

EAGER ISN

Research Team



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- Overall Objectives: “Implement a potentially transformative coupled agent-based and interdiction optimization modeling approach to demonstrate:
 1. how current efforts to disrupt narco-trafficking networks are in fact making them more widespread, resilient, and economically powerful;
 2. the potential for alternative interdiction approaches to weaken and contain traffickers.”

Research Questions

- Research Question 1: How do alternative interdiction strategies affect key operational aspects of narco-trafficking networks – specifically the volume and price of cocaine delivered?
- Research Question 2: How do operational changes within narco-trafficking networks in response to interdiction relate to the scale of spatial and structural adjustments of trafficking routes?

Hypotheses

- Hypothesis 1a: **High intensity**, targeted interdiction events result in **large disruptions** of cocaine volume delivered but with **little effect on prices**
 - Narco-trafficking networks compensate with **spatially distant and large structural adjustments** to trafficking routes to locations with **higher vulnerability** and **comparable value** to enroll in the narco-trafficking network.

Hypotheses

- Hypothesis 1b: **Low intensity but consistent** interdiction efforts result in **small disruptions** of cocaine volume delivered and **localized price increases**
 - Narco-trafficking networks compensate with **proximate and small structural adjustments** to trafficking routes due to **locally high profit potential** driven by elevated interdiction risk.

Hypotheses

- Hypothesis 2: **Low intensity** interdiction strategies (e.g., sweeps of vulnerable areas rather than specific nodes) will **reduce the spatial footprint** of narco-traffickers and **overall volume** of cocaine delivered.
 - Mechanism – spatial “jumps” are based on risk-profit trade-off, for which there is a threshold
 - More risk = more people in the game, risk premium to be had
 - Too much risk = more profitable to establish new node elsewhere

Theorizing Spatial Vulnerability to Narco-Trafficking

- **Routine activities theory (RAT)** is criminological theory that studies spatio-temporal patterns of crime and victimization within particular situational contexts following a rational decision-making process of the offender. Crime will occur at the convergence of:
 - a motivated offender with both the inclination and ability to commit crime (e.g., extreme profits, social connections)
 - an object (or person) seen as valuable to the offender (e.g., trafficking space)
 - insufficient guardianship (e.g., law enforcement, peers, social organizations) capable of preventing crime from occurring

Theorizing Spatial Vulnerability to Narco-Trafficking

- Drug trafficking will preferentially locate in areas with **routine activities that facilitate trafficking** and/or provide opportunities to **mix licit and illicit activities** to evade detection.
 - E.g., avenues for money laundering, modes of trafficking (e.g., media reports at airports)
- Deliverable: Sub-national **map of vulnerability**
 - Money laundering opportunities (choice set, existing business, Western Union, etc.)
 - Land-use and tenure arrangements.
- With the spatial footprint of narco-trafficking route adjustments in response to interdiction, test Hypothesis 1 by identifying **characteristics of new trafficking node locations** following interdiction events.

Interdiction Modeling

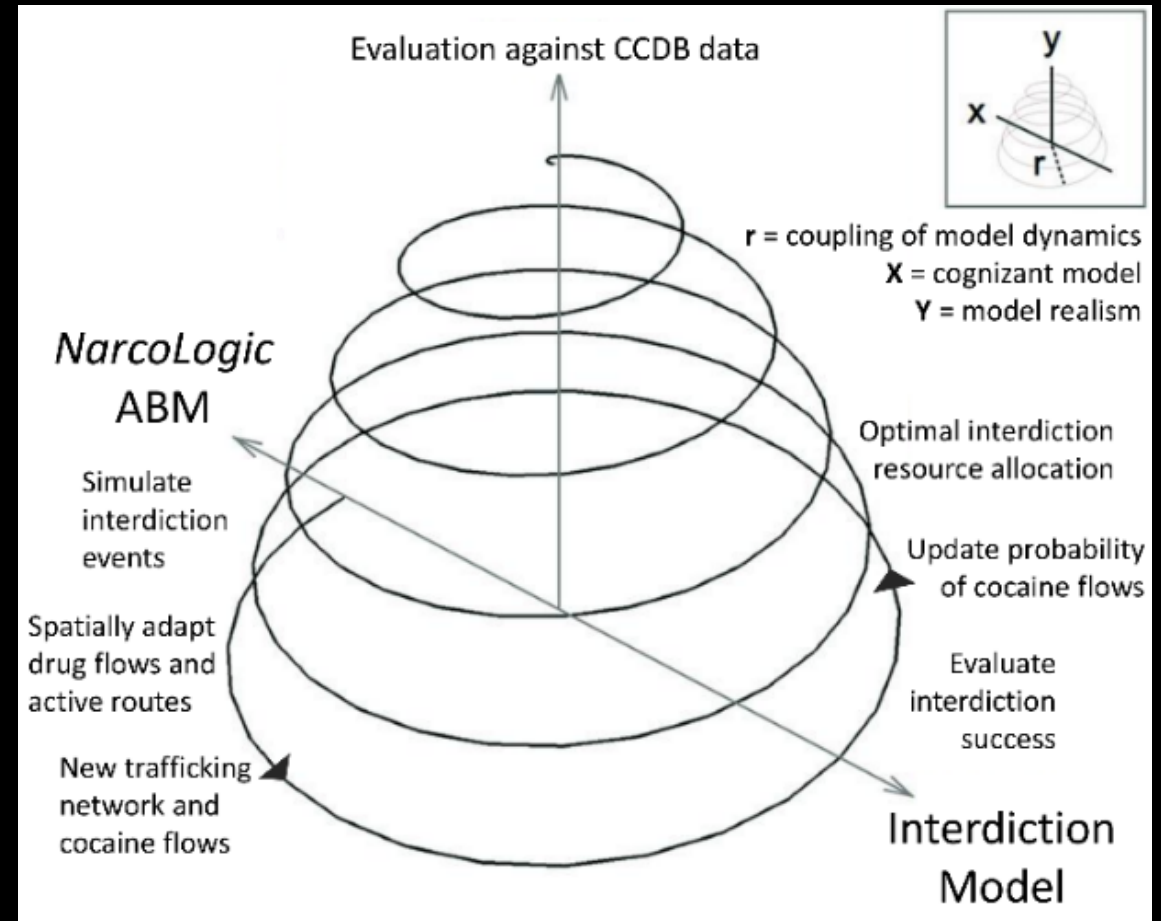
- Interdiction models: reduce the ability of illicit actors to move goods through a network, increase the length of the path needed to move illicit goods, maximize the probability of disrupting unwanted flow, or minimize interdiction costs
 - Flow is typically a **known data input**, rather than being dynamic.
 - Interdiction may also be presumed to be a **single act** of assigning interdiction resources to some element of the network.
 - A more holistic approach recognizes that interdiction activities in one part of the network are likely to influence flows in other parts of the network over the planning horizon of interdiction operations -> **need dynamic interdiction model**

Interdiction Modeling

- Begin with a baseline formulation that was originally generated in the context of **sweeping networks** for Improvised Explosive Devices (IEDs) in order to minimize risk on the transport network
- Goal is to **optimally allocate interdiction resources** to segments of the drug transport network to maximize drug seizure volumes over the entire network, and over the entire planning horizon.
- Deliverable: Integrated ABM and interdiction models that take into account the **effectiveness of past interdiction** events and the **return time** to highly profitable and/or vulnerable routes.
- Probabilistic values will be replaced with ABM-simulated network spatial and operational changes to **endogenize trafficker-interdiction interactions** and enable model integration

Model Integration

- Deliverable: Formulate a **family of models** (i.e., alternative interdiction strategies) that incorporate temporal change, and seek interdiction solutions over the entire interdiction planning time period.
- Interdiction models will inform and be informed by sequential iterations of the NarcoLogic ABM in an upward spiral of model development and integration.



Alternative Interdiction Strategies

Three alternative interdiction strategies:

1. **Infrequent, high-intensity** (i.e., nearly 100% effective), and targeted interdiction of trafficking routes between two suspected nodes (current practice and baseline case);
2. Dramatic de-escalation of current practice
3. **Low-intensity** (i.e., less effective) and **frequent** interdiction sweeps in the **highest vulnerability areas** (derived from RAT, section 4.2);
4. Interdiction strategy 2 + **sweeps spatially concentrated** near recently interdicted route segments.

To test Hypotheses 1 and 2, overall differences in delivered cocaine volumes, prices, and spatial activity will be extracted from *NarcoLogic* and compared for each interdiction strategy (via matching)

Data and Model Validation

- A follow-up request to the Office of National Drug Control Policy (ONDCP) is currently underway to obtain additional years and more systematic cocaine flows data from the Consolidated Counterdrug Database (CCDB).
- Same strategy for model validation as used in first iteration of *NarcoLogic* (Pattern-Oriented Modeling) comparing timing and magnitude of cocaine flows
 - Adding media data (?); price data (?)

Expected Outputs

- Publications (target journal):
 - Linking anomalous deforestation to narco-trafficking responses to counterdrug interdiction (PNAS USA)
 - Spatial patterns of narco-trafficking intensity under different interdiction scenarios (Int. J. Drug Policy)
 - Effectiveness of alternative network interdiction strategies (Transportation Science)
 - Mapping narco-trafficking money laundering opportunities (Criminology)
 - Integration of agent-based and network optimization model for simulating complex adaptive networks (GeoJournal).

Expected Outputs

- Extramural funding proposal targets:
 - NSF: Operations Engineering – Disrupting Illicit Supply Networks (to follow EAGER DCL)
 - NSF: Geography & Spatial Sciences – annual solicitation (17-566)
 - First Thursday in September
 - Gordon and Betty Moore Foundation/Open Society Foundation

Resources & Tasks

- 1 or 2 Ph.D. student(s) (Geography and Geography/CCJ) and/or 1 M.S. student (Geography)
 - Model development and integration; validation with CCDB
 - Vulnerability mapping; spatial analysis of route adjustments
- CCJ undergraduate researcher
 - Literature review: vulnerability characteristics through RAT lens
- Postdoc through ATI?

The project will follow this timeline:

	Year 1		Year 2	
Student hiring; Additional CCDB data acquisition	■			
ABM and interdiction model development, integration, and validation	■	■	■	
Scenario development, hypothesis testing, interpretation		■	■	■
Manuscript preparation and submission; Conference presentations		■	■	■
All team meeting				■
Project evaluations (formative and summative)	■	■	■	■

Grantee Meeting

- Arlington, VA on February 4-5, 2019
- “... continue to evolve this research community through interactions with fellow researchers and representatives of federal agencies.”
- Prepare supplemental request to support travel

EAGER as a launching pad ...

- NSF: Can we detect signatures (spatial or otherwise) of illicit supply network transactions?
 - Money laundering expertise
- Linking to LITCA project – anomalous deforestation
- Connecting to PEGASUS project: birth of a new node
 - Can we recreate that process?
 - Telecoupling with other locations through the trafficking network in response to interdiction
 - Can this give us insight into where new nodes establish, or old nodes reactivate, in the future?