Environmental Assessment of Rail Infrastructure in Illinois

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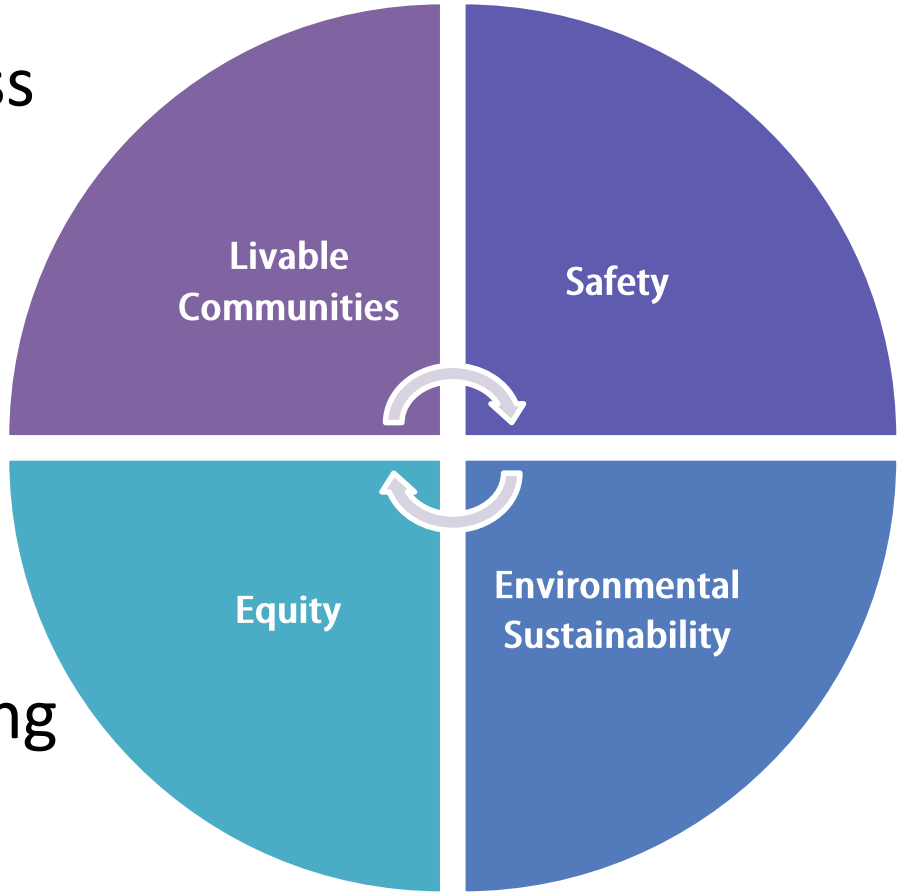
Outline

- Project Overview
- Research Methodology
- Highlights of Ongoing Research
  - Sustainable rail assessment metrics
  - Location-specific modeling and data integration
  - Web mapping tool under development
- Summary

Project Overview

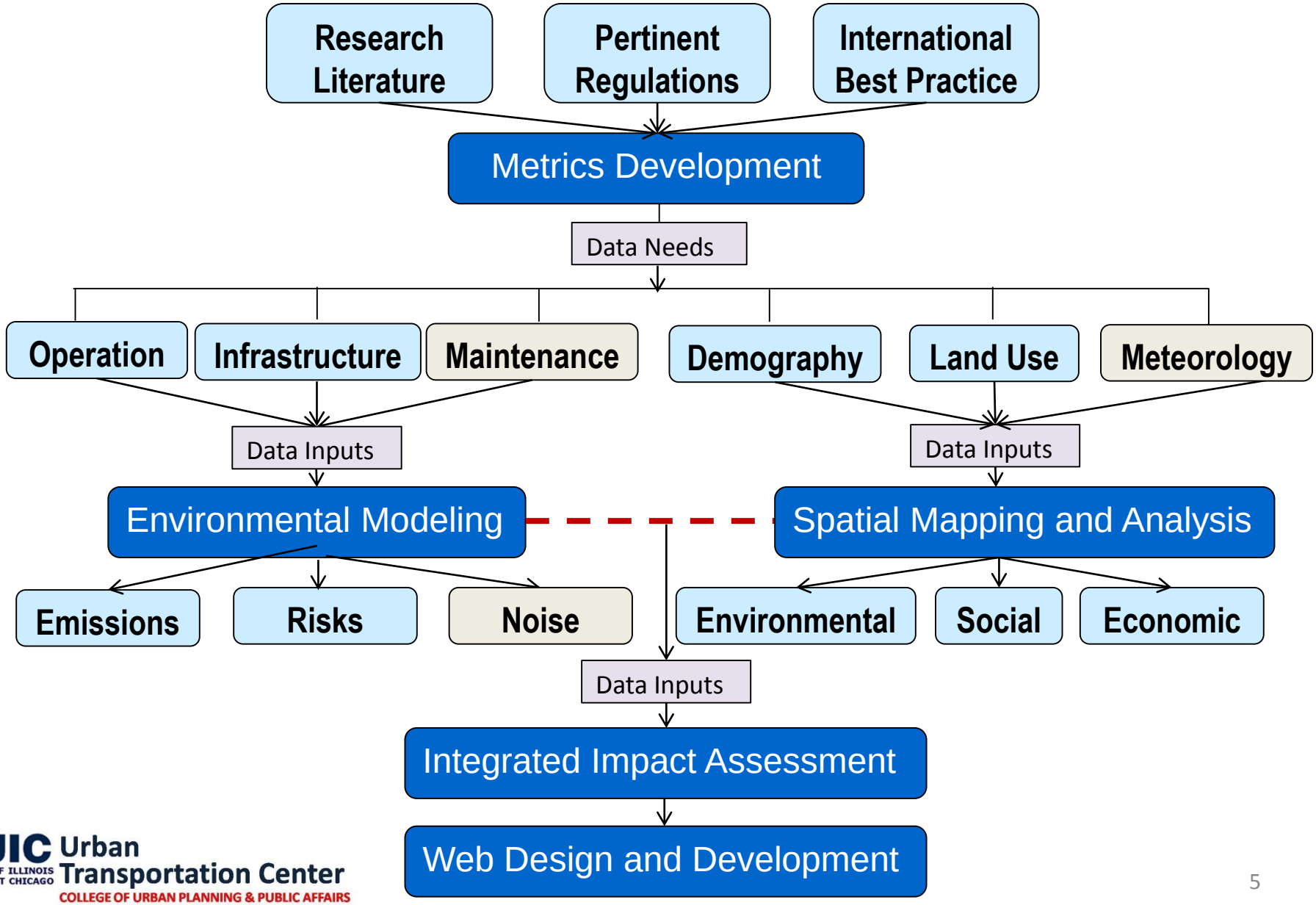
- Objective
  - Increase the effectiveness and efficiency of environmental impact assessment of rail infrastructure
- Approach
  - Integrated system view
  - Location-specific modeling
  - One-stop GIS database
  - Interactive web interface



Expected Use of the Research Results

- Pre-NEPA review
- Streamlining rail planning process
- Identification of high priority and sensitive areas for sustainable rail planning and management
- Environmental advocacy
- Public engagement

Research Methodology



Sustainable Rail Assessment Framework: General Structure

- Category
  - Transit rail
  - Commuter passenger rail
  - Freight rail
- Metric
  - Performance (vs. Output)
- Spatial & Non-Spatial
  - GIS Interface
  - Spreadsheet
- Tiered Metrics
  - Tier 1: Required or Commonly Used
  - Tier 2: Advanced Assessment
- Benchmark data (work in progress)
  - National & Regional
  - Best Practice

Sustainability Checklist: Transit Rail

(Tier I)

SPATIAL INDICATORS			
DOT Goal	**Strategy**	**Metric**	**Legislation or Guidance**
Safety	Improve rail safety performance	Passenger fatality and injury rate	MAP-21; OSHA; FRSA; 49 CFR B; DOT *Strategic Plan 2012 - 2016*
	Avoid natural hazard areas	Acres in high flood hazard area	Flood Disaster Protection Act
		Acres in high seismic hazard area	49 CFR 41 Seismic Safety
		Acres in historical tornado hazard area	Disaster Mitigation Act (PL 106-390)
Environmental Sustainability	Reduce air emissions	Pounds of greenhouse gases emitted per capita-mi	MAP-21
	Protect high-quality wetlands and water resources	Acres on or near wetlands or water resources	Clean Water Act; Fish and Wildlife Coordination Act; Illinois Interagency Wetlands Policy Act
	Protect high-quality habitat for threatened and endangered species, and species of concern	Acres on or near critical habitat	Endangered Species Act; Illinois Endangered Species Act
	Protect high-quality natural & agricultural landscapes	Acres on or near natural and agricultural lands	Farmland Protection Policy Act; Illinois Farmland Preservation Act; Illinois Natural Areas Preservation Act

Sustainability Checklist: Transit Rail

(Tier I – Cont'd)

SPATIAL INDICATORS			
Livable Communities	Improve rail accessibility	Population density within a half-mile of rail transit station	USEPA *Guide to Sustainable Transportation Performance Measures (* 2011)
		Employment density within a half-mile of rail transit station	USEPA *Guide to Sustainable Transportation Performance Measures (* 2011)
	Locate stations and service frequency equitably throughout service area	Percentage of minority individuals within service area of station	Title VI; 49 CFR 21; FTA C 4702.1B
		Percentage of low-income households within service area of station	Title VI; 49 CFR 21; FTA C 4702.1B
	Avoid disproportionate adverse impacts to minority and low-income populations	Percentage of service reductions in low-income or minority communities	Title VI; 49 CFR 21; FTA C 4702.1B
		Acres within or near low-income or minority community area	Uniform Relocation Assistance and Real Property Acquisition Act; EO 12898; 49 CFR 24
	Protect cultural and recreational resources	Acres on or partitioning national trails or other greenways	National Trails System Act; Land and Water Conservation Fund Act
		Acres on or near parks and recreational land	49 USC 303 Sec. 4(f); Land and Water Conservation Fund Act
		Acres on or near historical or cultural areas	National Historic Preservation Act; 49 USC 303 Sec. 4(f); Archeological and Historic Preservation Act; American Indian Religious Freedom Act; Illinois Historic Preservation Act
	Protect community cohesion	Acres partitioning residential or commercial districts	NEPA; Passenger Rail Investment and Improvement Act; Illinois Highway Code

Sustainability Checklist: Transit Rail

(Tier I – Cont'd)

NON-SPATIAL INDICATORS			
DOT Goal	**Strategy**	**Metric**	**Legislation or Guidance**
State of Good Repair	Maintain rail assets in a state of good repair	Percentage of rail assets evaluated as adequate condition or better	DOT *Strategic Plan 2012 - 2016*
	Perform sustainable economic investment in rail	Capital funds expended per vehicle revenue mile	RTA *Subregional Peer Report* (2011)
		Operating cost per passenger mile	RTA *Subregional Peer Report* (2011)
Livable Communities	Improve rail access for limited-mobility passengers	Percentage of passenger rail stations compliant with ADA	American Disabilities Act; 49 CFR 37
	Reduce road traffic congestion	Average daily number of congested hours of weekday travel	Haghshenas, et al. *Urban sustainable transportation indicators for global comparison.* Ecological Indicators (2012)
	Provide high-quality service for all passengers	Percentage of "very satisfied" survey responses	FRA *Metrics and Standards for Intercity Passenger Rail Service* (2009)
	Provide all stakeholders with opportunity for meaningful input on projects and operations	Number of public meeting attendees and comments	NEPA; EO 13045; EO 13175
Economic Competitiveness	Increase rail mode share	Mode share of trips	USEPA *Guide to Sustainable Transportation Performance Measures* (2011)
		Transit rail system passenger miles per capita	DOT *Strategic Plan 2012 - 2016*
	Maximize economic returns on rail investment	Operating expense per vehicle revenue-mi	Dobranskyte-Niskota, et al. *Indicators to assess sustainability of transport activities.* European Commission (2007)

Sustainability Checklist: Transit Rail

(Tier I – Cont'd)

NON-SPATIAL INDICATORS			
Environmental Sustainability	Protect wetlands and habitat	Survival rate of nearby wetland plants and habitat	EO 11990; Robin Environmental Consultants *California high speed rail ecosystem management plan* (2012)
	Prevent growth of invasive species	Percent cover of invasive species	EO 13112; Robin Environmental Consultants *California high speed rail ecosystem management plan* (2012)
	Protect rare, threatened or endangered plants and animals	Survival rate of protected species	Endangered Species Act; Robin Environmental Consultants *California high speed rail ecosystem management plan* (2012)
	Avoid adverse noise impacts	Frequency of noise exceeding standard	OSHA; Noise Control Act; 49 CFR 210; FTA *Transit Noise and Vibration Impact Assessment* (2006)
	Avoid adverse vibration impacts	Frequency of vibration exceeding standard	FTA *Transit Noise and Vibration Impact Assessment* (2006)
	Reduce energy usage	Energy intensity of operations	MAP-21; International Union of Railways *Railway specific environmental performance indicators* (2008)
	Increase the share of renewable energy	Percent renewable energy used for operations	International Union of Railways *Railway specific environmental performance indicators* (2008)

Sustainability Checklist: Transit Rail

(Tier II)

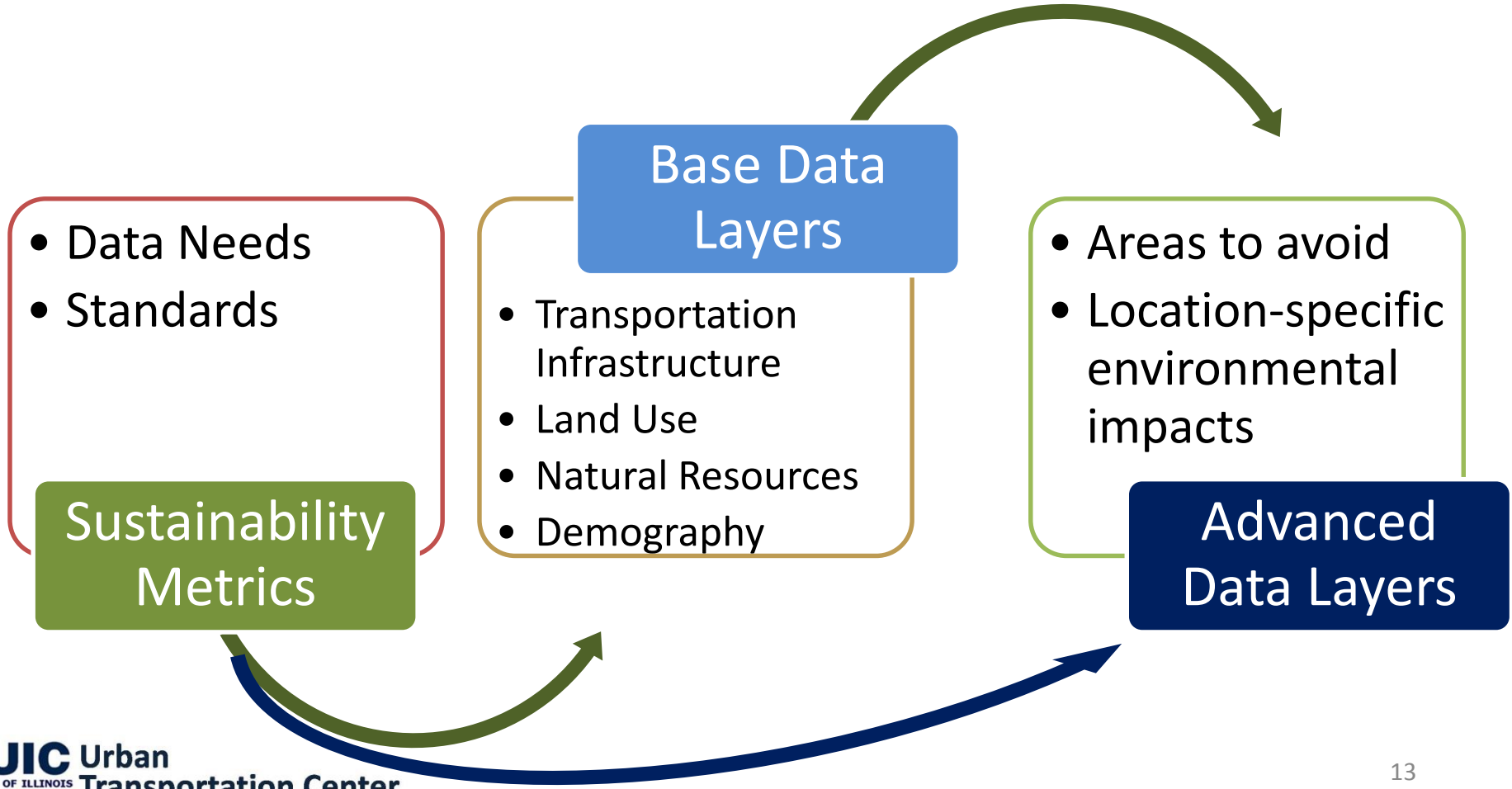
SPATIAL INDICATORS			
DOT Goal	**Strategy**	**Metric**	**Legislation or Guidance**
Livable Communities	Provide rail facilities and service in transit-dependent communities	Percentage of households without cars	UIC Voorhees Center *Transit Equity Matters* (2009)
		Percentage of workers commuting >60 min	UIC Voorhees Center *Transit Equity Matters* (2009)
		Percentage of disabled individuals	UIC Voorhees Center *Transit Equity Matters* (2009)
		Percentage of elderly individuals	UIC Voorhees Center *Transit Equity Matters* (2009)
	Promote urban infill and minimize greenfield development	Acres built on impervious land cover	USEPA *Guide to Sustainable Transportation Performance Measures* (2011)

Sustainability Checklist: Transit Rail

(Tier II – Cont'd)

NON-SPATIAL INDICATORS			
DOT Goal	**Strategy**	**Metric**	**Legislation or Guidance**
Safety	Accommodate pedestrians and bicycles	Percentage of grade crossings assessed for pedestrian and bicycle safety	MAP-21; DOT *Strategic Plan 2012 - 2016*
Livable Communities	Improve transportation affordability	Percentage of household income spent on transportation	USEPA *Guide to Sustainable Transportation Performance Measures* (2011)
	Increase employment	Number of jobs created per capita-mi	Carpenter, T. *The environmental impact of railways* (1994)
	Protect community property values	Percent change in property values along rail corridor	Carpenter, T. *The environmental impact of railways* (1994)
Environmental Sustainability	Determine most sustainable transportation mode	Mode-shift analysis index	Shiau & Peng *Mode-based transport sustainability: A comparative study of Taipei and Kaohsiung cities* (2012)
	Reduce urban heat island effect	Percentage of infrastructure with high RFI rating	LEED
	Protect trees and desirable vegetation	Survival rate of protected trees and plants along rail corridor	Illinois DOT *D&E 18: Preservation & Replacement of Trees*
	Protect wildlife migration corridors	Acres of wildlife corridors fragmented per capita-mi	Robin Environmental Consultants *California high speed rail ecosystem management plan* (2012)
	Achieve zero-waste operations	Percentage of out-of-service equipment, debris and waste disposed to a landfill	Dobranskyte-Niskota, et al. *Indicators to assess sustainability of transport activities* (2007)
	Reduce lifecycle waste	Tons of waste generated per capita-mi	

Connecting Sustainability Metrics with Spatial Mapping Tools



Example: Rail Emission Impact Modeling

Three-Step Analysis

Hot Spot Identification

- Number of trains
- Speed
- Line haul vs. switching operation
- Rail Yards/Stations

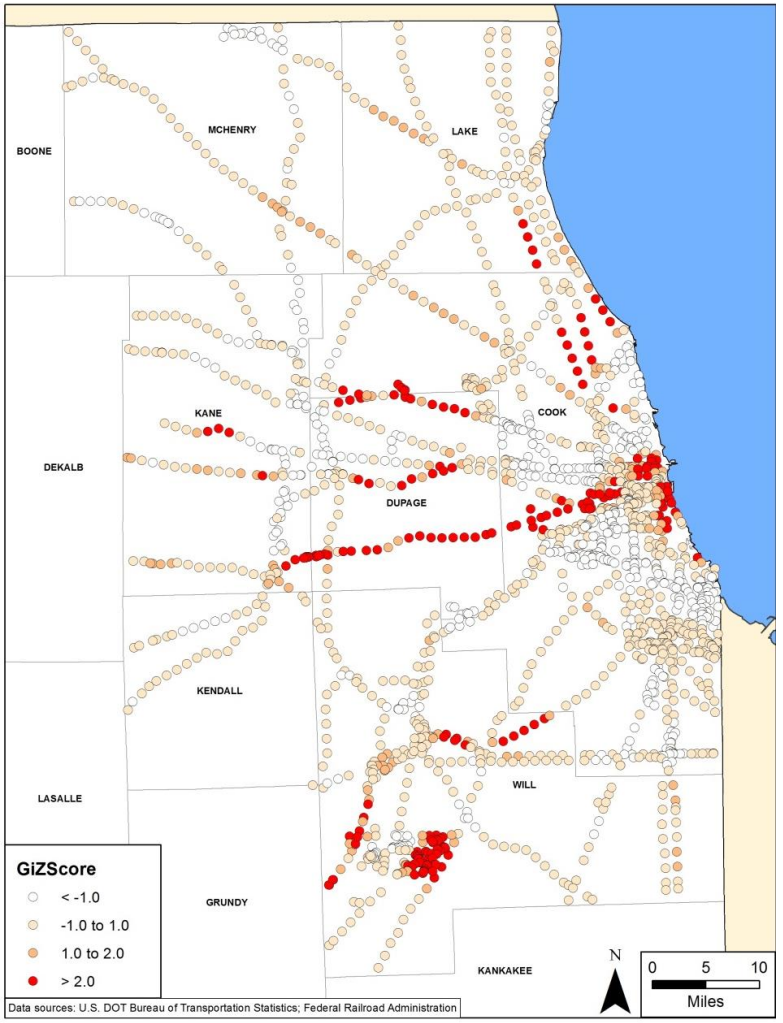
Location-Specific Modeling

- Grade-crossing
- Train traffic
- Freight focus
- Tonnage/Carloads
- Fuel efficiency
- Emission factor

Impact Analysis

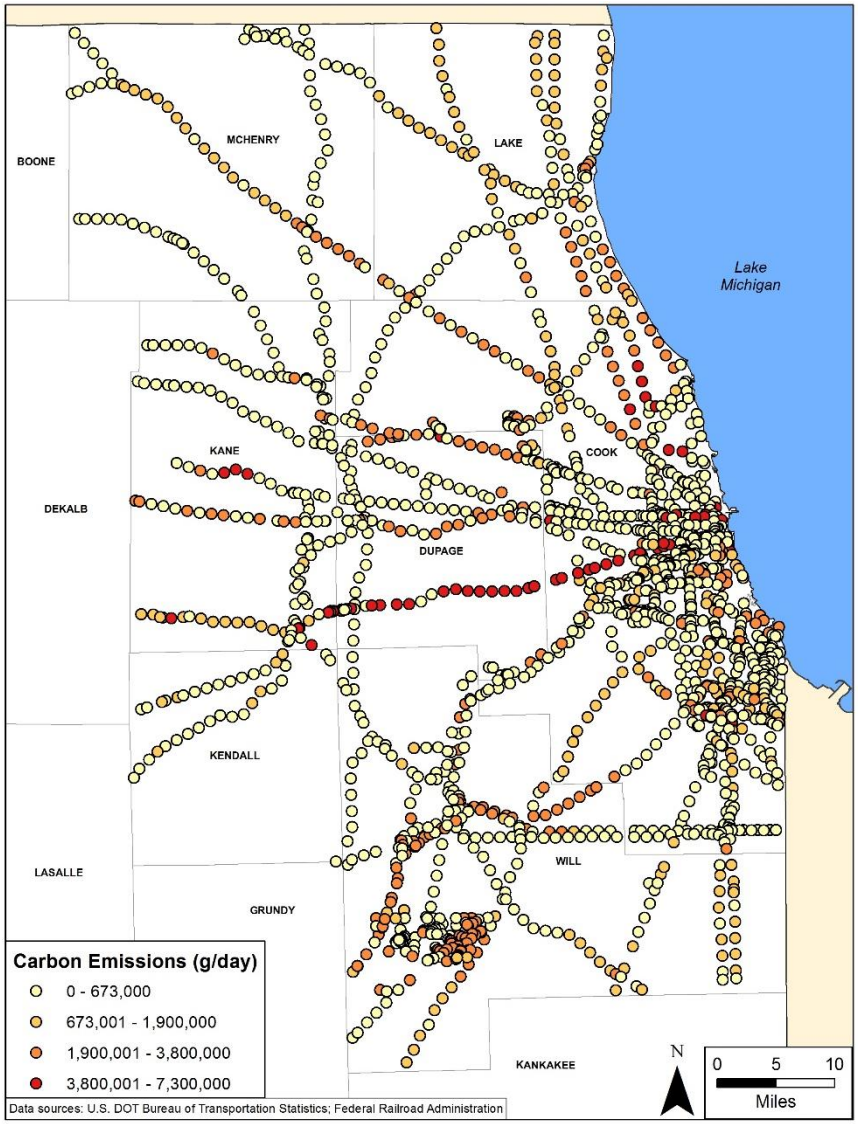
- Existing land use
- Demography

Rail Emission Hot Spots

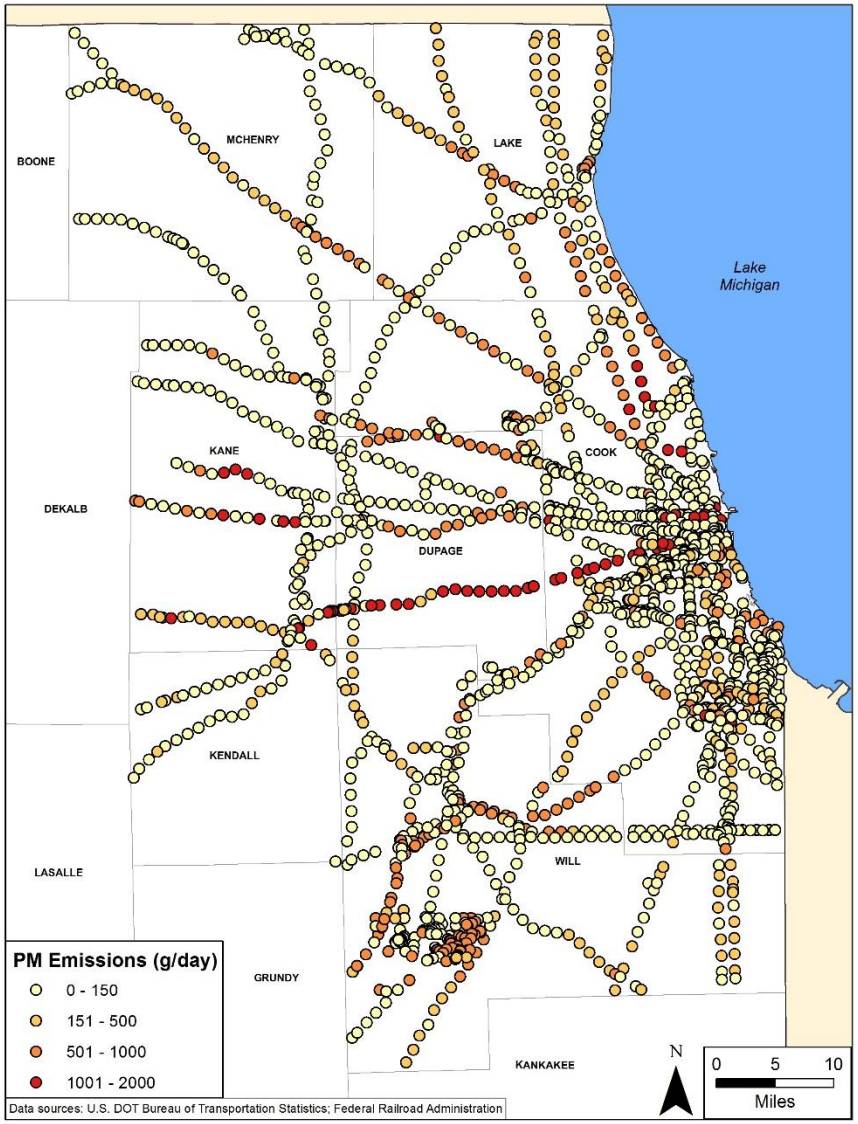


Emission Estimates from Freight Rail

Carbon Emissions

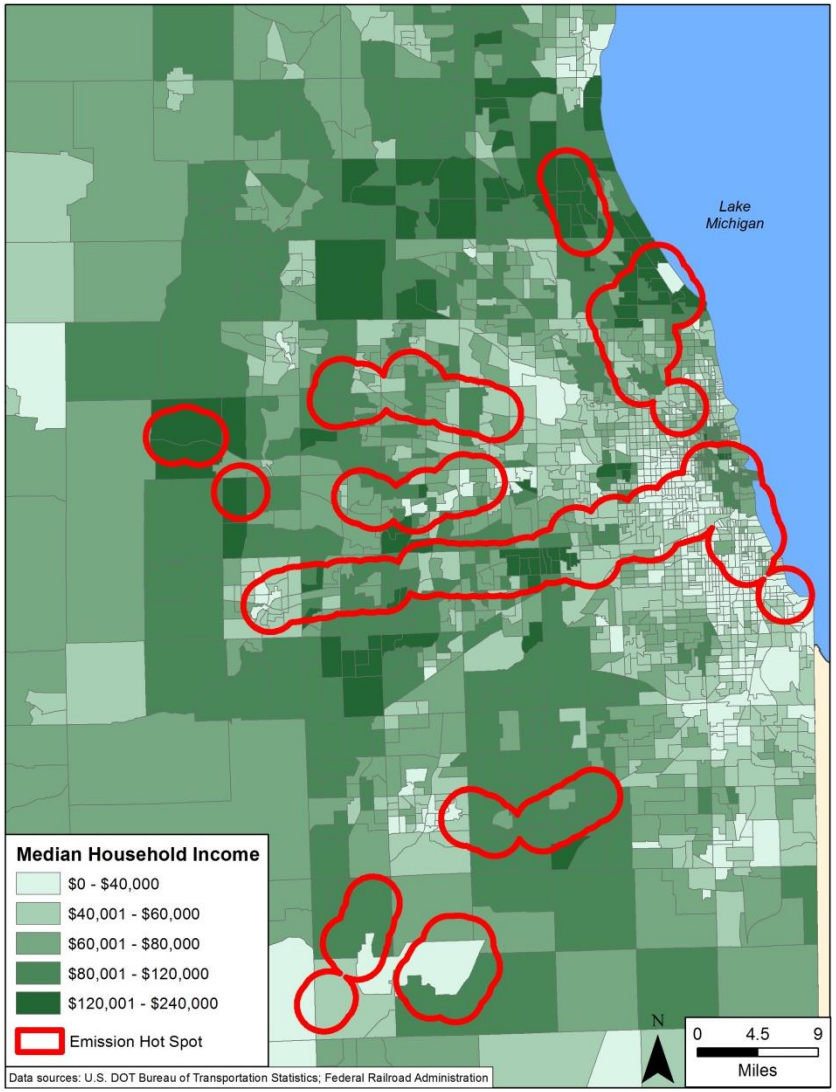


PM Emissions

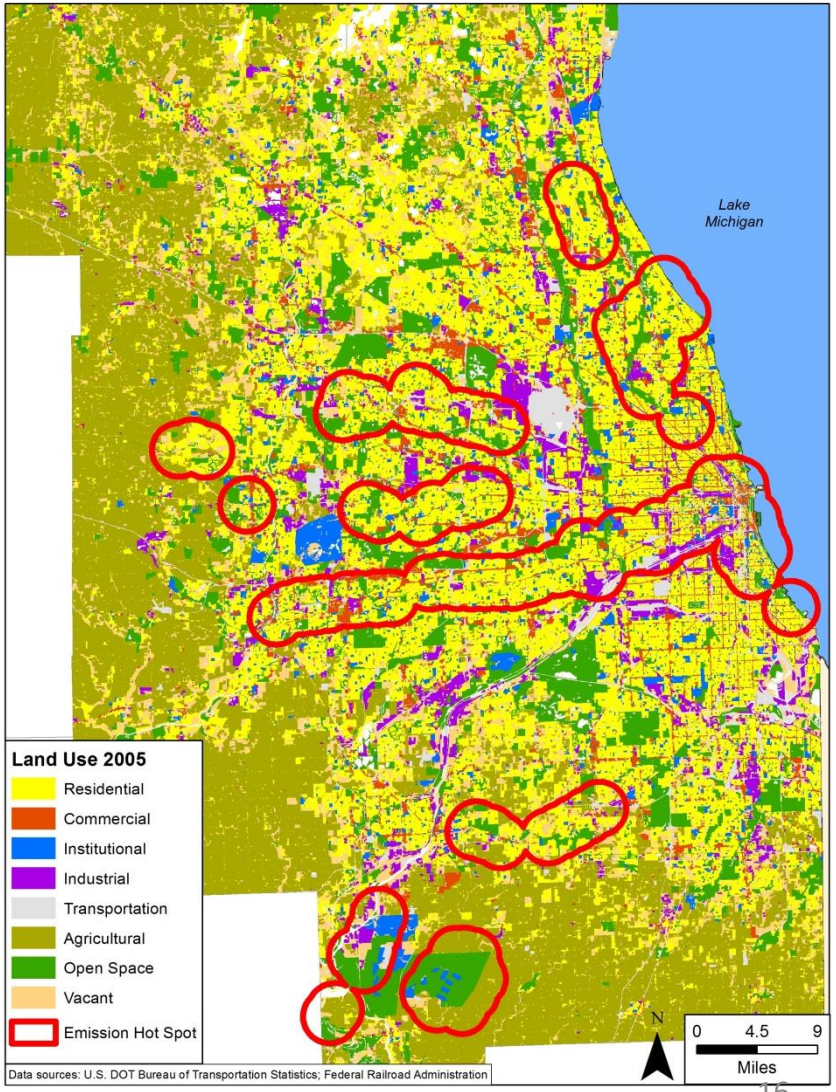


Community Exposure to Freight Rail Emissions

Overlay map with income

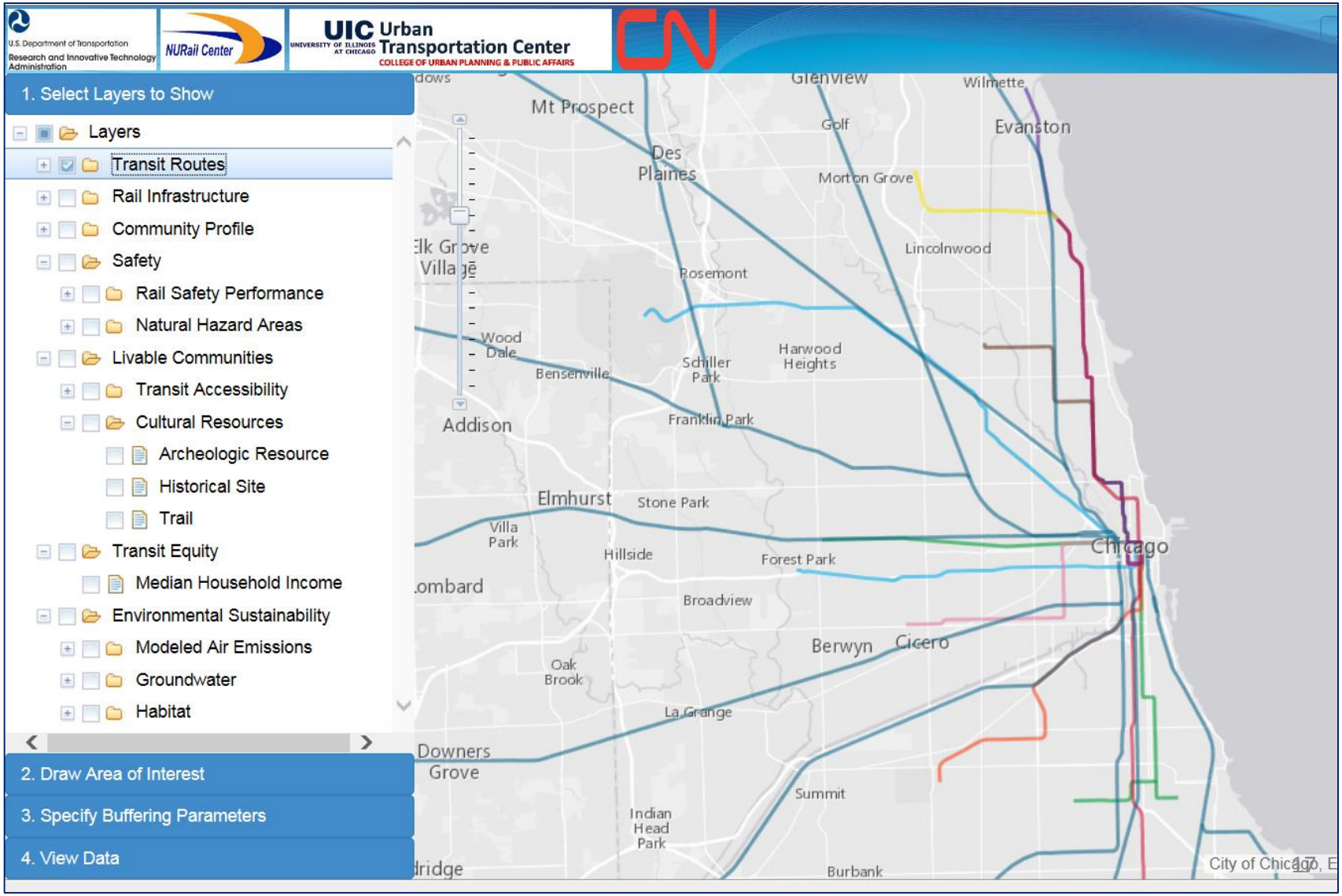


Overlay map with land use

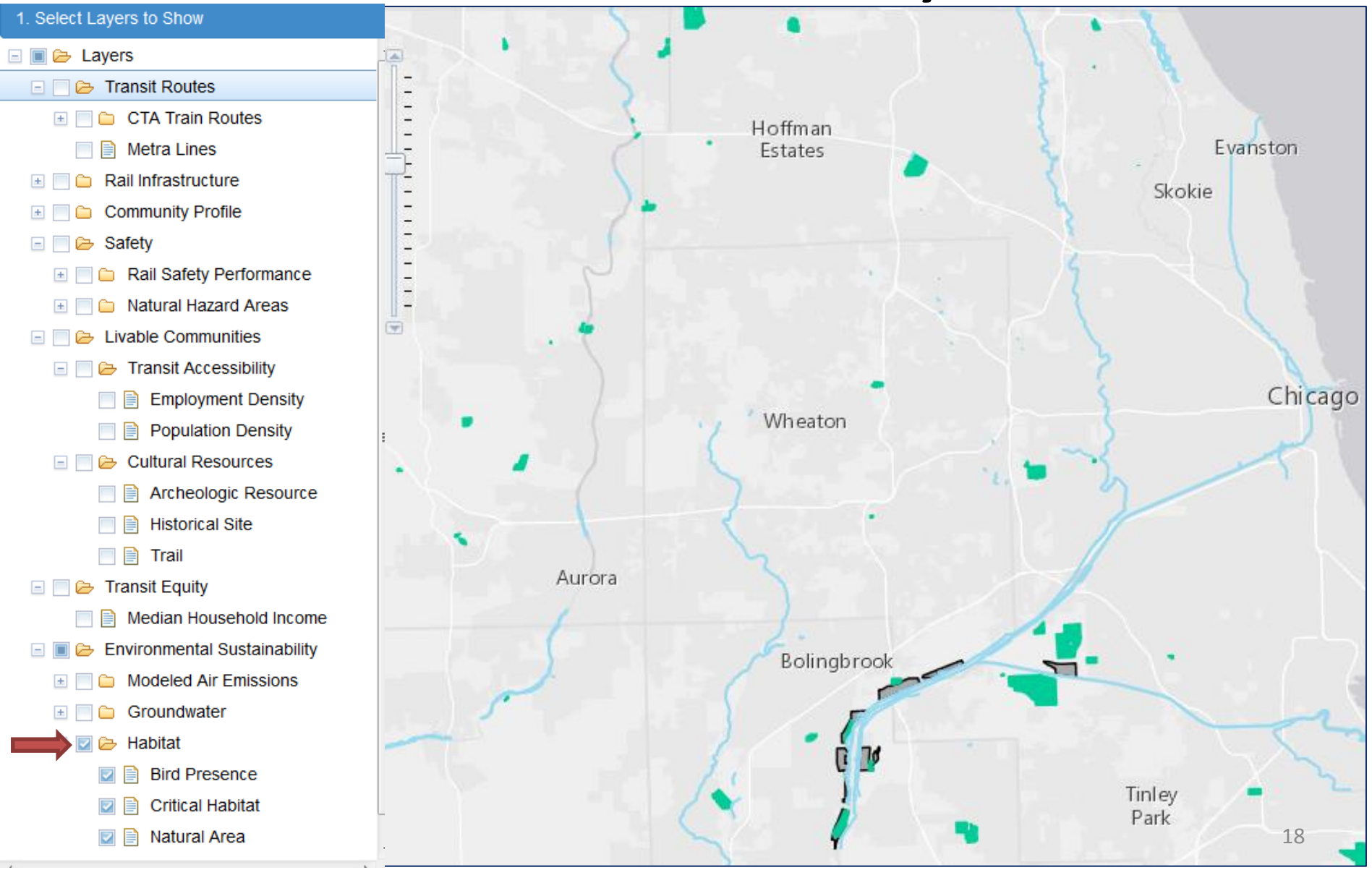


Web Mapping Tool

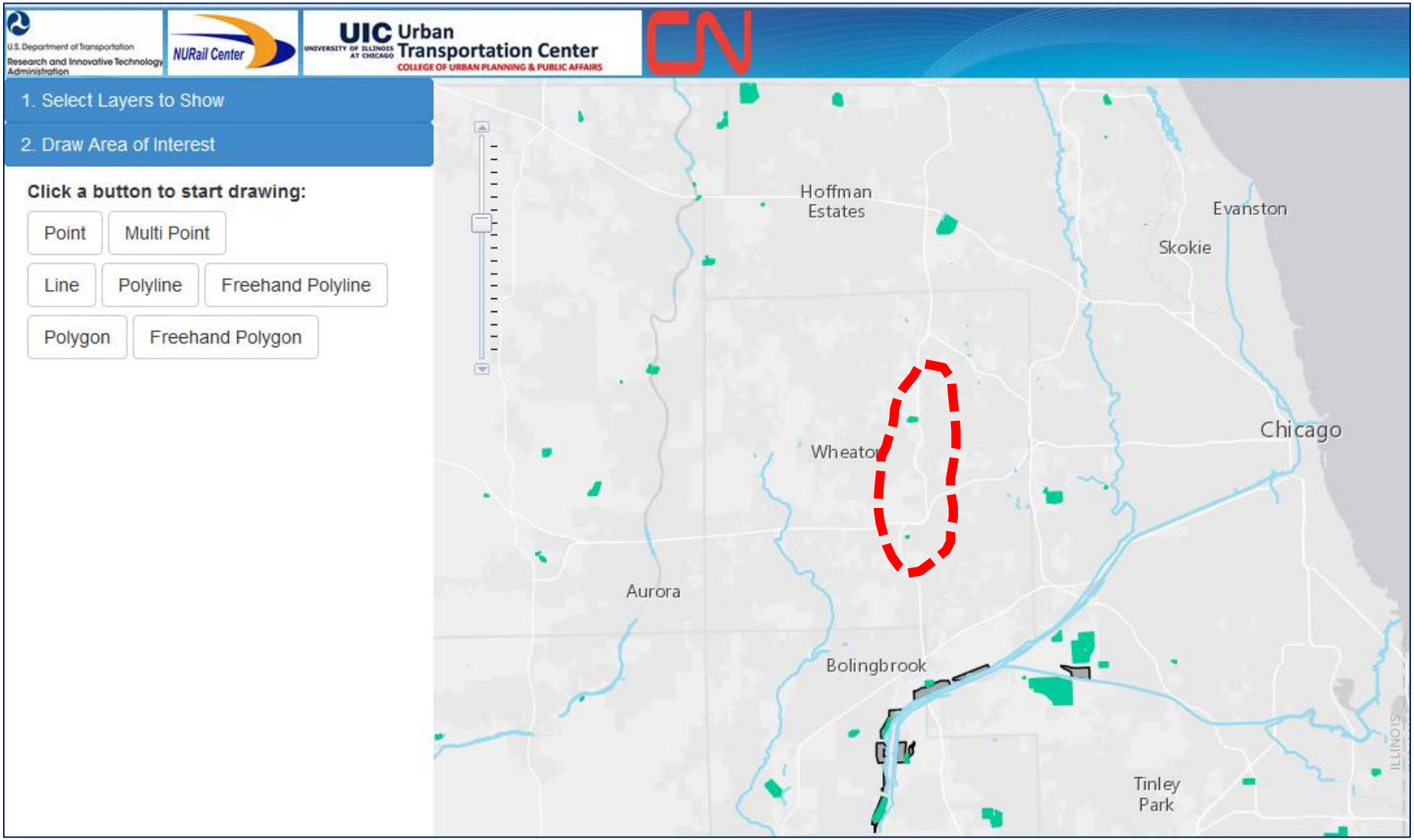
NURAIL.UIC.EDU



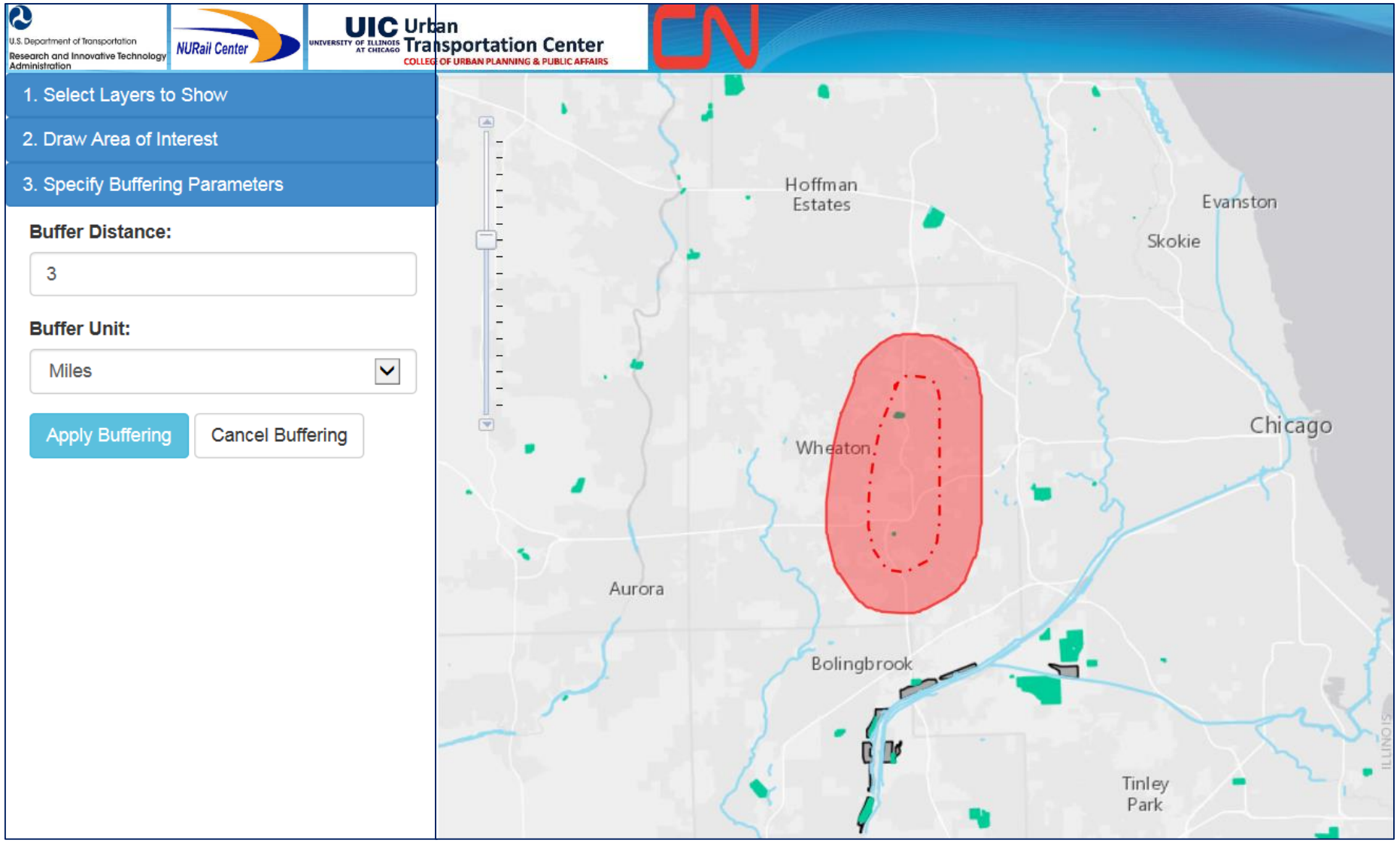
Customizable Data Layers



Customizable Study Area



Optional Buffer Specification



View Data of Interest in Selected Area

Natural Area

Acres	Name
5.65	Wolf Road Prairie
10.01	Wolf Road Prairie
283.65	Salt Creek Woods
10.07	Belmont Prairie
10.34	Salt Creek Woods

Summary

Significance of Research

- Streamline rail planning process
- Provide reference for a pre-NEPA review
- Facilitate coordination within rail agencies
- Advance rail research
- Engage the public

Ongoing Work and Challenges

- Project-specific impact analysis
- Noise impact
- Data maintenance
- Web server host




THANK YOU!

For Questions and Comments

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U.S. Department of Transportation

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