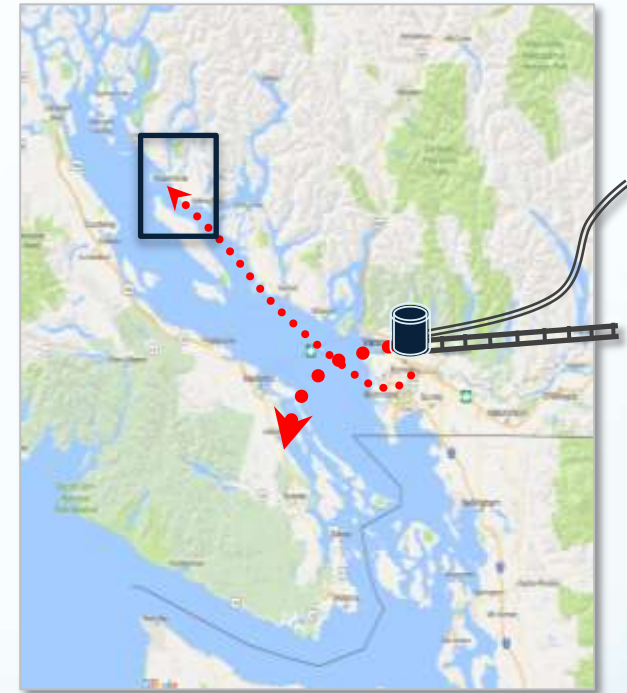
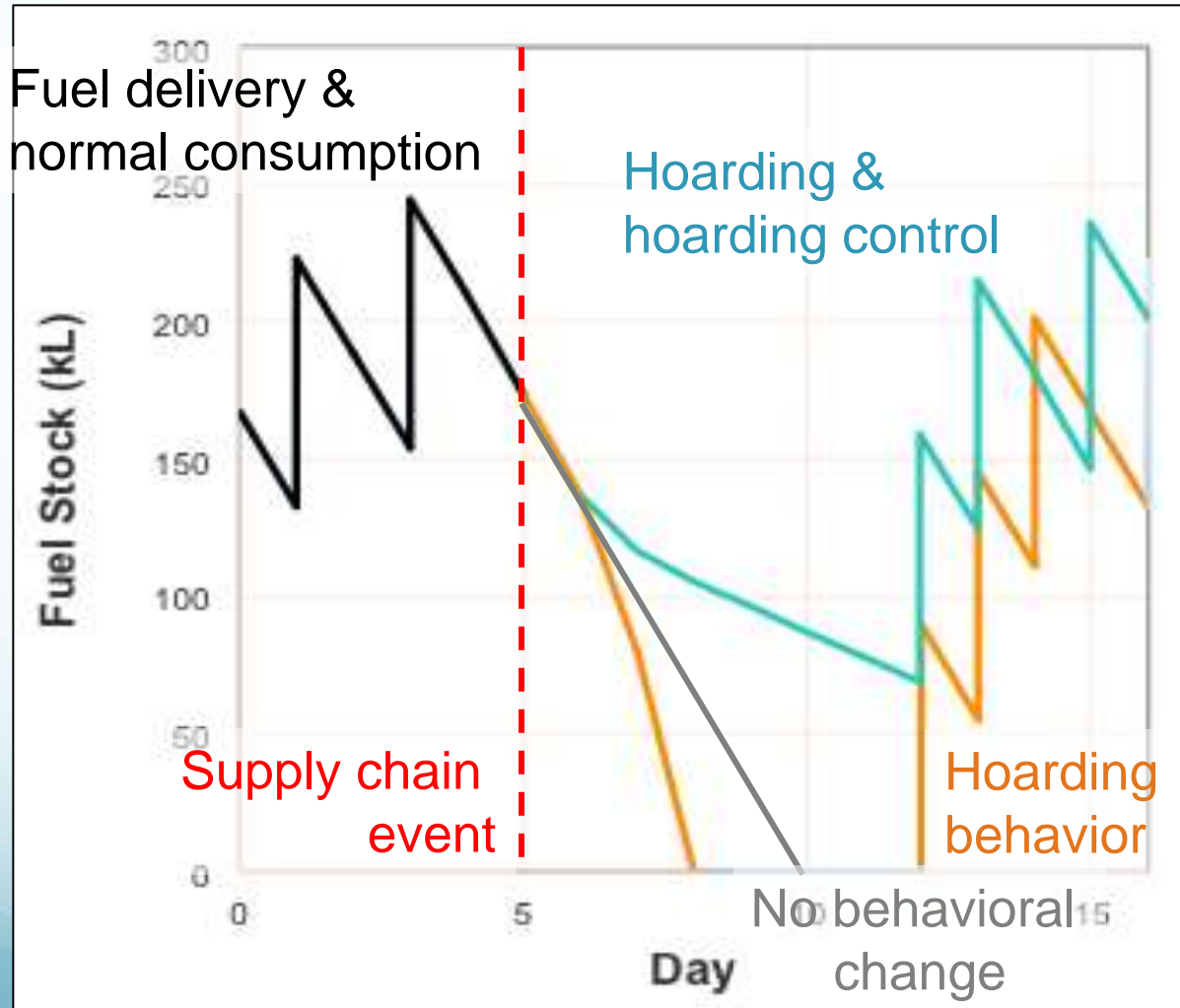
Modeling Approach

- Simulation-based
 - ☞ Focus on spatial flow of commodity through regional transport system
 - ☞ Explore alternative decisions; not optimization
- Reasonably realistic
 - ☞ Capture essential elements of system and operations
- Modular
 - ☞ Allows focus on different aspects of problem
- Different types of decisions
 - ☞ Many decisions affect system resilience; no single decision-maker
- Operational outcome variables
 - ☞ Duration of disruption; probability of outage days $>$ threshold; volume of local inventory available

Modeling Transport System Decisions



Modeling Demand Management Decisions



Conclusions

- Models are needed for an integrated understanding of system risks
- Many types of hazards, many types of solutions, many decision-makers
- Some local specificity is important
- General problem needs more attention: How to build community resilience to supply chain disruption and community isolation?