

Updated GIS Data for Use in WRAP Regional Modeling

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Acknowledgements

- Funding from the Western Regional Air Partnership (WRAP) GIS Landuse Database Project
<http://www.wrapair.org/forums/toc/GIS.html>
- Gerard Mansell, ENVIRON

Outline

- Background/Introduction
- GIS Data Sources and Evaluation
- Applications

Background/Introduction

- Emission inventory development and GIS
- Air quality analysis and GIS
- Need updated GIS data (2000-2004)
- Need consistent, uniform data formats and attributes
- WRAP funded project

Project Design

- Identify and collect relevant GIS data
- Evaluate data
- Assemble and process uniform, consistent databases
- Qualify and quantify impacts of using updated GIS data in a number of applications relevant for WRAP and other modeling efforts

Data Needs and Requirements

- Emission inventory development needs
 - Land characterization, e.g. vegetation, LU/LC, soils
 - Transportation networks, e.g. roads, rail, shipping
 - Surrogate data, e.g. population, housing, transportation
- Air quality analysis needs
 - Land use for deposition component of modeling
 - Activity data for control strategies
- Regional databases
- Local databases
- Specialized data

Data Collection

- Requests sent to all WRAP state representatives
- Comprehensive web searches
- Data cataloguing
- Data evaluation and selection for further consideration

Data Evaluation

- Evaluation Criteria
 - Vintage, spatial resolution and extent, data quality and cost
 - Specific characteristics of the data
 - Required data processing resources
 - Expected impact with respect to emission inventory development
 - Intended uses of the data

GIS Data Portals (partial list)

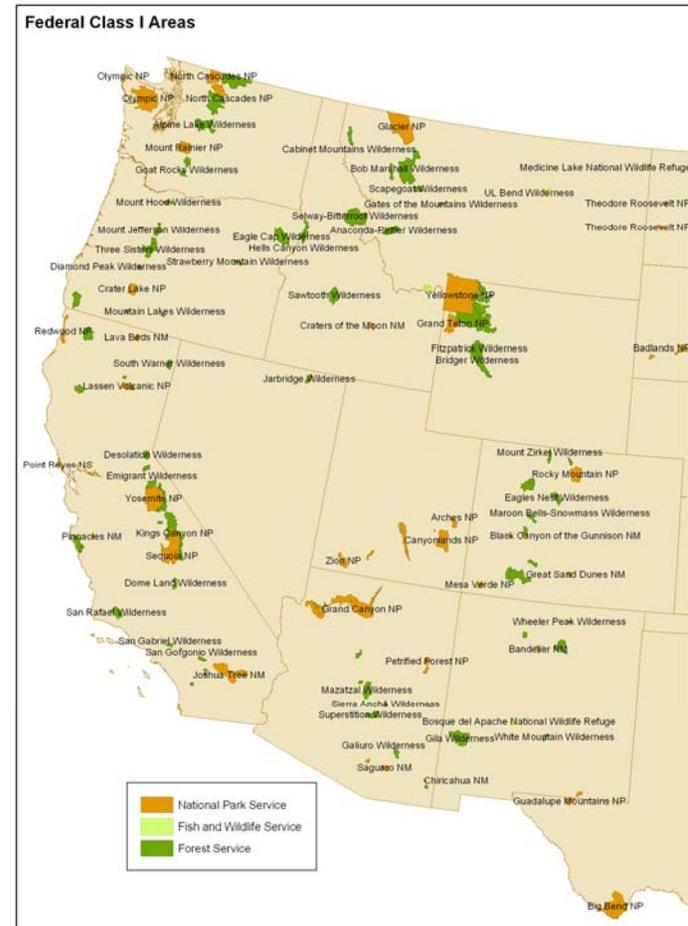
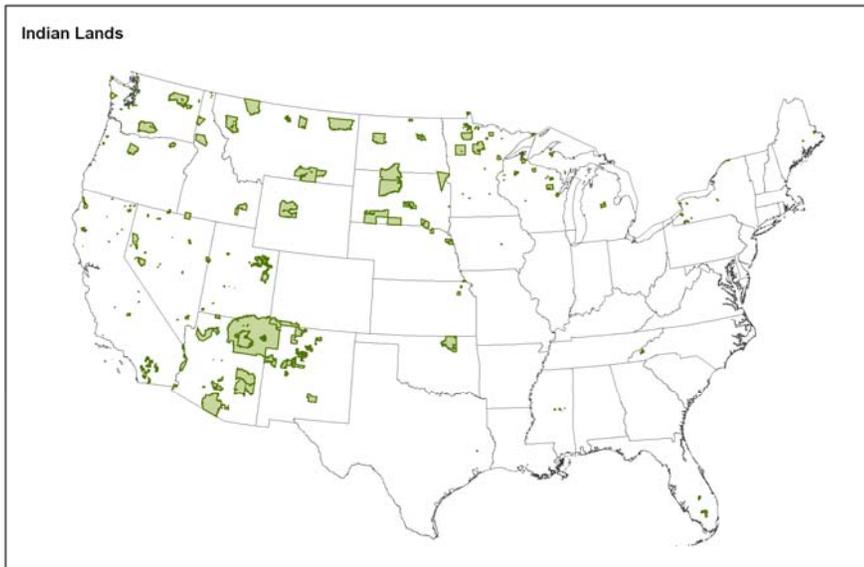
Portal Name and Web Address	Description
<p>National Atlas of the United States (http://www.nationalatlas.gov/)</p>	<p>The National Atlas allows users to generate maps of the US interactively. The maps can depict a variety of information including spatial features and demographic data. Accurate and reliable data sources are derived from more than 20 Federal agencies and organizations coordinated by the USGS.</p>
<p>USGS GISDATA Map Studio (http://gisdata.usgs.gov/)</p>	<p>This is a site hosted at the National Center for Earth Resources Observation and Science (EROS) by the USGS and allows users to access public web map services, and interfaces developed at the center.</p>
<p>US EPA Emission Surrogate Database (ftp.epa.gov/pub/EmisInventory/emiss_shp2003)</p>	<p>In 2003, the US EPA developed numerous GIS data layers and spatial surrogate datasets for emissions development applications. The data were derived from various sources and includes data for the entire US and parts of Canada and Mexico. All data layers are available as ArcView shapefiles in a Lambert Conformal projection corresponding to the Inter-RPO National Modeling domain. Data sources and attributes associated with the GIS databases are described in the available documentation.</p>
<p>National Spatial Data Infrastructure Geospatial One-Stop (http://www.geodata.gov/go.s)</p>	<p>The geodata.gov portal, also known as the Geospatial One-Stop, serves as a public gateway for improving access to geospatial information and data under the Geospatial One-Stop e-government initiative. The portal, sponsored by the Federal Office of Management and Budget (OMB), is designed to facilitate communication and sharing of geographic data and resources to enhance government efficiency and improve citizen services. This portal provides easier, faster and less expensive access to a wealth of geospatial data and information.</p>

GIS Data Portals (partial list, cont'd)

Portal Name and Web Address	Description
<p>The National Map (USGS) (http://nationalmap.gov/)</p>	<p>The National Map is a consistent framework for geographic knowledge. It provides public access to high-quality, geospatial data and information from multiple partners to help support decision making by resource managers and the public. The National Map is the product of a consortium of Federal, State, and local partners who provide geospatial data to enhance the public's ability to access, integrate, and apply geospatial data at global, national, and local scales.</p>
<p>Geography Network (http://www.geographynetwork.com/)</p>	<p>The Geography Network is a global network of geographic information users and providers. It provides the infrastructure needed to support the sharing of geographic information among data providers, service providers, and users around the world. Through the Geography Network, you can access many types of geographic content including dynamic maps, downloadable data, and more advanced Web services.</p>
<p>Geospatial Data Depot (http://data.geocomm.com/)</p>	<p>The GeoCommunity's Geospatial Data Depot is a leading online provider of geographic products and services to the GIS community. Its mission is to support and promote the GIS industry by providing software, data, news, job postings and other services to GIS/CAD professionals via the Internet. The GeoCommunity is a GIS portal site that offers a virtual marketplace for buyers, sellers, advertisers, students and government officials to exchange information.</p>

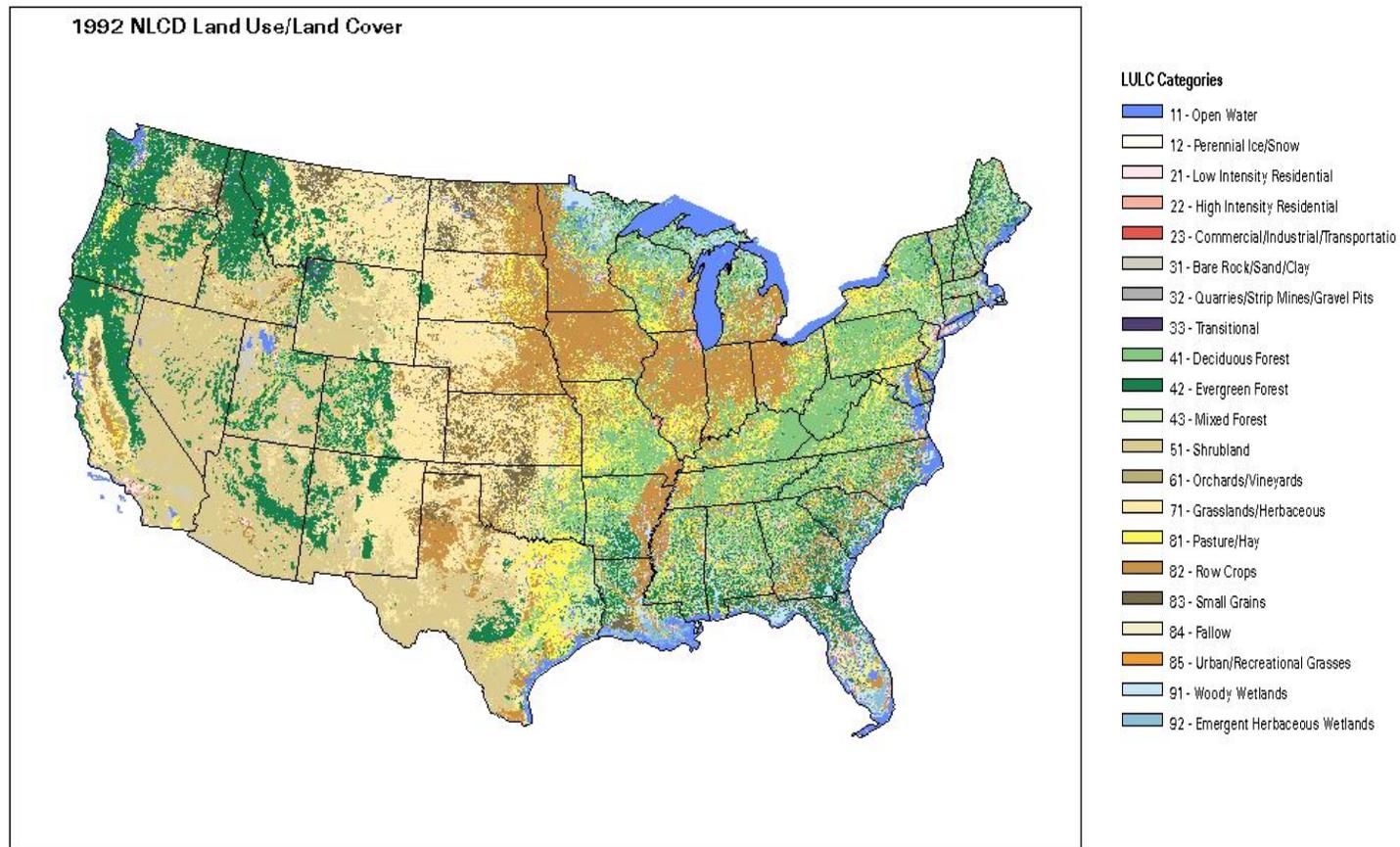
Summary of Data Types Evaluated

- Administrative Boundaries



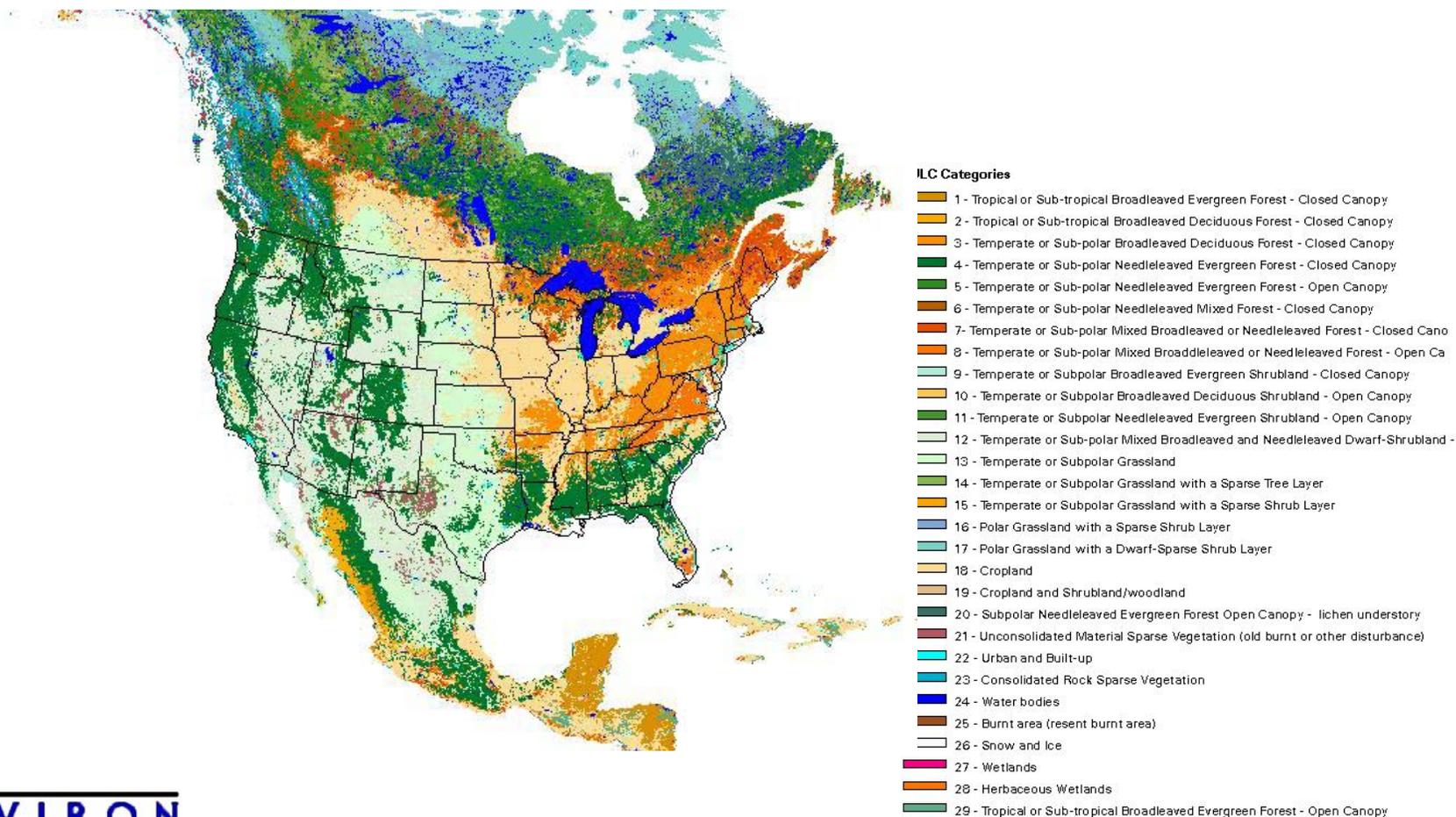
Summary of Data Types Evaluated

- Landuse/Landcover (LULC)



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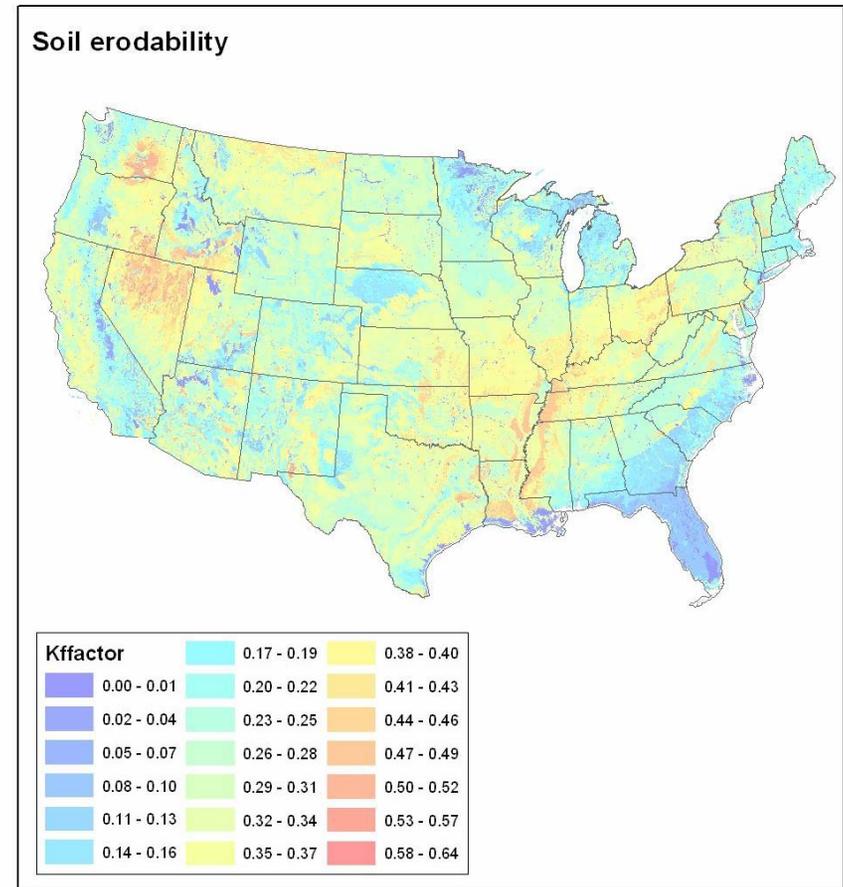
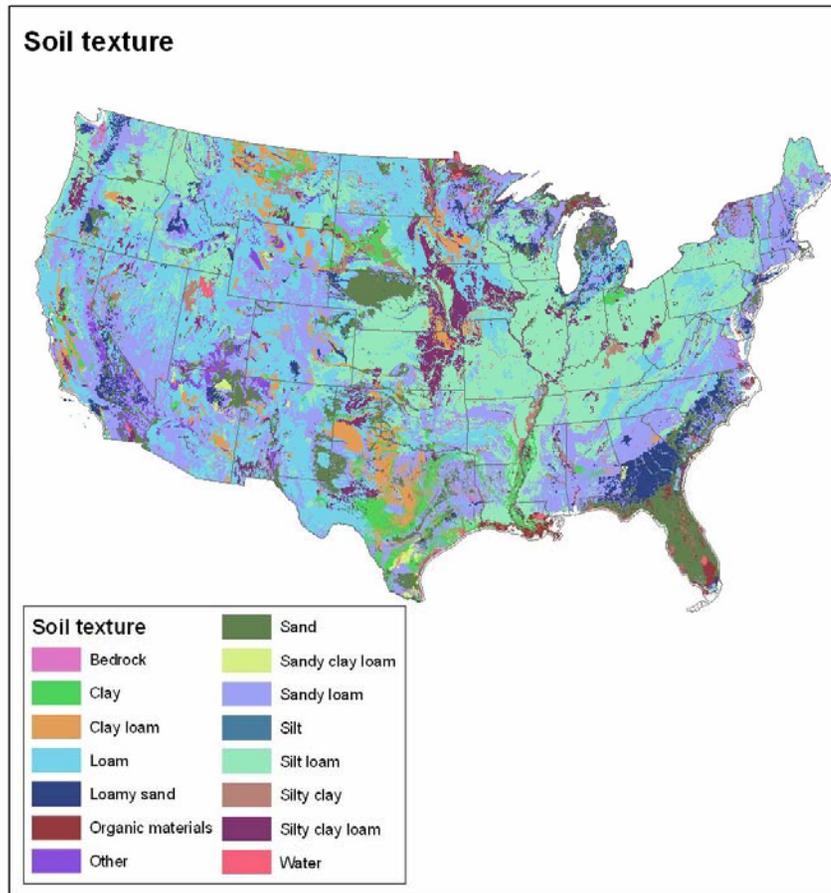


Summary of Data Types Evaluated

- Landuse/Landcover (LULC)
 - GAP Analysis Program
 - State-level projects
 - Year varies (mid-90s to 2001)
 - Archive state/regional layers
 - Develop consistent classification scheme for merging into a national data layer
 - Some land use categories lack detail
 - USGS Land Cover Characteristics
 - Gridded 1km x 1km
 - Lacks certain relevant categories
 - USGS Urban Change
 - Comparison of LULC between 1990 and 2000
 - “New residential” category if became urban

Summary of Data Types Evaluated

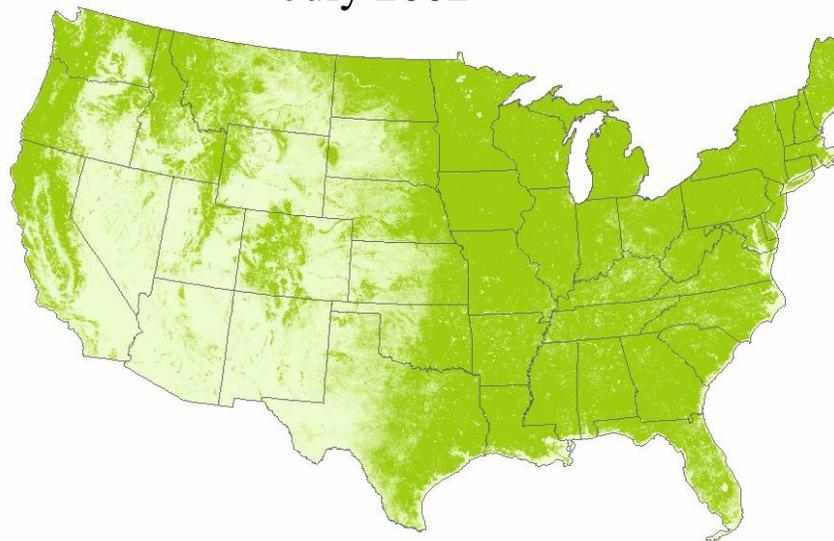
- Land Surface Characteristics



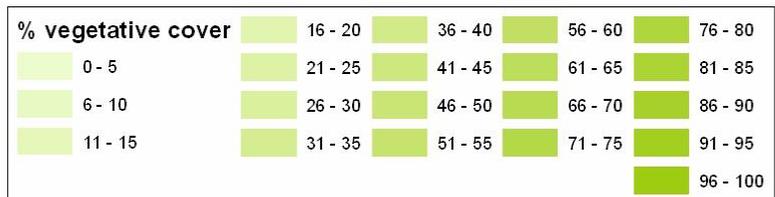
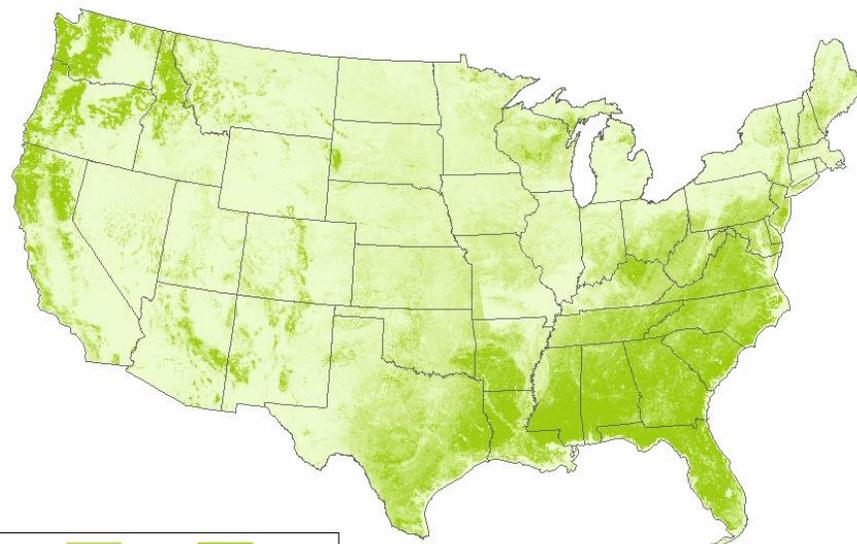
Summary of Data Types Evaluated

- Land Surface Characteristics

July 2002

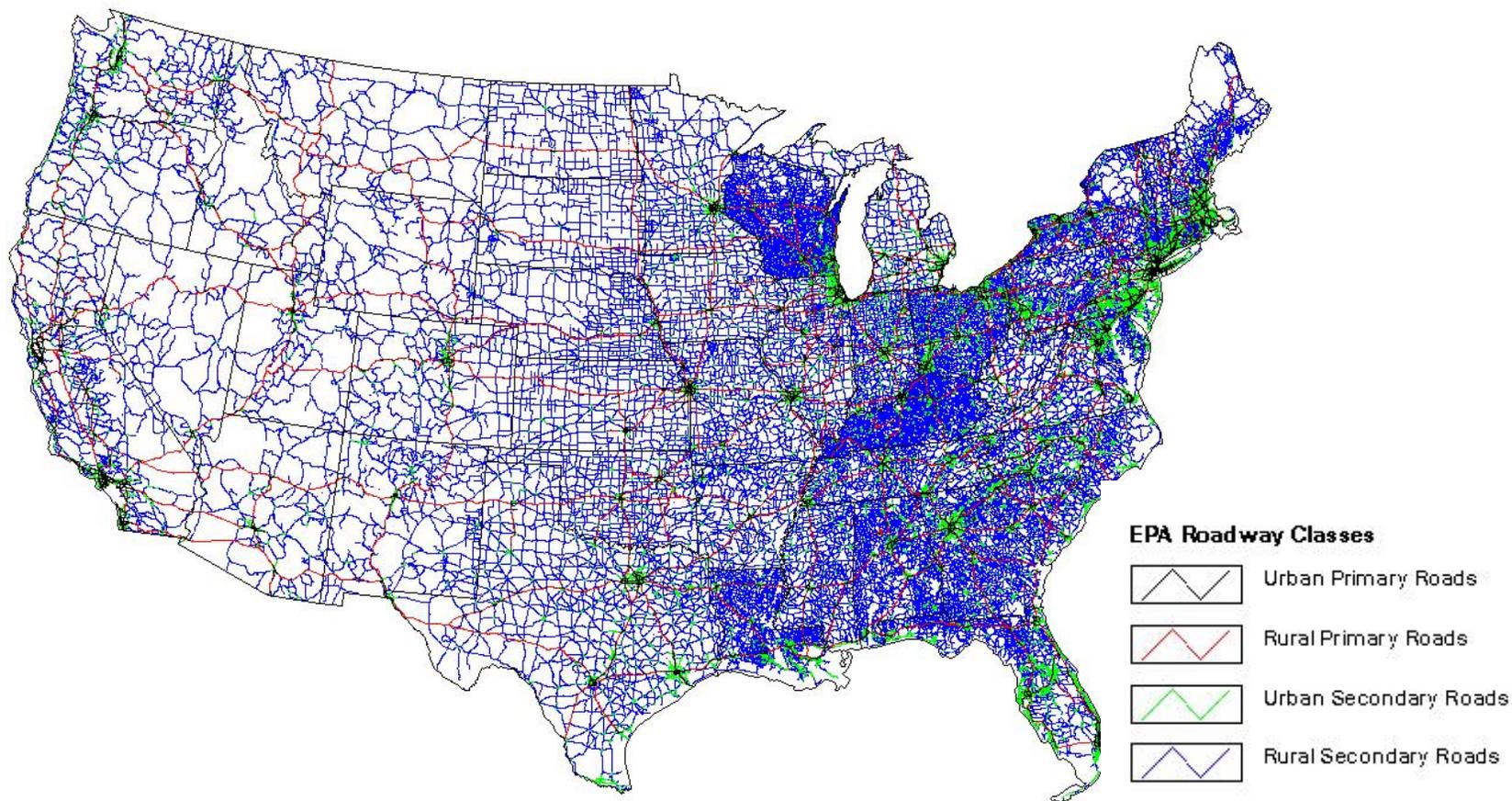


November 2002



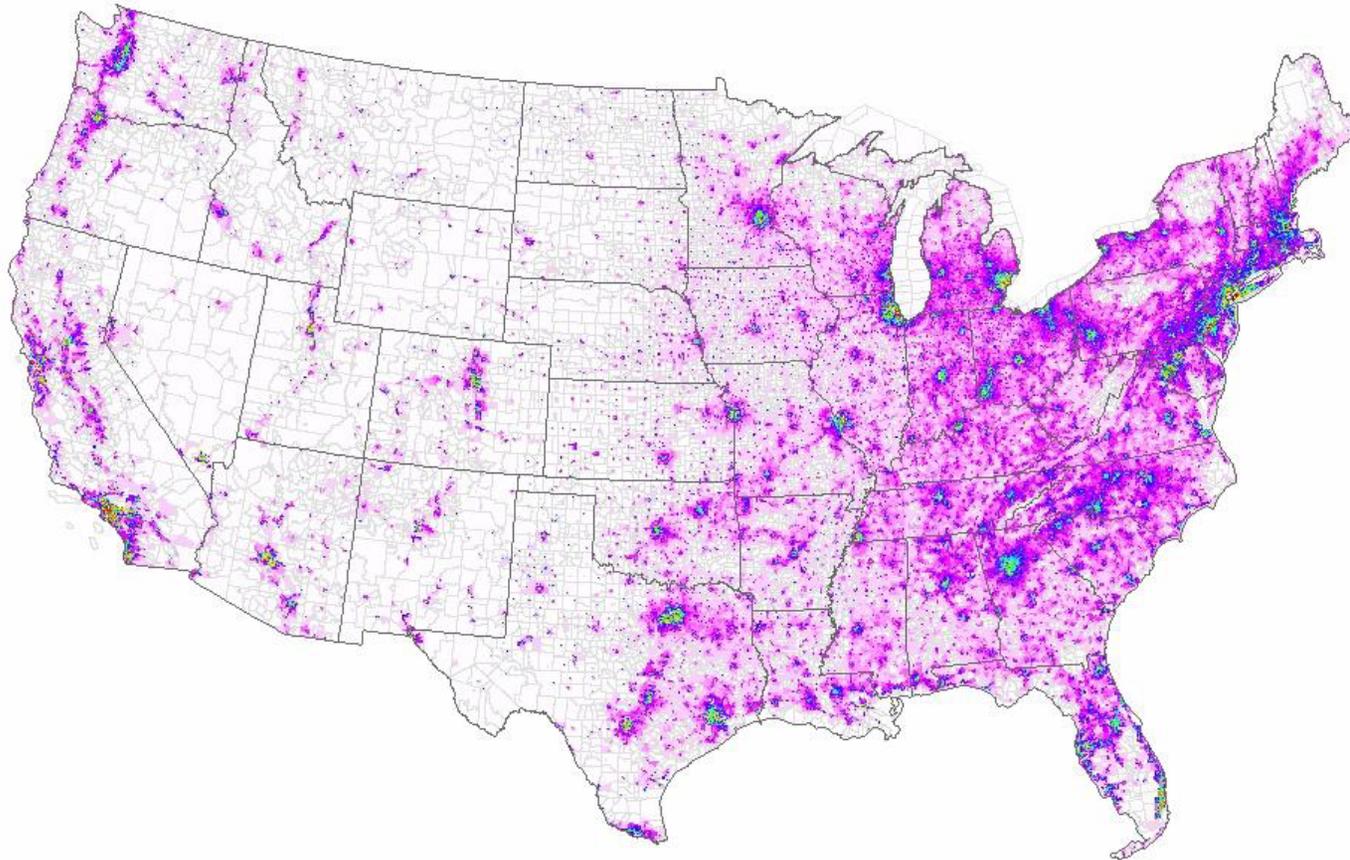
Summary of Data Types Evaluated

- Transportation Networks



Summary of Data Types Evaluated

- Population/Socioeconomic Data



Summary of Data Types Evaluated

- Environmental Data
 - Meteorology
 - Agricultural and economic statistics
 - Ambient observations
- Geospatial Data for Canada and Mexico

Applications

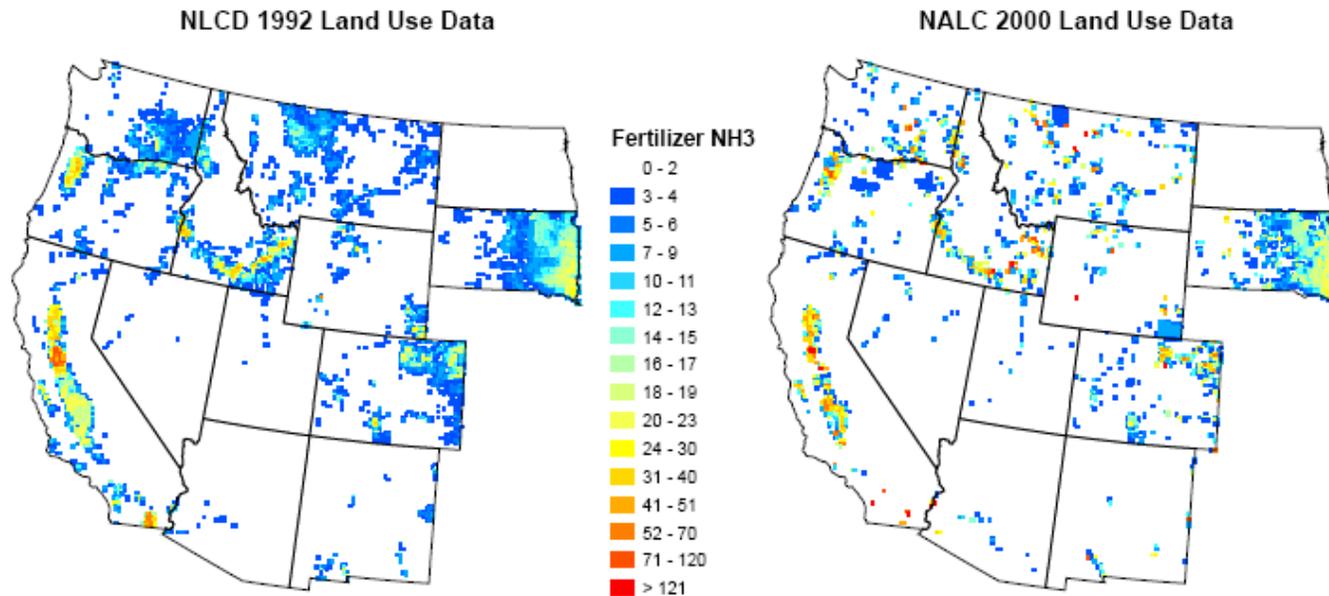
- WRAP GIS NH₃ Emissions Model
- WRAP Fugitive Windblown Dust Emissions Model
- Fugitive Dust Transport Fractions

WRAP GIS NH₃ Emissions Model

- GIS-based model for estimating ammonia emissions from
 - Fertilizer application
 - Livestock
 - Natural soils
 - Domestic sources
 - Wild animals
- Model relies on LULC and population density from GIS layers
 - Current version of model and inventory rely on 1992 NLCD data
- Investigate effect of replacing 1992 NLCD data with 2000 NALC data

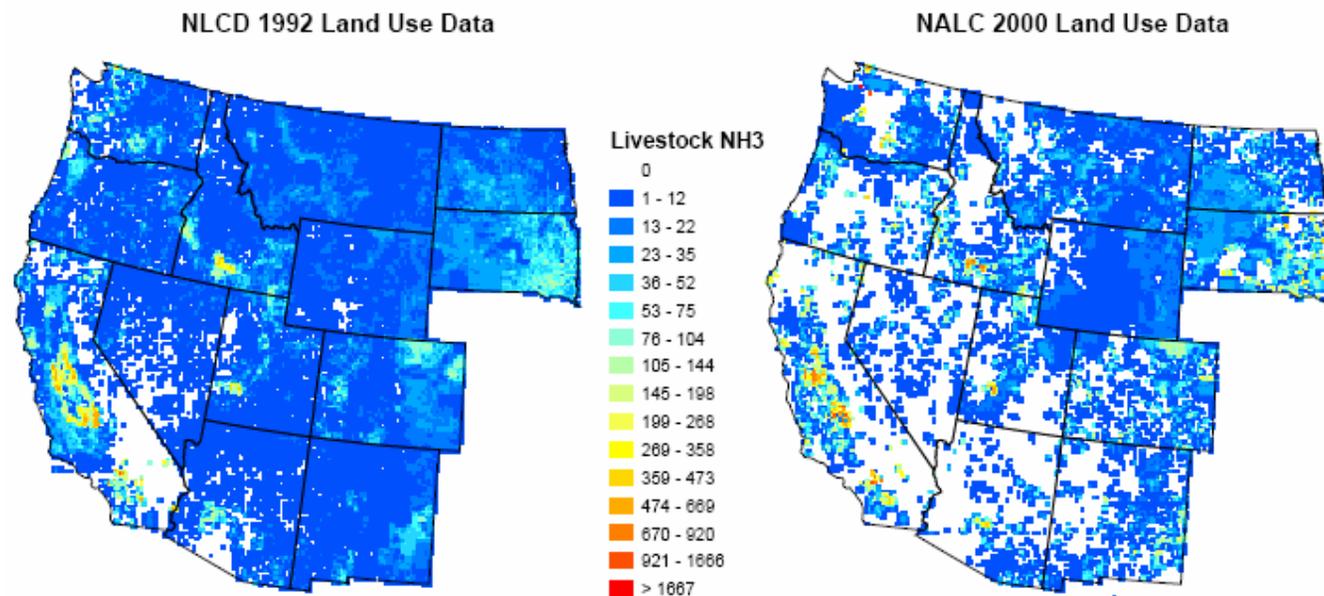
WRAP GIS NH₃ Emissions Model

- Fertilizer NH₃ –spatial allocation changes



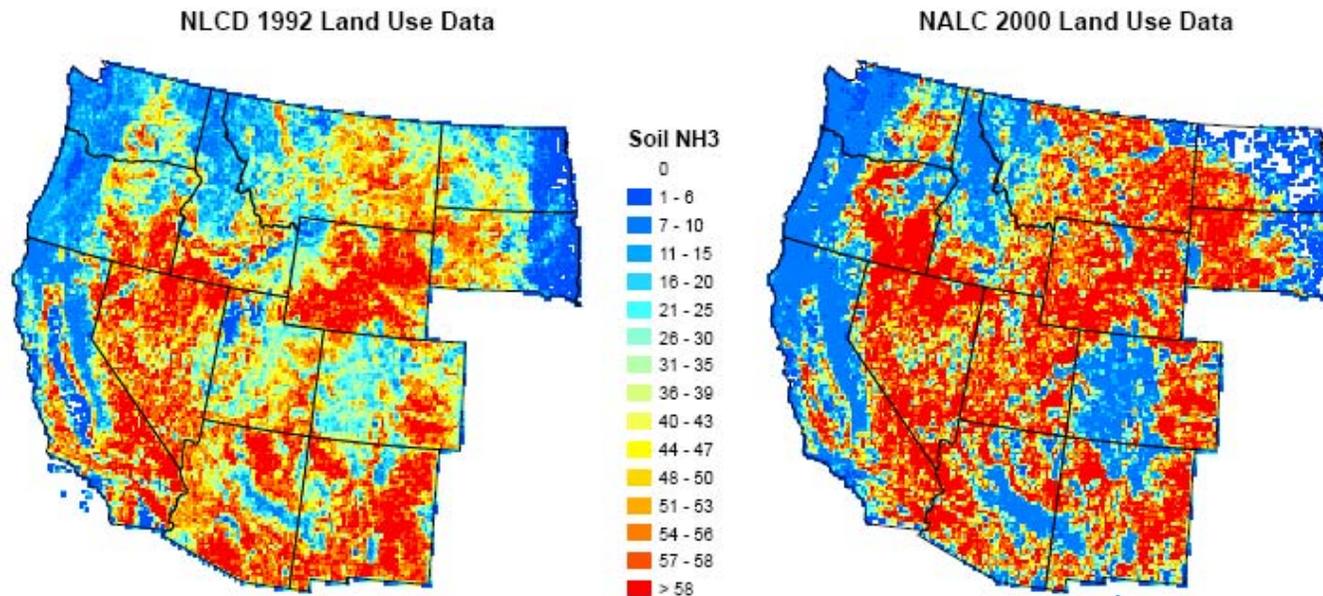
WRAP GIS NH₃ Emissions Model

- Livestock NH₃ – spatial allocation changes



WRAP GIS NH₃ Emissions Model

- Soil NH₃ – magnitude & spatial allocation change



WRAP Fugitive Windblown Dust (WBD) Emissions Model

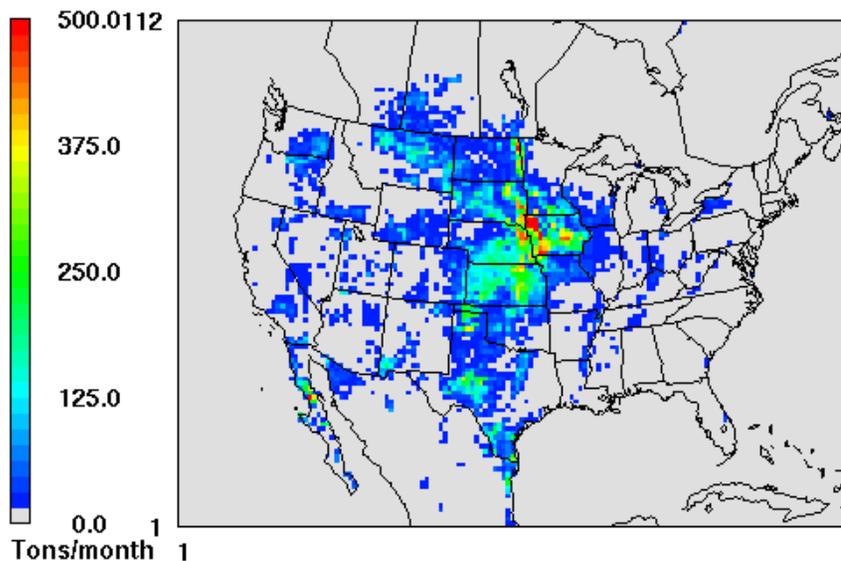
- PM dust emissions from wind erosion
- Relies on land use and soil characteristics in order to estimate threshold surface friction velocities and emission rates
- Special treatment for agricultural lands
- Current version of model relies on BELD3 data for agriculture and 1992 NLCD data for LULC
- Investigate effect of replacing 1992 NLCD data with 2000 NALC data

WRAP WBD Emissions Model

- PM_{2.5} comparison (graphical)

PMFINE

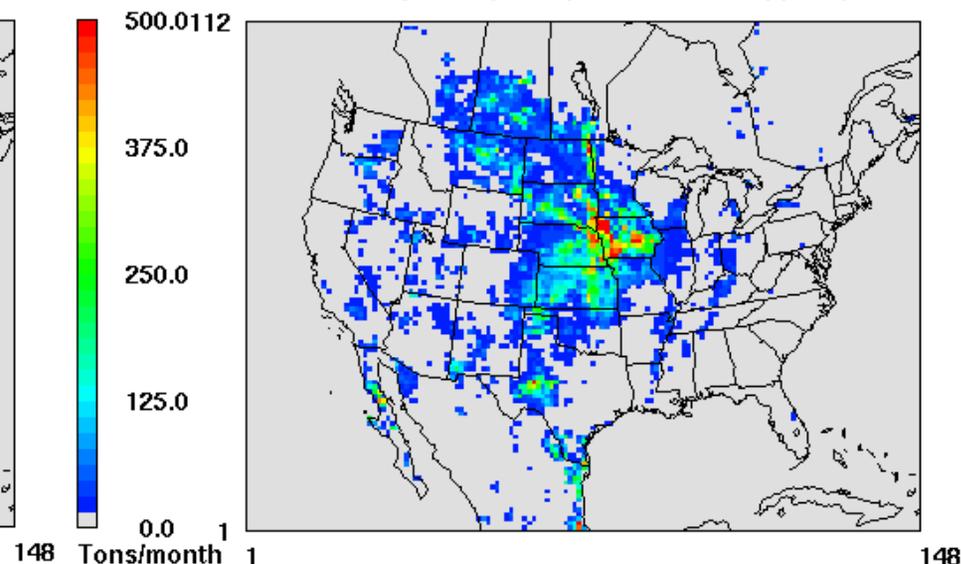
Windblown Dust Emissions (1992 NLCD)
Monthly Total (Transport Fractions Applied)



April 30,2002 0:00:00
Min= 0.0 at (1,1), Max= 781.2 at (79,67)

PMFINE

Windblown Dust Emissions (2000 NALC)
Monthly Total (Transport Fractions Applied)



April 30,2002 0:00:00
Min= 0.0 at (1,1), Max= 817.8 at (79,67)

WRAP WBD Emissions Model

- PM₁₀ comparison (quantitative)

Landuse Category	1992 NLCD (tons/year)	2002 NALC (tons/year)
Agricultural	988,264	393,306
Grasslands	411,595	308,099
Shrublands	820,937	1,950,862
Barren	143,292	79,435
Total	2,364,089	2,731,702

Fugitive Dust Transport Fractions

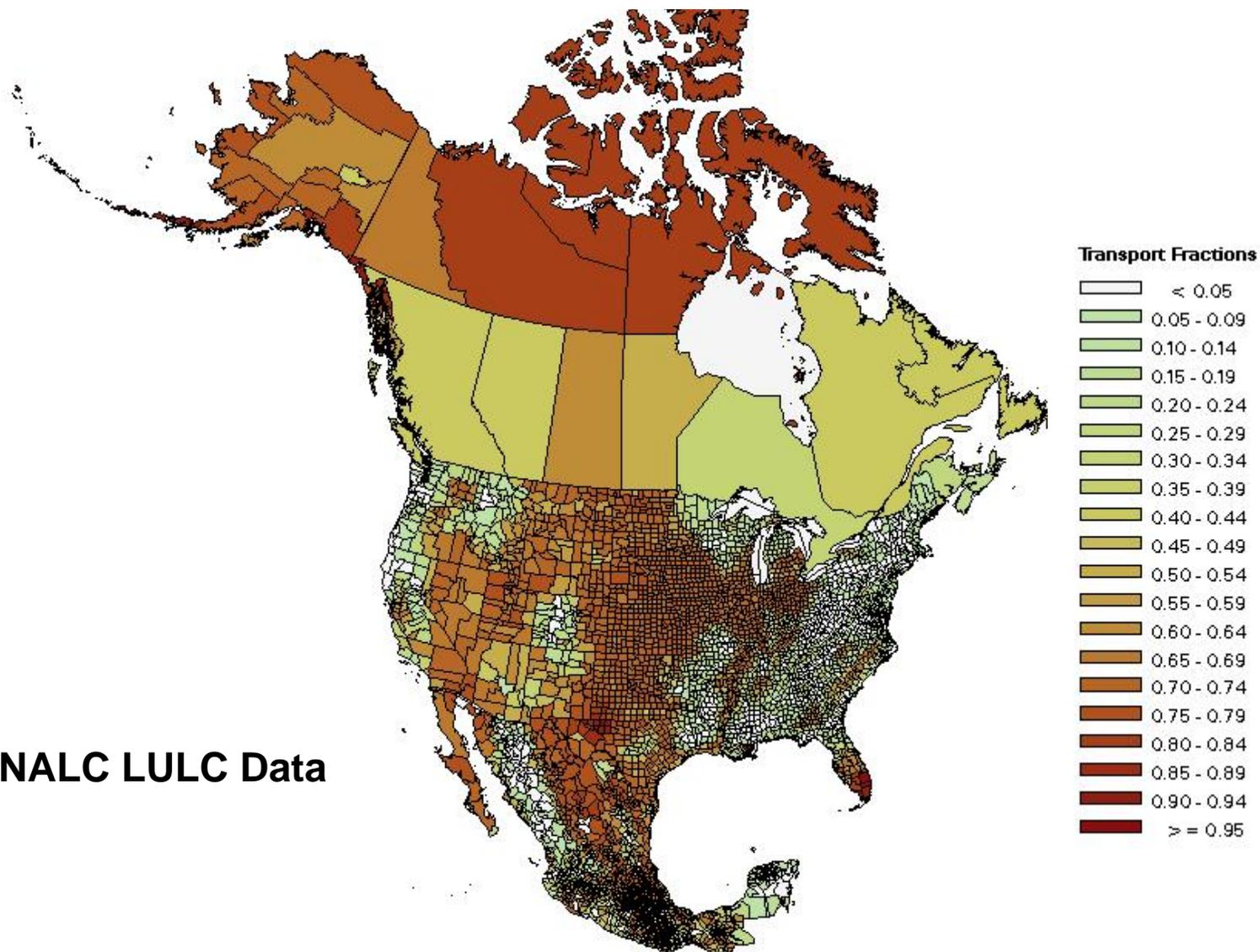
- Grid-based air quality models limited with respect to near-source deposition and impaction removal processes for fugitive dust emissions
- Near-source removal processes are related to grid resolution and land use/land cover characteristics
- Recently revised methodology based on work of Tom Pace, EPA
(http://www.epa.gov/ttn/chief/emch/invent/transportable_fraction_080305_rev.pdf)
- Evaluate impacts of updating LULC data from BELD to 2000 NALC

Fugitive Dust Transport Fractions

LULC Type	Avg. Ht (m)	CF (1-TF)	Estimated Range	Comments/ Basis
Forest	18.4	1.0	0.8 – 1.0	Forested areas capture dust efficiently
Urban	5 – 50+	0.5	0.25 – 0.75	Structures interspersed with open areas
Scrub/Grass	1 – 2	0.25	0.10 – 0.40	Portion of plume below sparse vegetation
Agricultural	1 - 2	0.25	0.10 – 0.40	Portion of plume below crop canopy (seasonally)
Water/Barren	0	0	0 – 0.10	Barren/vacant lands are inefficient wrt dust capture

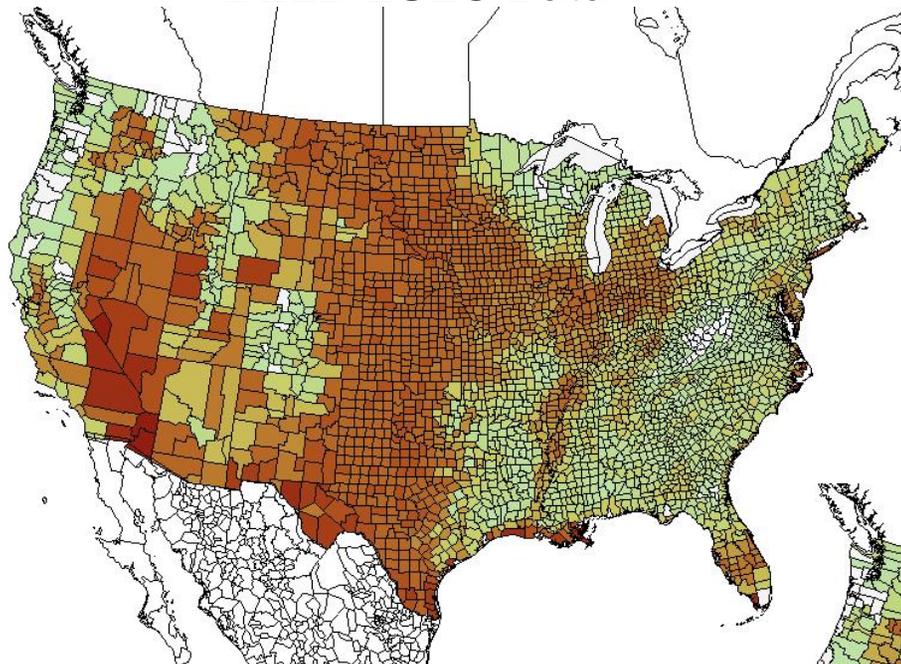
Fugitive Dust Transport Fractions

2000 NALC LULC Data

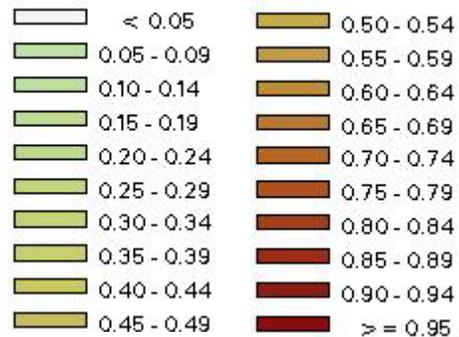


Fugitive Dust Transport Fractions

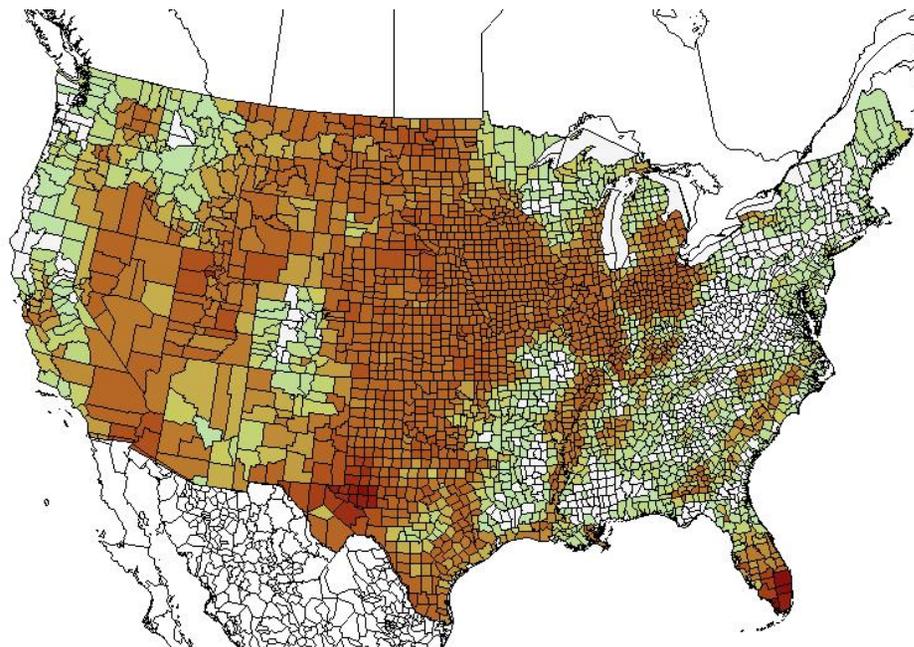
BELD LULC Data



Transport Fractions



NALC LULC Data



Conclusions

- WRAP GIS Landuse Database Project Site
<http://www.wrapair.org/forums/toc/GIS.html>
- Comments/Questions?