Hunters Creek County Park, Mapping Trail Difficulty and Scenic Routes for Biking and Hiking Activities

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Environmental Modeling
Spring 2009
Professor Bian

Introduction

Trail Map of Hunters Creek

Problem:

- Many outdoor recreational areas provide maps for their visitors.
- They tend to only show direction and distance of pathways.
- By providing information of maps about trail difficulty less injuries may take place within the park bounds.
- By providing information of scenic routes people can utilize their time better during their day of leisure.

Study Site: Hunters Creek Park

Located in the Town of Wales, New York.

It is part of Erie County Conservation Parks.

These trails are purposely underdeveloped to promote environmental consideration and the enhancement of natural resources.

Has roughly twenty miles of multi-use, marked and unmarked trails.

Within Hunters Creek limits there contain deep gorges, tributary ravines, open meadows, a shale bottom creek, and old growth forest.

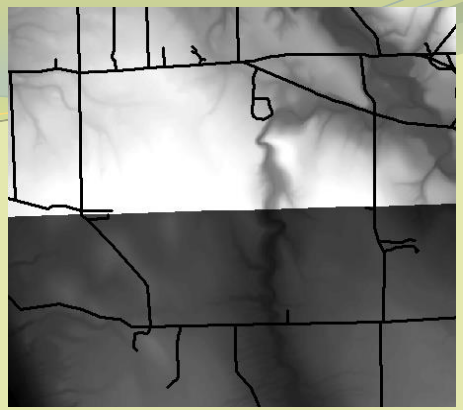
Data & Methods

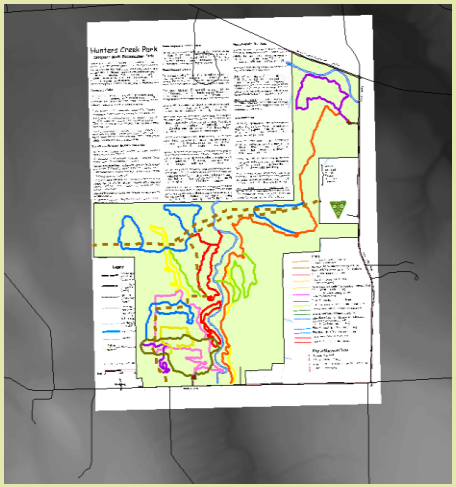
- DEMs from CUGIR in 1:24,000 Quads , 10 meters
- East Aurora DEM
- Holland DEM

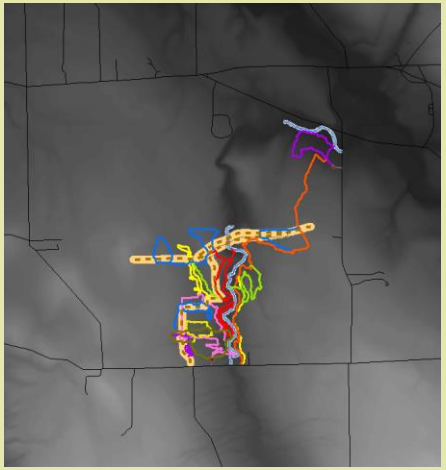
(projected in original North American Datum of 1927)

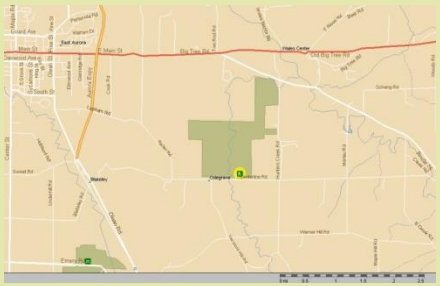
- Erie County Roads shape files from CUGIR

  (defined in NAD 1972, Zone 17)
- Google Maps and Trails Maps from http://www.wnymba.org/static/maps/hunters.pdf were also used to locate the park and trails.
- ERSI ArcMap, ArcScene, and ArcCatalog were implemented for the project.
- After Merging the East Aurora DEM to the Holland DEM a JPEG trail map was overlaid and georectified to the DEM to identify trails and park boundaries using the Erie County roads.









Buffers

Buffer for Dirt Trail
50 Meters
Noise & Crowdedness

Buffer to Creek
15 Meters
Wetness

These are just a few attributes that people may want to avoid while participating in recreational activities at any park.

Cost Distance to Dirt Trail

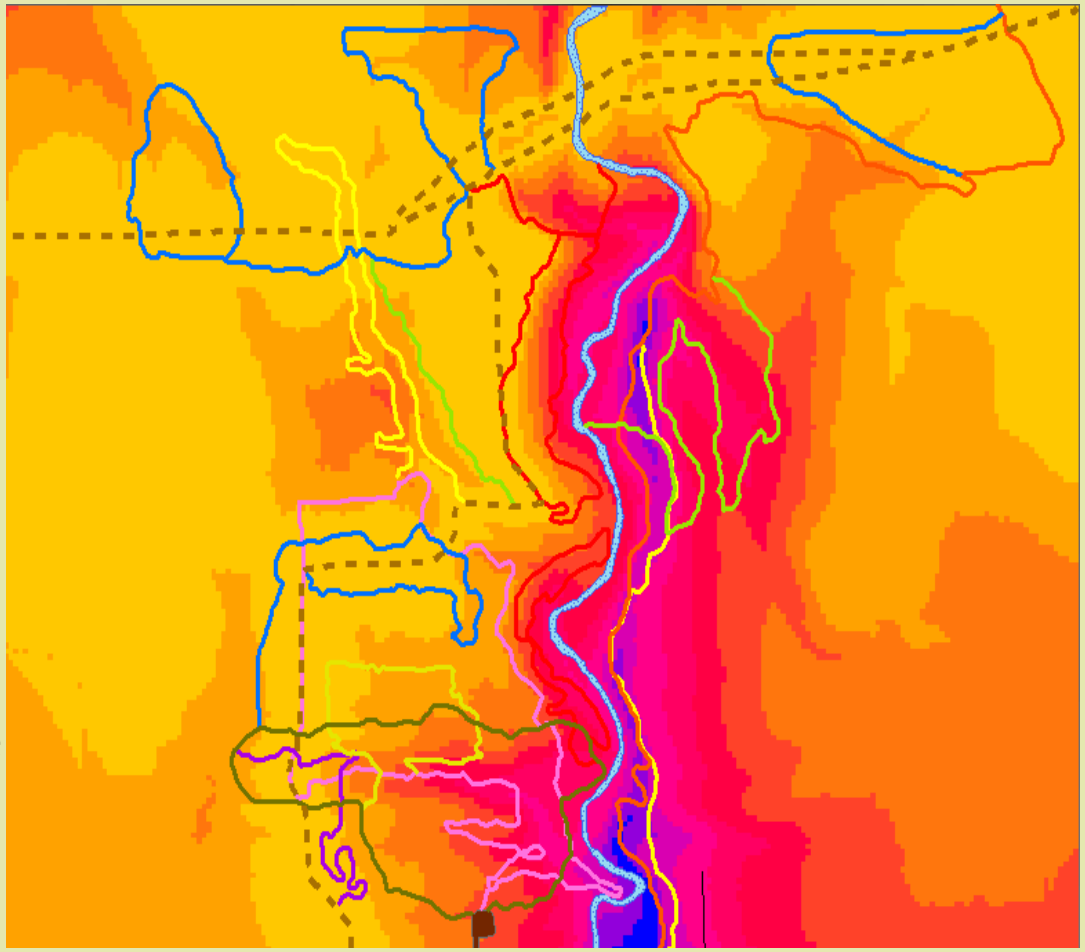
The dirt trail is the main trail in Hunters Creek Park.

If there was ever an emergency this trail would be the easiest trail to take.

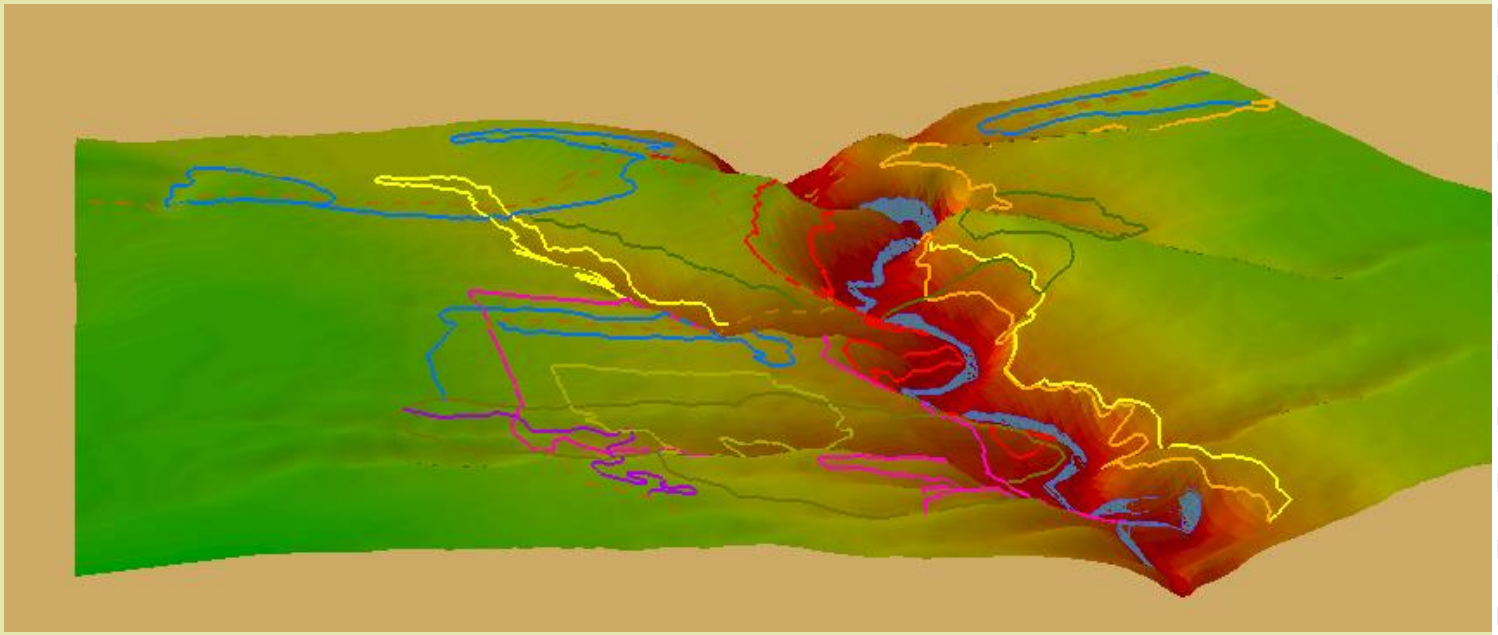
It is it the widest trail and is clear of vegetation, it is also connected to most of the other trails or easily.

Least Cost path distance would not be suitable for this study because of the variable terrain.

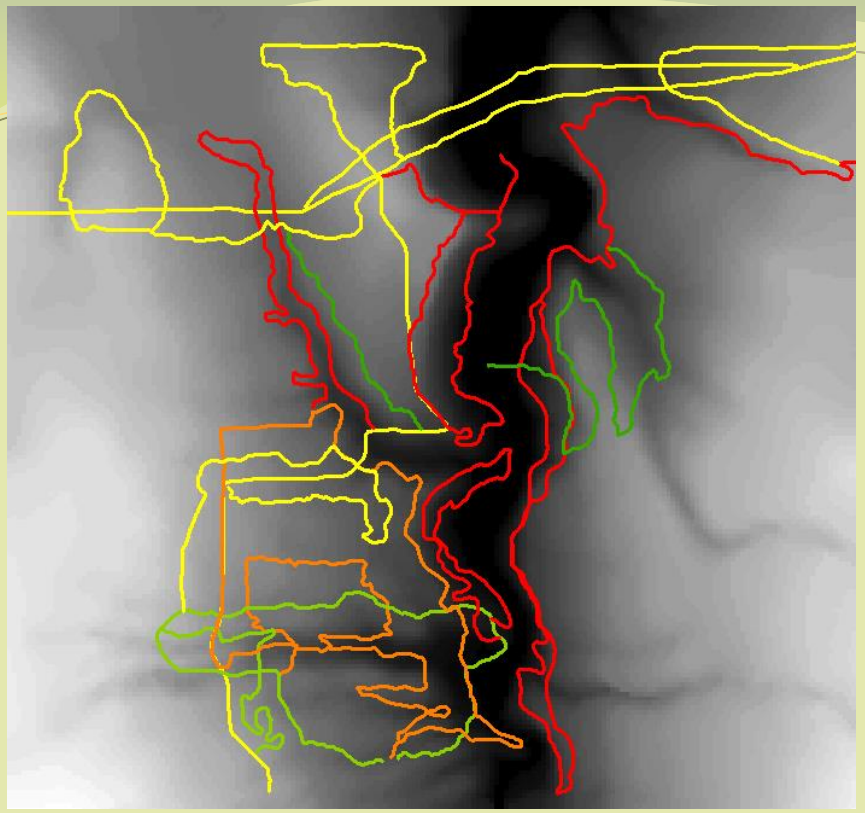
The cost distance to trail directly takes into account the slope of the area along with the distance, to create a visual representation of areas that are easily accessed by people to and from the main trail.



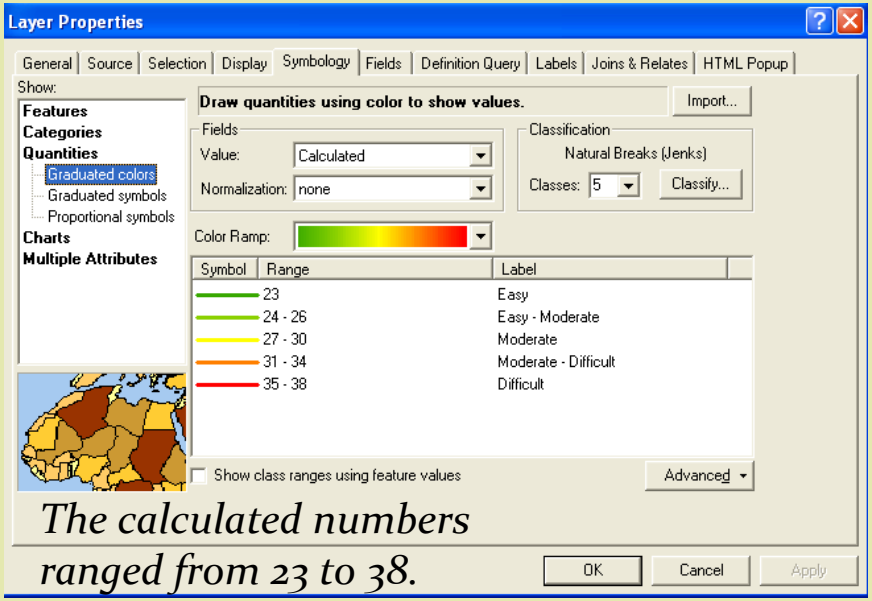
3D View of Hunters Creek Park



By viewing the park's terrain in this manor, one can predict where the more difficult trails may be located.



The trails were merged together, the data put into the attribute table (of the merged trails) and then derived the sum using the field calculator.



The calculated numbers ranged from 23 to 38.

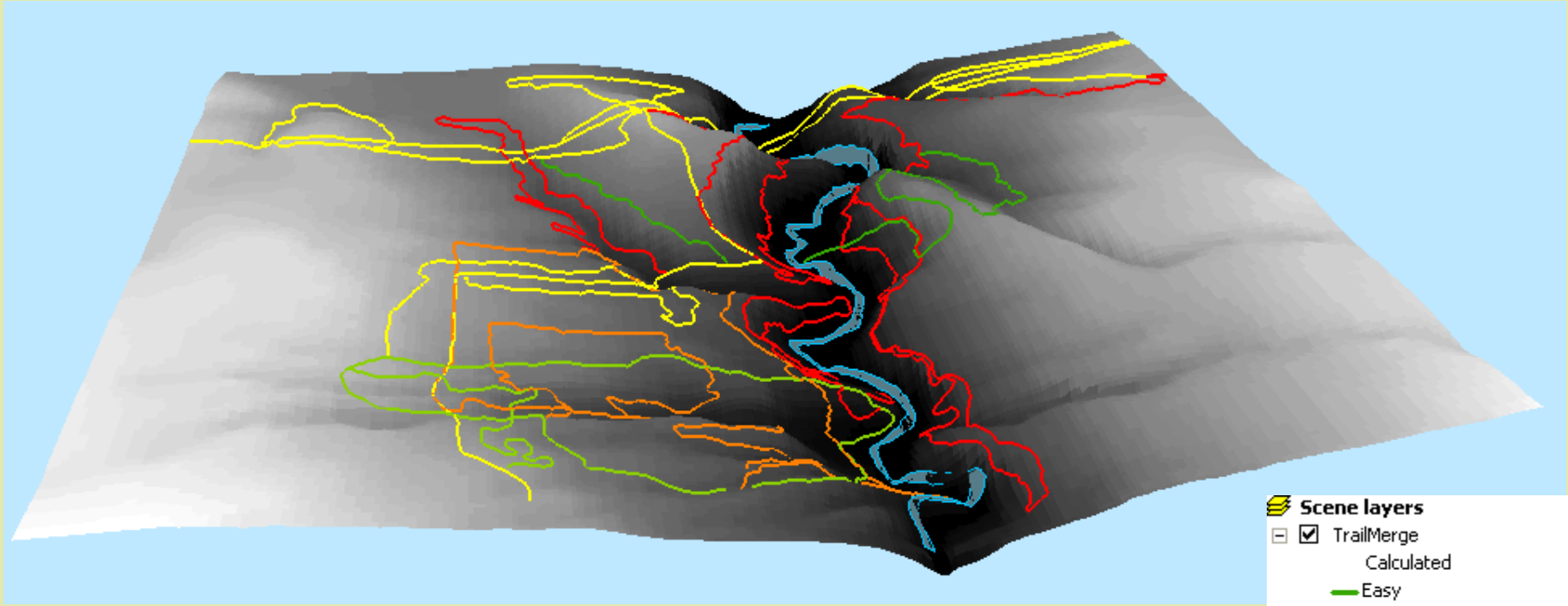
Legend

- Easy
- Easy - Moderate
- Moderate
- Moderate - Difficult
- Difficult

Trail	Number of Peaks & Sinks	Number of Turns	Non-Visible View Shed Number and Rank
Dirt	22	6	4,154 **(1)**
Sgt. Mark	10	8	16,431 **(8)**
YellowGreen	14	10	19,628 **(10)**
Green	15	5	13,348 **(3)**
Blue	17	11	6,880 **(2)**
Purple	10	6	18,321 **(9)**
Pink	16	11	14,600 **(6)**
Red	20	13	14,141 **(5)**
Orange	25	8	13,864 **(4)**
Yellow	23	8	15,137 **(7)**

Results

The Trail Difficulty Analysis indicates that most of the harder trails are located near the creek where the slope and terrain is the most variable and steepest. The easier trails are on more level land, and the main trail and the blue trails which pass through both types of terrain are of moderate level.



Easy: Green Trail
Easy – Moderate: Sgt. Mark & Purple Trail
Moderate: Dirt Trail & Blue Trail
Moderate – Difficult: Yellow-Green Trail & Pink Trail
Difficult: Yellow Trail & Orange Trail

Wi-Fi in Downtown Buffalo

A Suitability Analysis

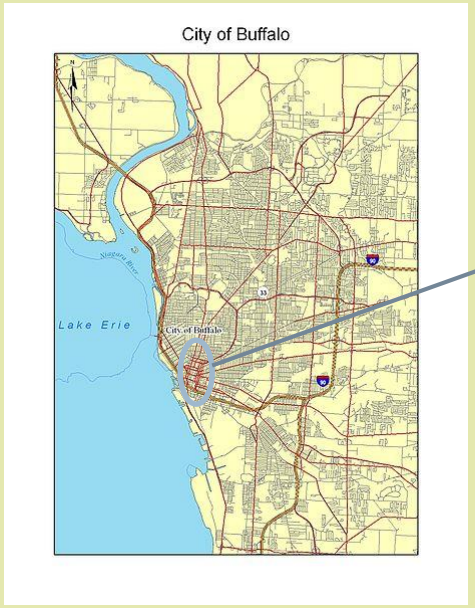
SUNY at Buffalo
Department of Geography
Alvin Guerrero 4/21/09

Environmental Modeling
Prof: Ling Bian

Introduction

Site: Downtown Buffalo
Located in Erie County, NY.

The boundaries of the downtown district are defined by Goodell St to the north, Oak St to the East, S Elwood to the West and finally stretching south to the waterfront by the HSBC Arena.



Approach

- The goal is to use GIS to Identify the most favorable areas for Wi-Fi usage. Thus, allowing for better decision making in terms of Wi-Fi router placement.

- Ultimately, this work could aid in the future planning of a city wide Wi-Fi network. In turn, targeting and servicing the areas with the highest needs.

Methods

Identify the Nodes or points of aggregation.

These are places of pause/recreation where residents assemble and relate to each other;

- Parks
- Plazas
- Bus Stops

➢ These are going to serve as the suitability factors in the project.

➢ Make use of the Spatial Analyst Tools in ArcGIS 9.3

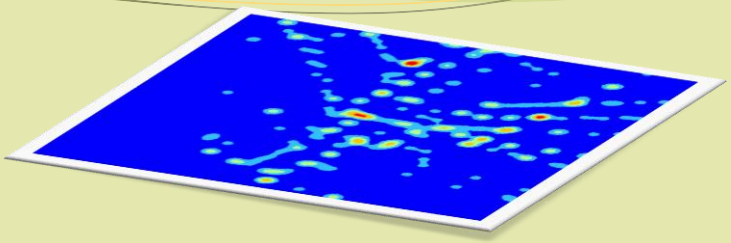
➢ Create a Bus Density layer and overlay with Parks and Plazas layers, to create a Suitability Map.

Data

- U. S. Geological Survey; USGS: The National Map Seamless Server
- Niagara Frontier Transit Authority: NFTA Bus Stop Data

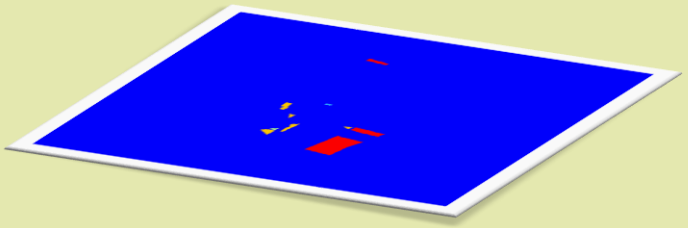
Methods

Weighted overlay



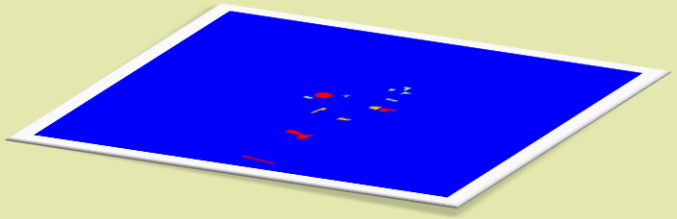
Bus Density

+

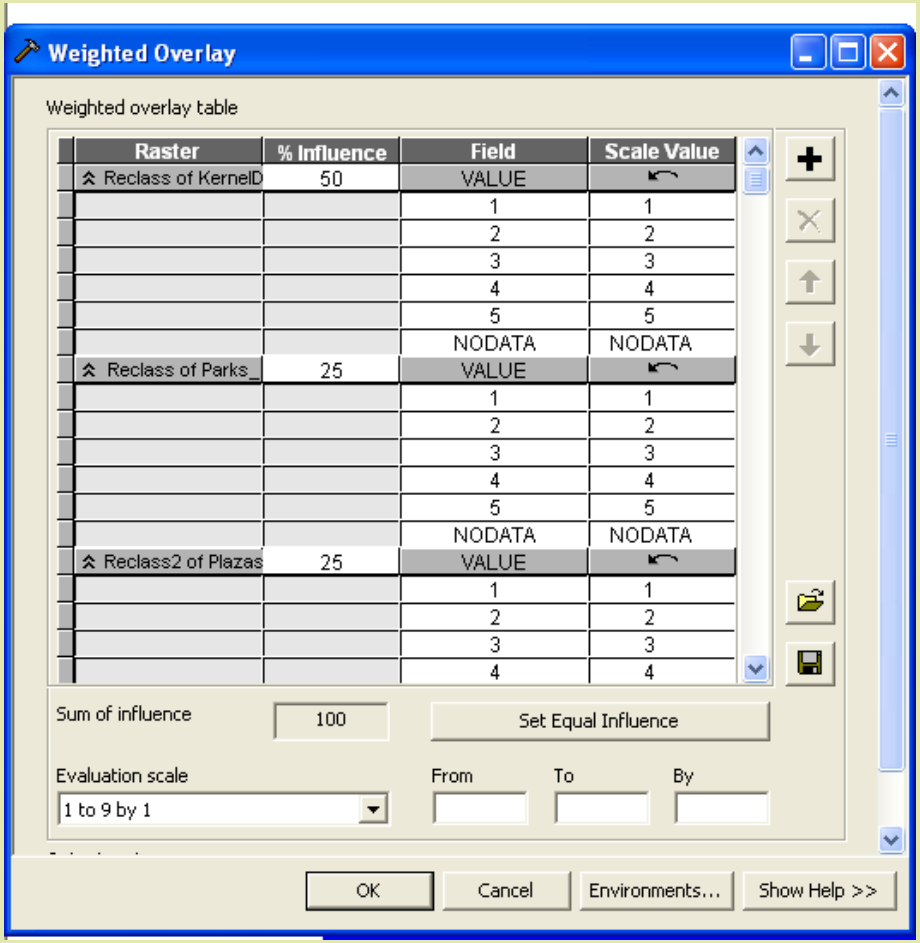


Parks

+

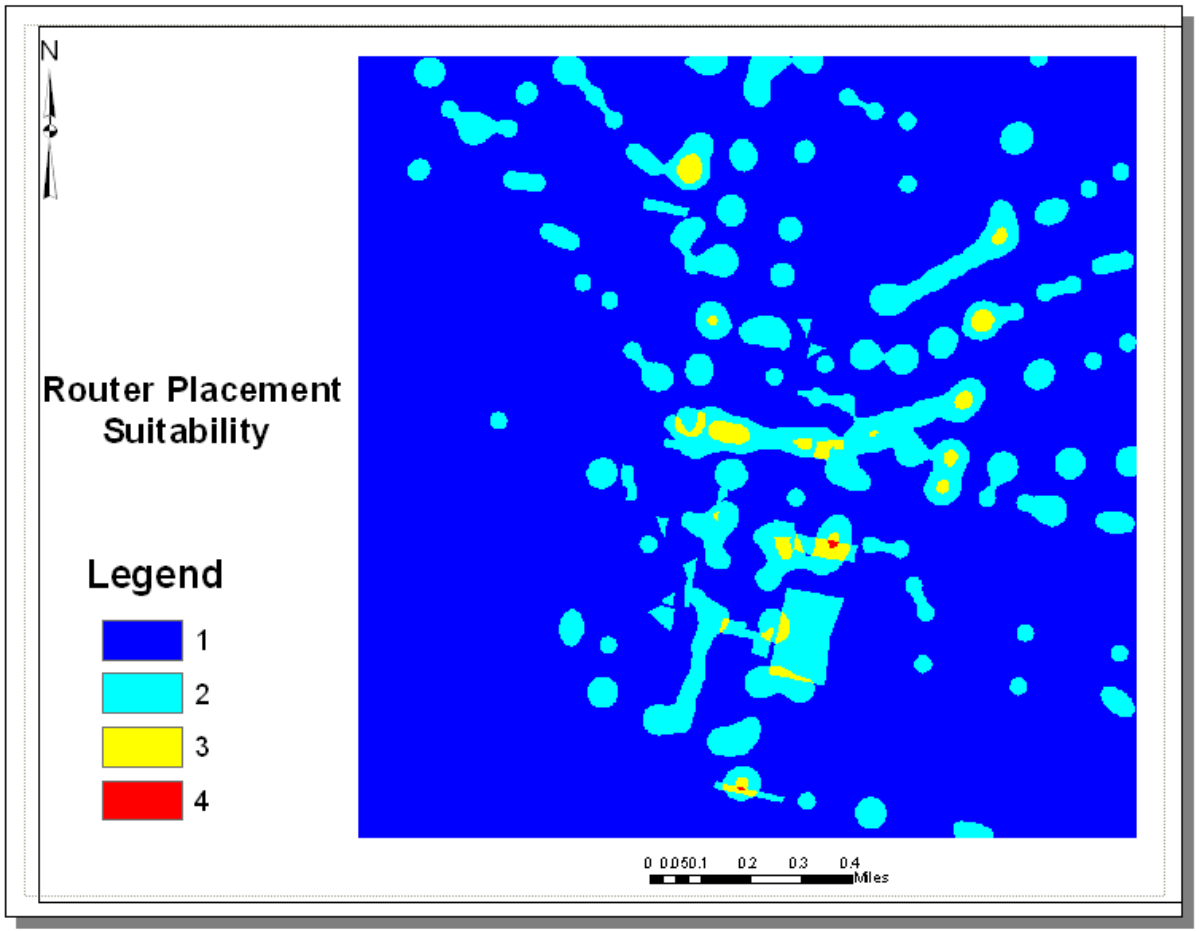


Plazas



Results

Overlay results



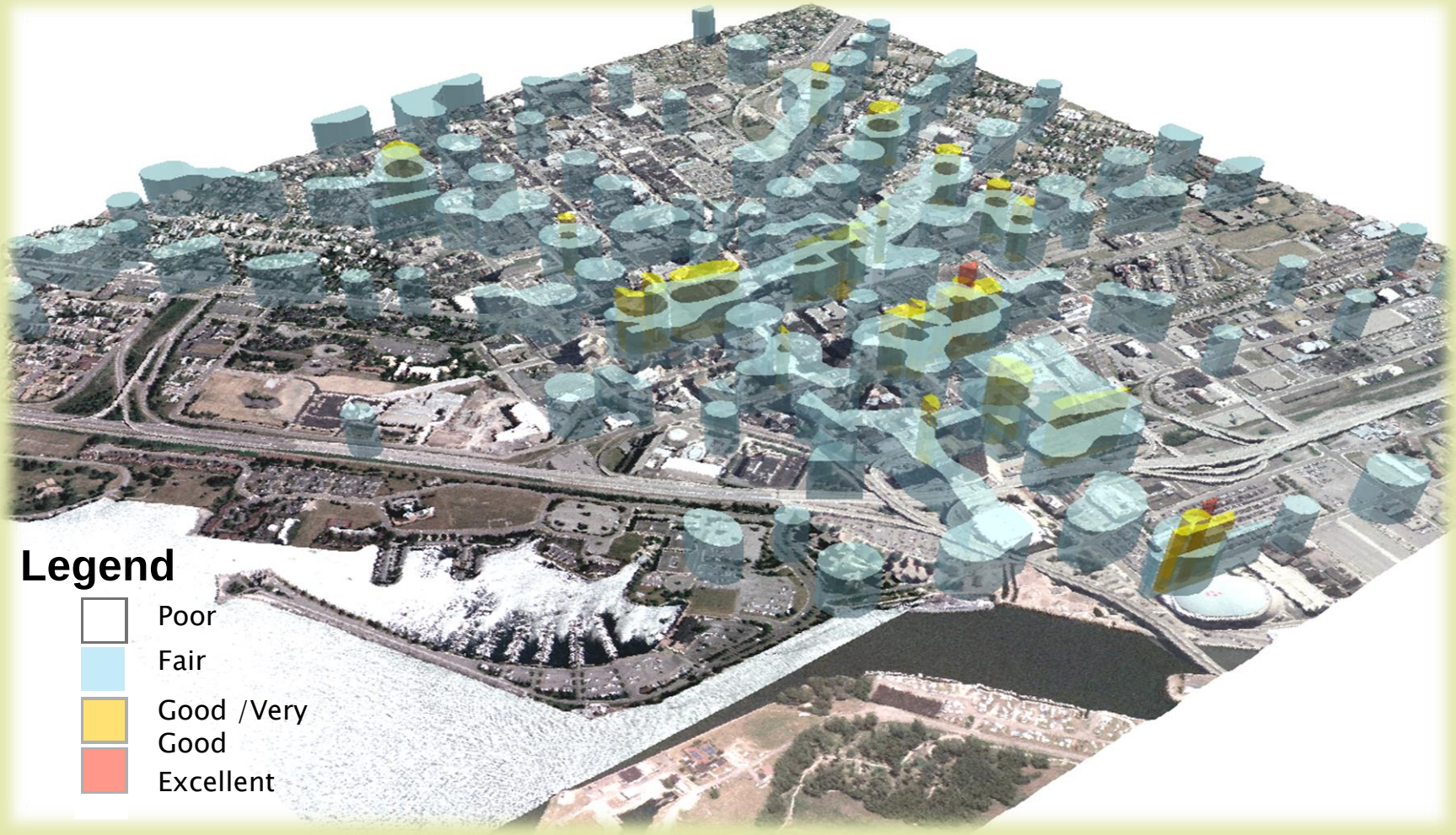
Legend

- Poor
- Fair
- Good /Very Good
- Excellent

The results are similar to the bus density map. This seems to occur because it was assigned half of the total weight.

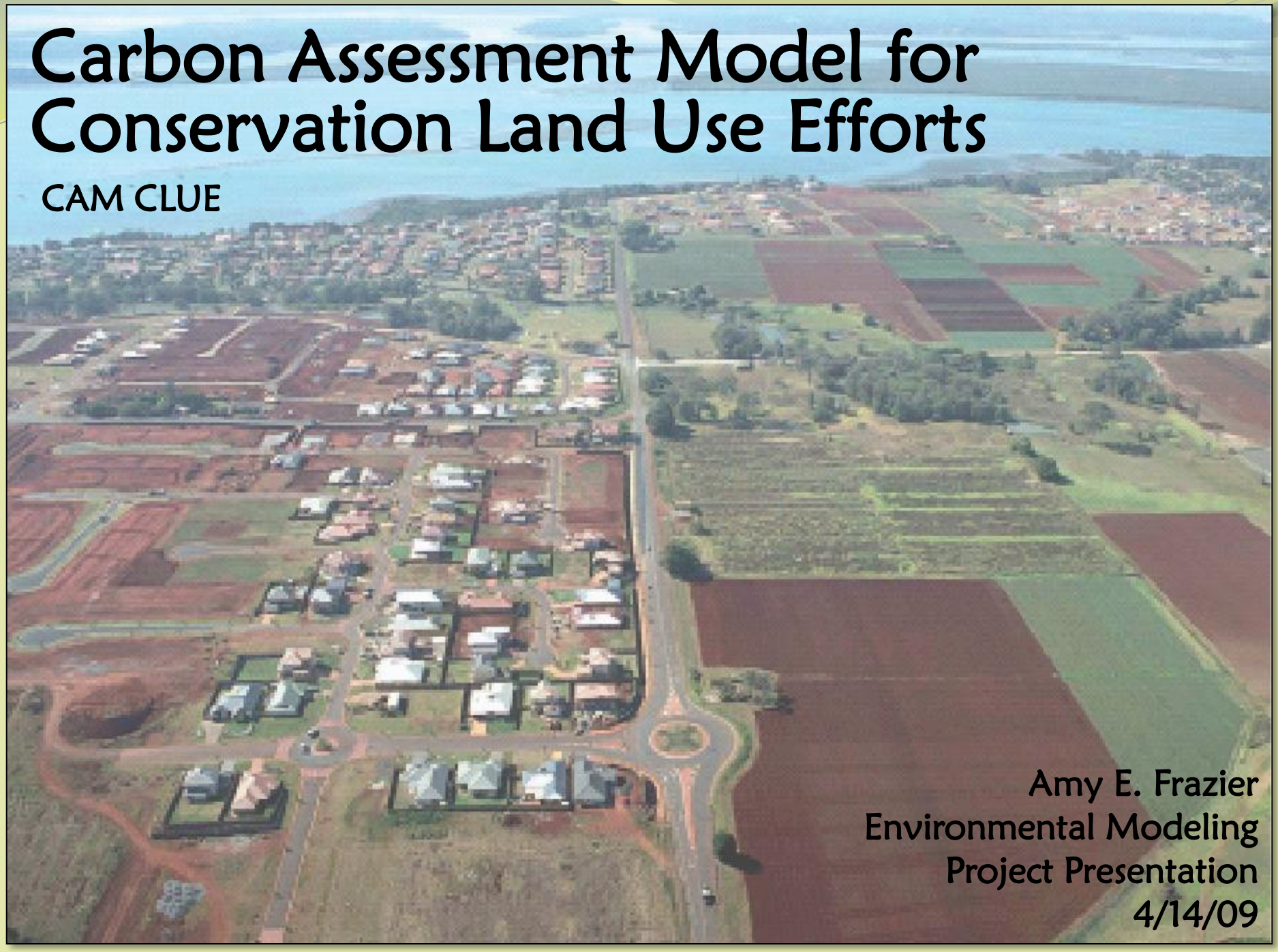
Discussion

- 3D representation of suitability areas.



Carbon Assessment Model for Conservation Land Use Efforts

CAM CLUE



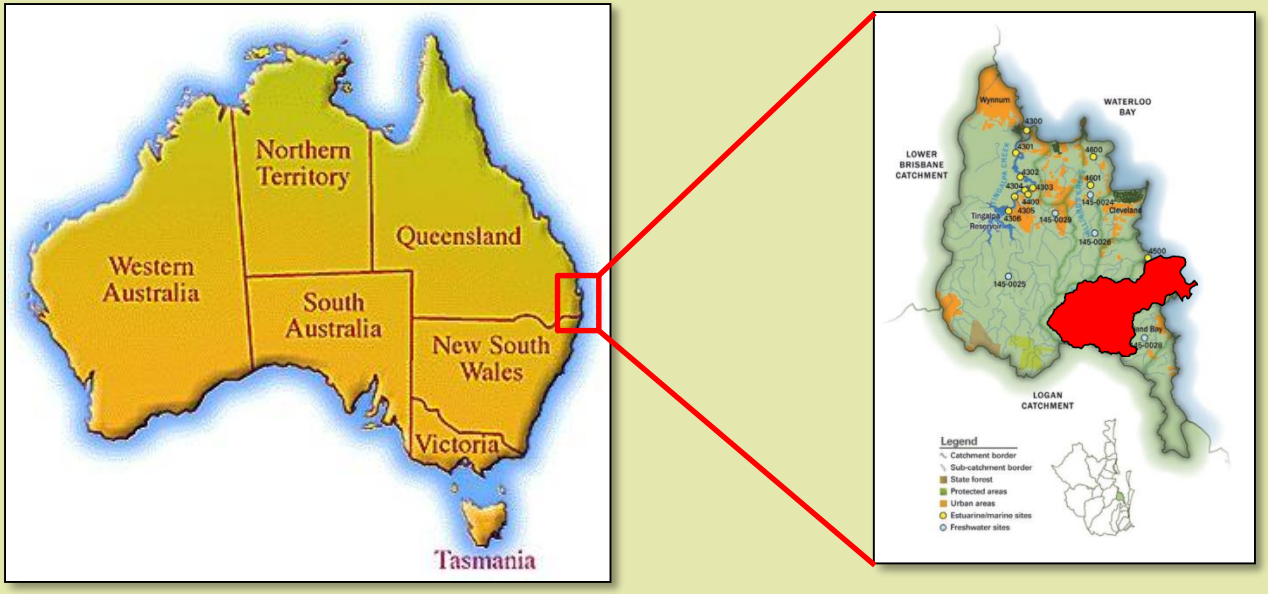
Amy E. Frazier

Environmental Modeling
Project Presentation
4/14/09

Introduction

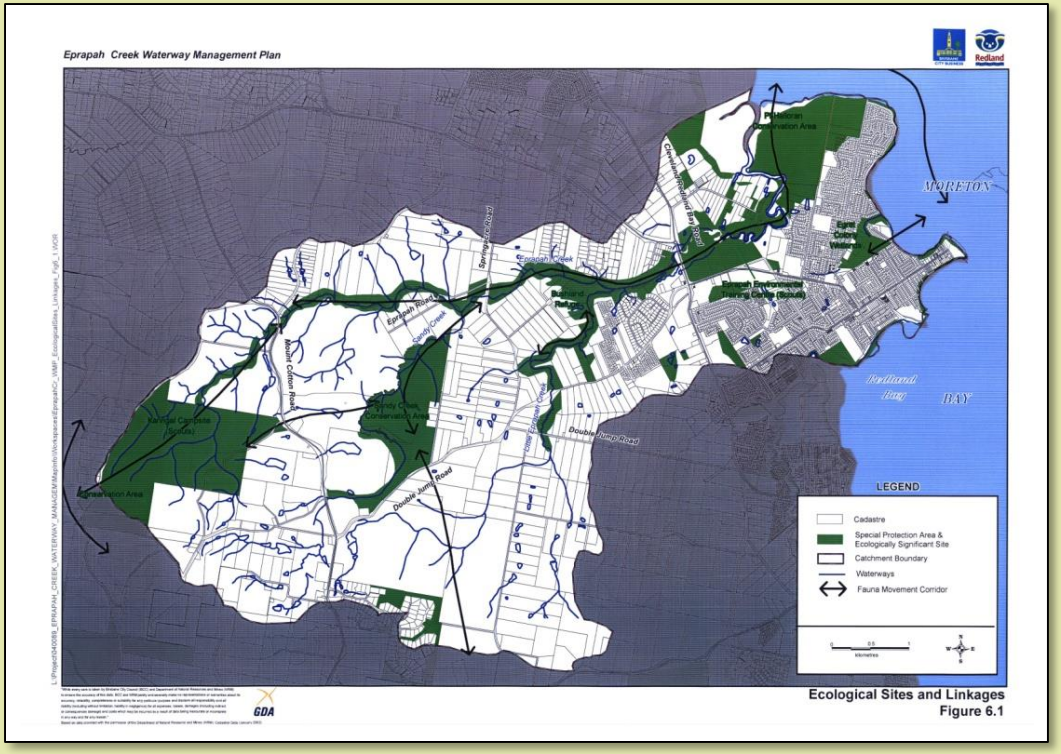
Eprapah Creek Catchment Study Area

- 39 km^2 subtropical watershed
- Located south of Brisbane in community of Redland Shire
- Fastest growing region in Australia
- Community has committed to reducing greenhouse gases by 15% from 1996 levels.



Study Objective

Develop a Carbon Assessment Model to determine if the Conserved areas within Eprapah Creek Catchment are having a positive effect on carbon sequestration and are helping to offset carbon emissions from higher intensity land uses (Commercial, Industrial, etc.)



Map of the Conserved Areas within Eprapah Creek Catchment

Data/Methodology

The CAMCLUE model is comprised of 3 main parts:

1. Baseline soil organic carbon levels:

SOC = -0.197 + [0.014*(elevation)] + [1.854*(exposure)]

(Cheng et al., 2004)

2. Remnant Vegetation (carbon sink)

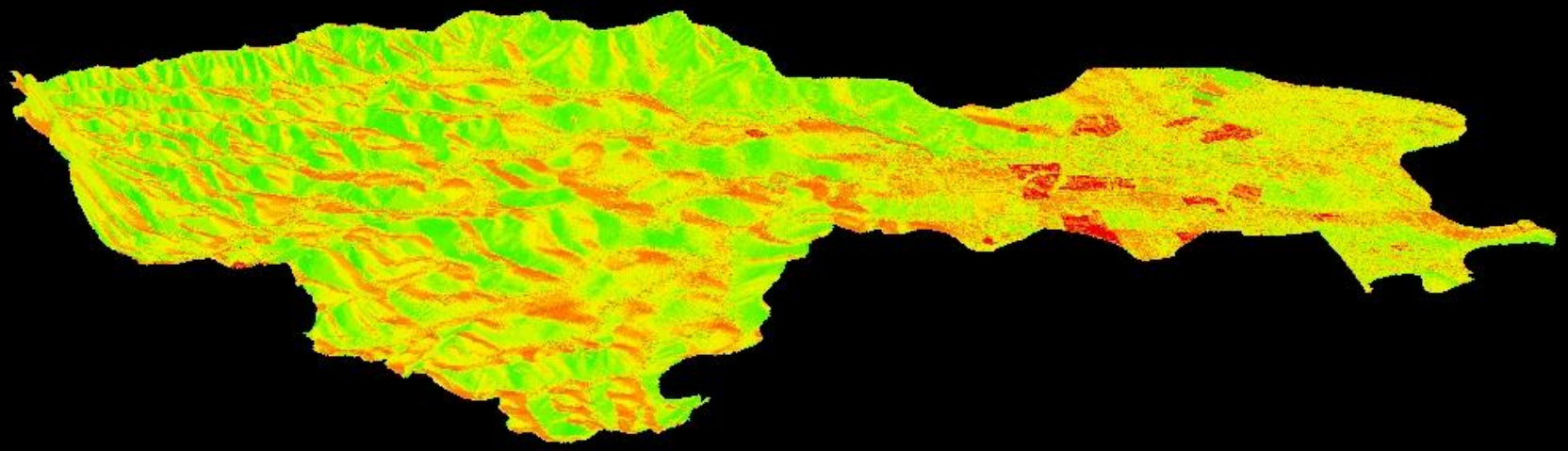
Nitrogen fixers sequester ~ 0.11 Kg C/m^2/yr

Non-Nitrogen fixers sequester ~ 0.00 Kg C/m^2/yr (Resh et al., 2002)

3. Land Use = (Per Pixel Land Use) * (Per Pixel Carbon Emissions)

Carbon Sequestration Surfaces

View from the South looking North

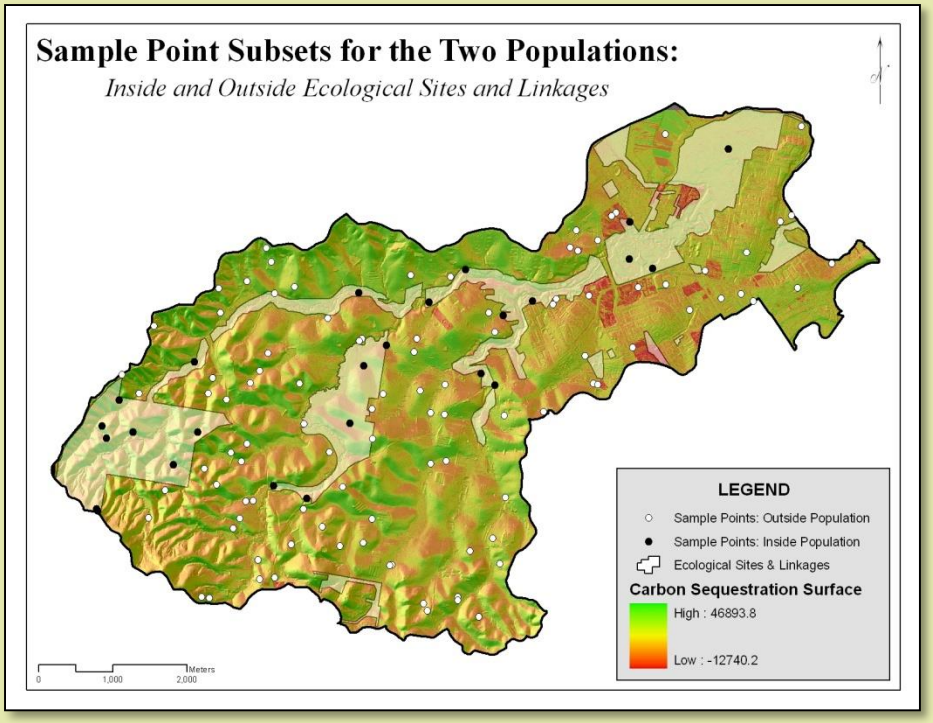


Data Conversion

Converted raster pixels to points (2m res)

- Over 10,000,000 points

Used Hawth's Tools to create random, equal-density selections – 25 inside, 100 outside Conserved Areas



Student's t-test Conclusions

- One-tailed, two-sample, homoscedastic (equal variance) t-test
- p= 0.025
  - ~ 2.5% probability that the samples are from the same population.
  - ~ Conservation efforts are having a positive effect on carbon values
- Conclusions
  - ~ Conservation efforts throughout the catchment are having a positive effect on carbon sequestration

Public transit gets green, goes green; but could they have gone even greener than the green they went?

An alternative to NFTA's plan for their twenty-five million dollars

Chris Fiorillo

Background

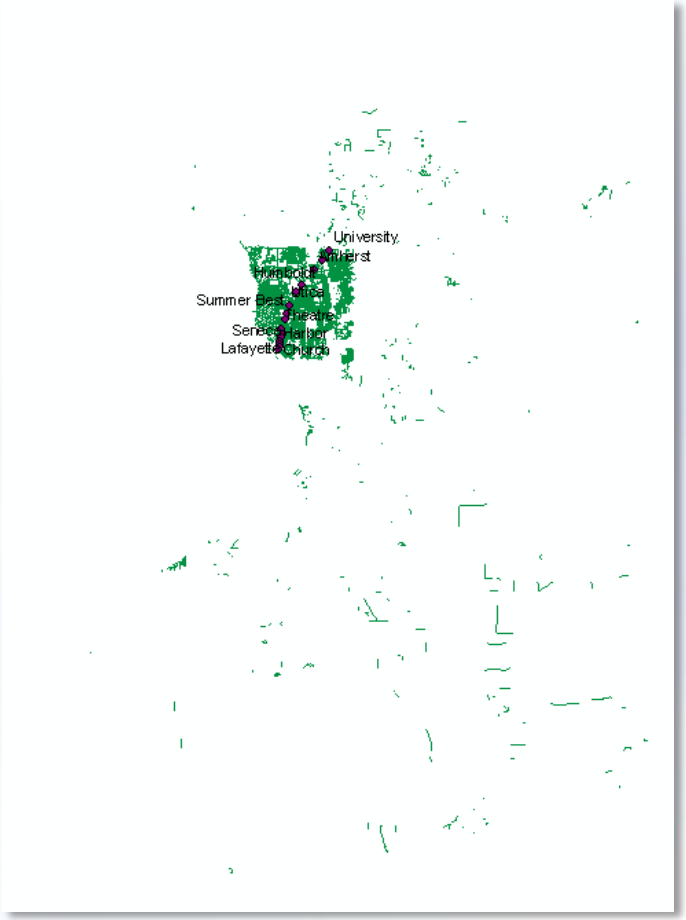
"The American Public Transportation Authority said Monday that light rail passenger traffic in Buffalo jumped 23.9 percent for the full year and up 30.9 percent in the fourth quarter. The light rail system, operated by the Niagara Frontier Transportation Authority, had 6.86 million passengers last year, up from 5.5 million in 2007.

Ridership on the NFTA's metro bus system increased 6.75 percent in 2008 to 21.38 million from 20 million year-over-year. In the fourth quarter, that figure was up 7.66 percent to 1.82 million from 1.67 million in the same period of 2007."

(Buffalo Business First, 03.03.09)

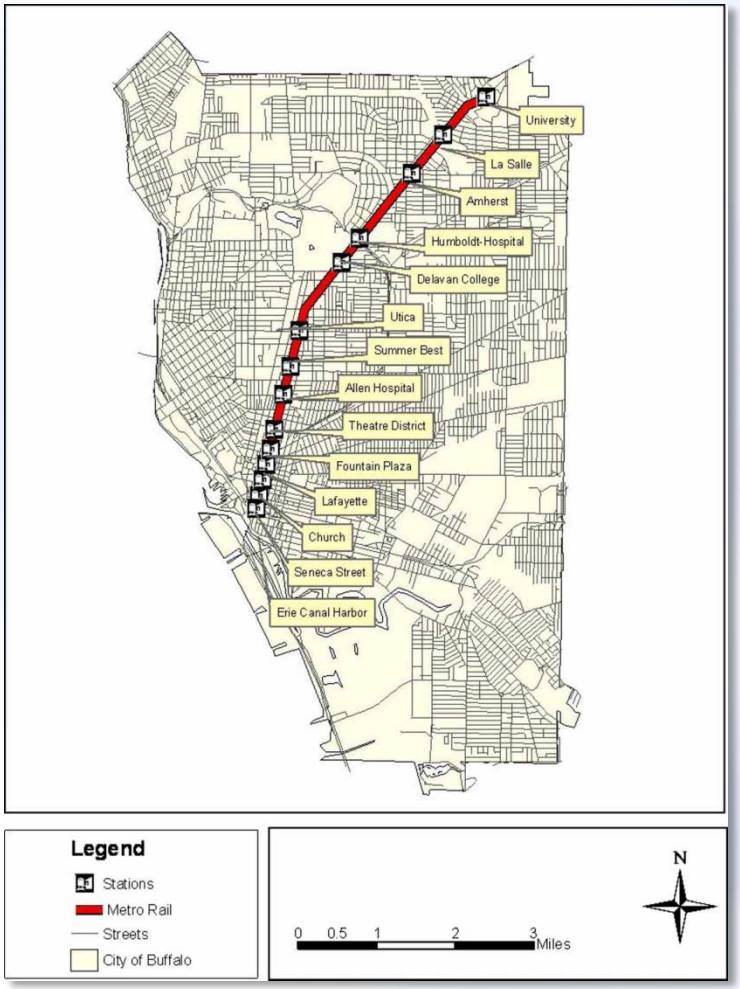
The goal of this study is to examine a cross section of the NFTA transportation network to determine the "effectiveness" of this investment in buses as opposed to instead investing some of these funds in the light rail network. Conclusions will be drawn based on relative EPP (emissions per person) and time in transit from one point across a network via a TOD style system (bicycle & rail) versus "traditional mass transit" via bus of both pre and post hybrid installation.

Study Area!

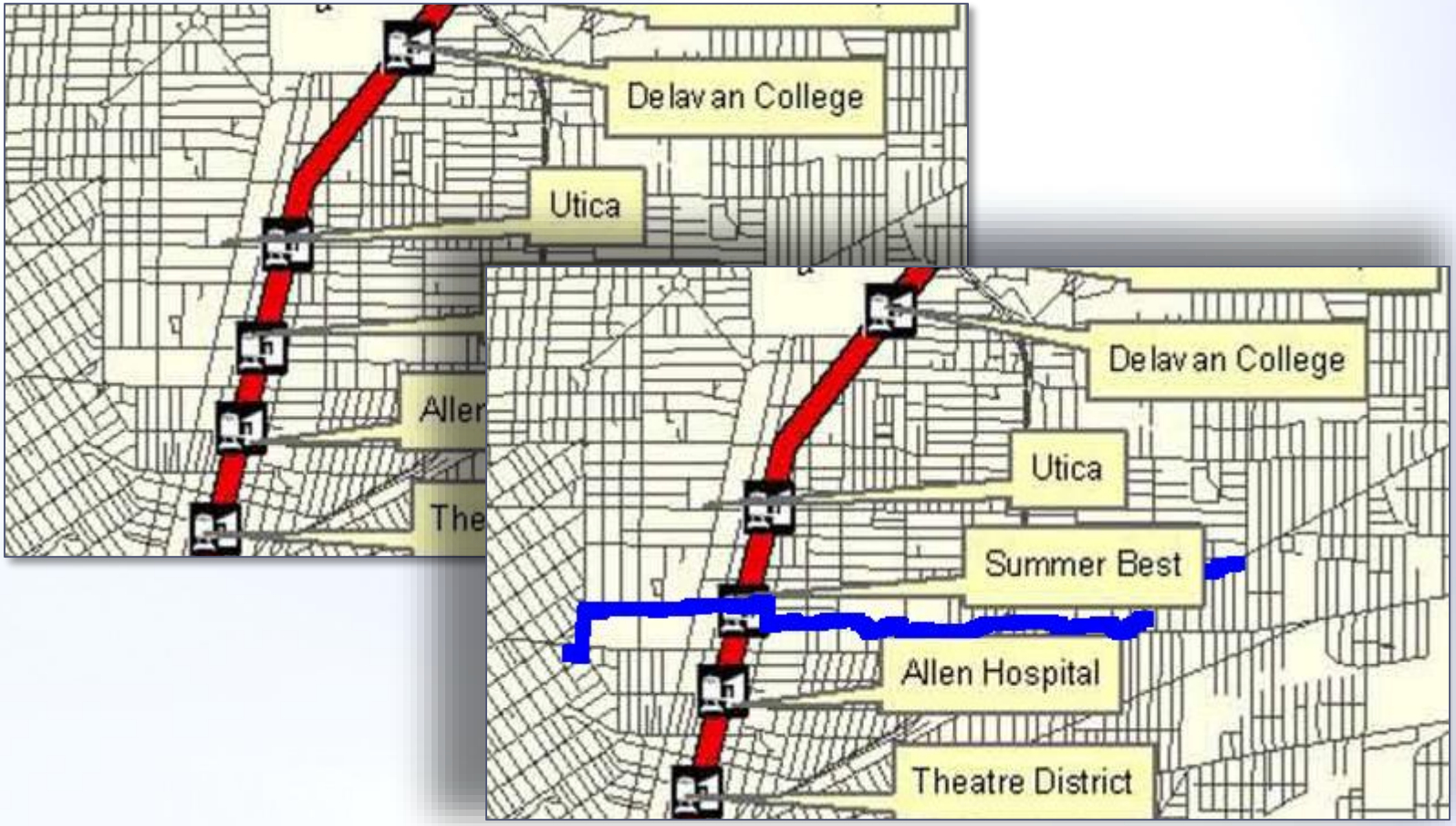


Chipmunks ate my map.

So I will borrow this one for the Powerpoint.



Study Area



Blue Line Indicates Route of Bus 22A

Some Pictures

A few more.

The plan.

Using network analyst (and lots of other fun things), I will eventually generate a series of raster grids representing distance traveled(which will, for the most part be a factor of time) by an individual to travel from one point to another within a given time period section of NFTA's transit network. Deduced from these, a total cost of energy can be calculated.

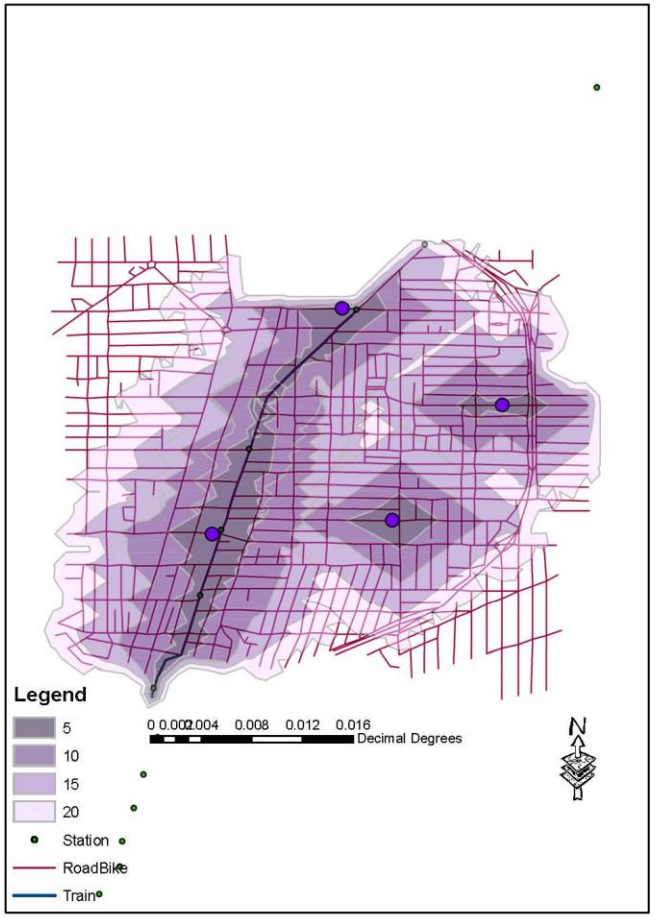
The primary goal of the study is to estimate environmental gains derived from a more cost effective and holistic planning approach centered around the principles of TOD, some of which are described below:

- A balanced mix of uses generates 24-hour ridership. There are places to work, to live, to learn, to relax, and to shop for daily needs.
-For every 1,000 workers, no more than 500 spaces and as few as 10 spaces are provided.
-Transit service is fast, frequent, reliable, and comfortable, with a headway of 15 minutes or less.
-Traffic is calmed, with roads designated to limit speep to 30mph on major streets and 20 mph on lesser streets.

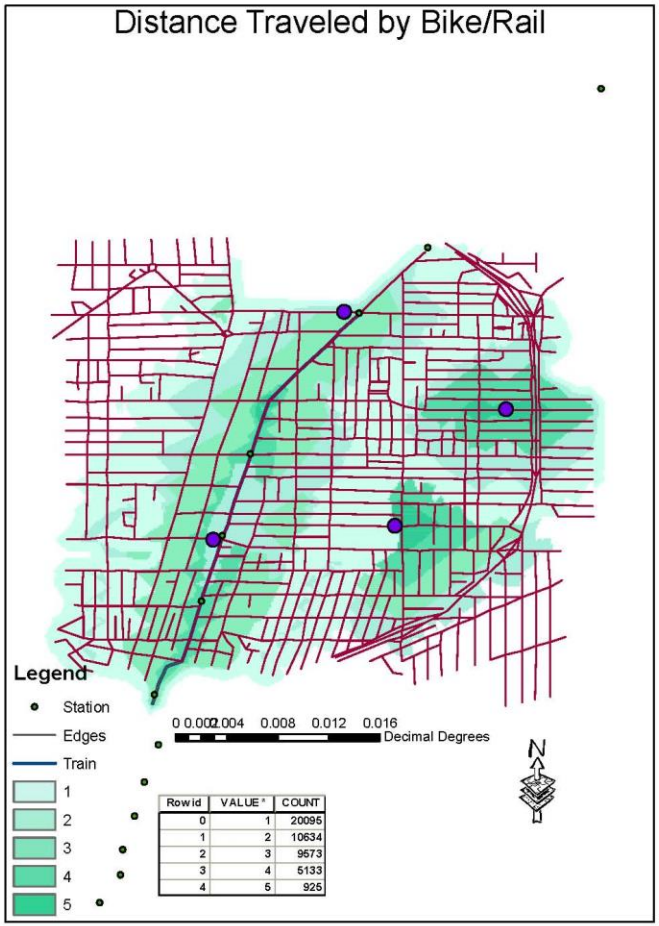
(Millard-Ball, 2003)

Data

Distances Traveled by Bike/Train

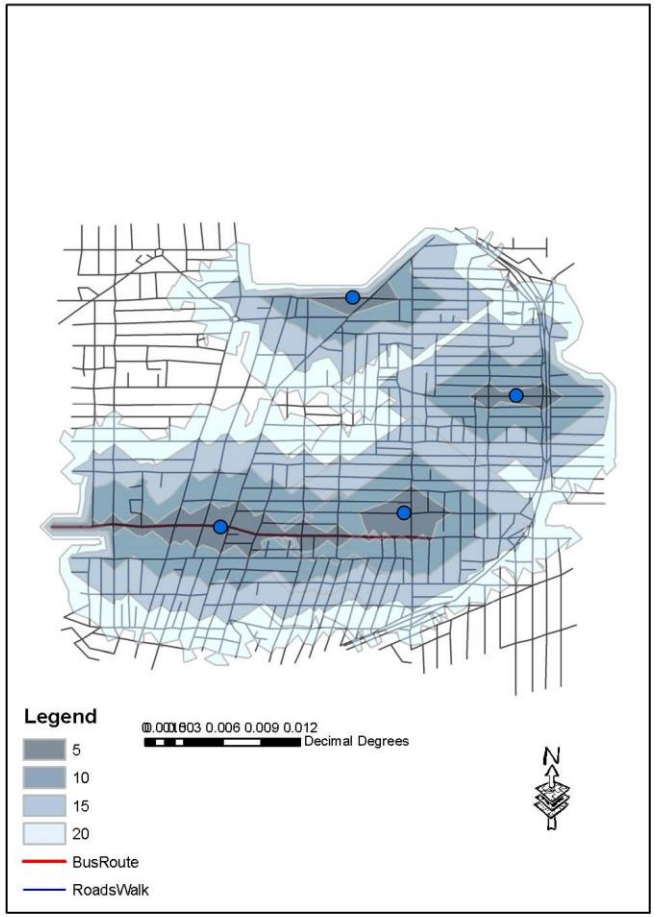


Distance Traveled by Bike/Rail

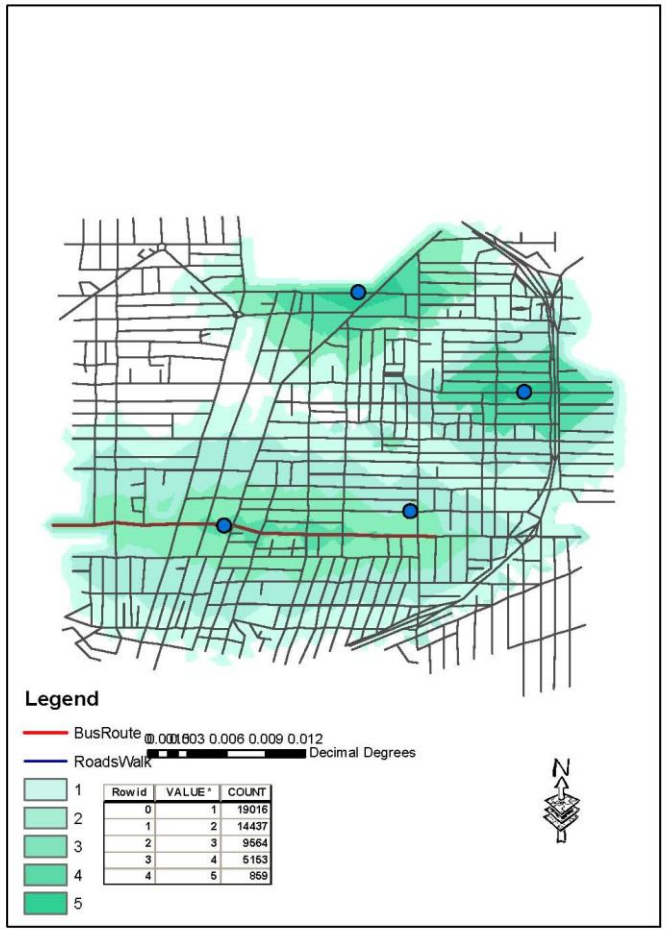


Data

Distances Traveled by Foot/Bus



Distances Traveled by Foot/Bus



Conclusions:

The resulting maps indicate that not only would one expect to cover a far greater distance using the bicycle and train when compared to on foot and bus, but they could expect to do so using less energy and reducing vehicle traffic and pollution as well. The service area is much larger and therefore the energy costs much less per mile via BT according to the maps and calculations.

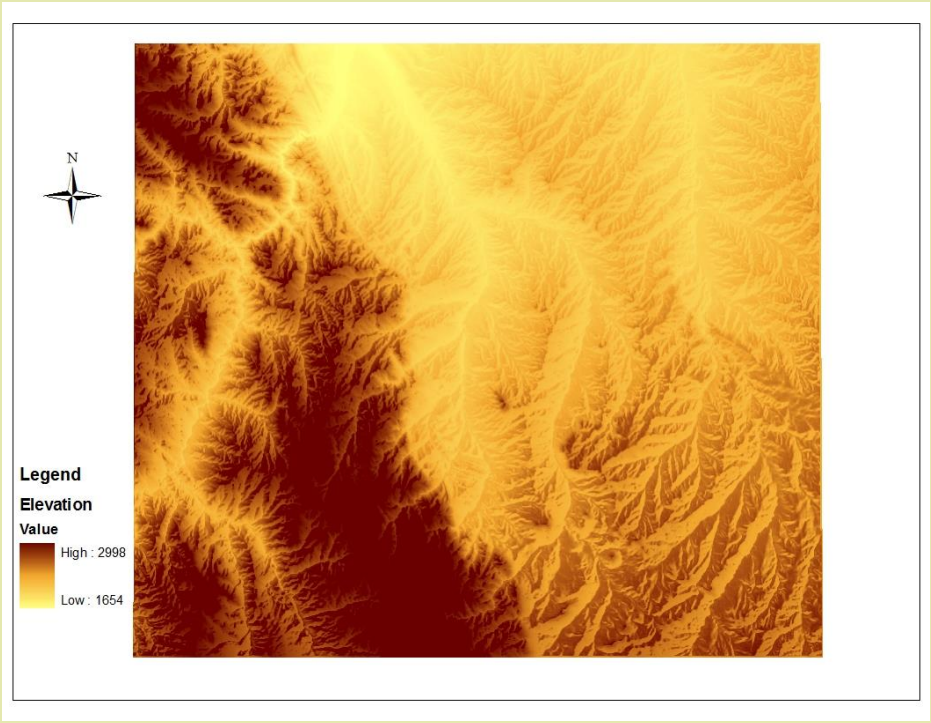
The goals of the project were multiple, ranging from simply exploring the idea of implementing a TOD policy to showing some of the potential advantages of travel via light rail to even proposing a way to cut transit costs while being considerate of the environment. In addition to these, the study has also shown a significant reduction in costs associated with providing transportation if one were to use only a bicycle and train rather than the network of buses. It is hoped that the next time the city of Buffalo receives a substantial sum of money for reinvestment, that they spend a bit more time in considering how to best spend it rather than simply choosing the most basic option.

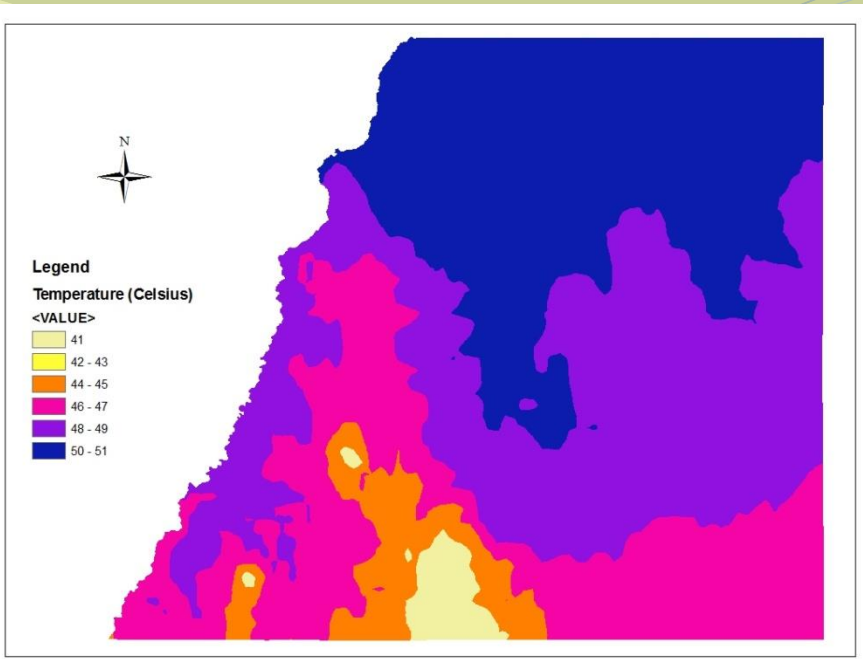
GIS and multi-criteria support system for site selection of photo-voltaic power plants

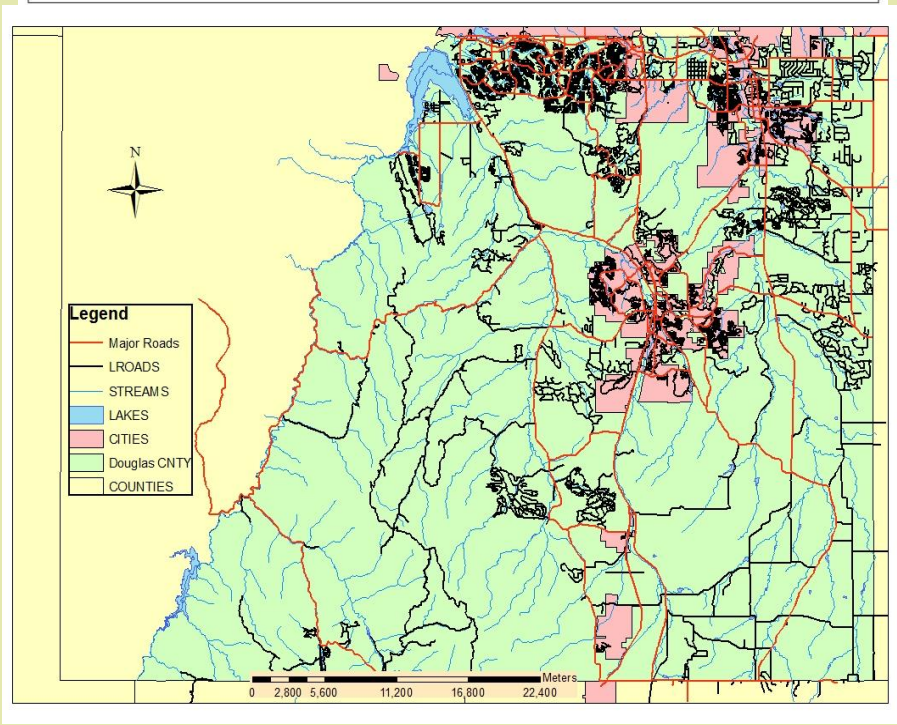
Cody Martin

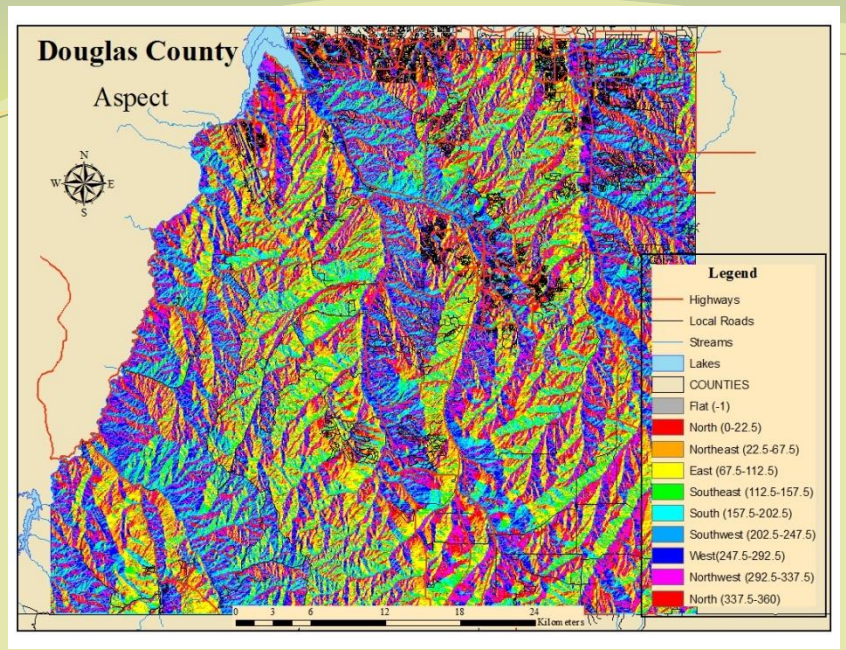
GEO 559

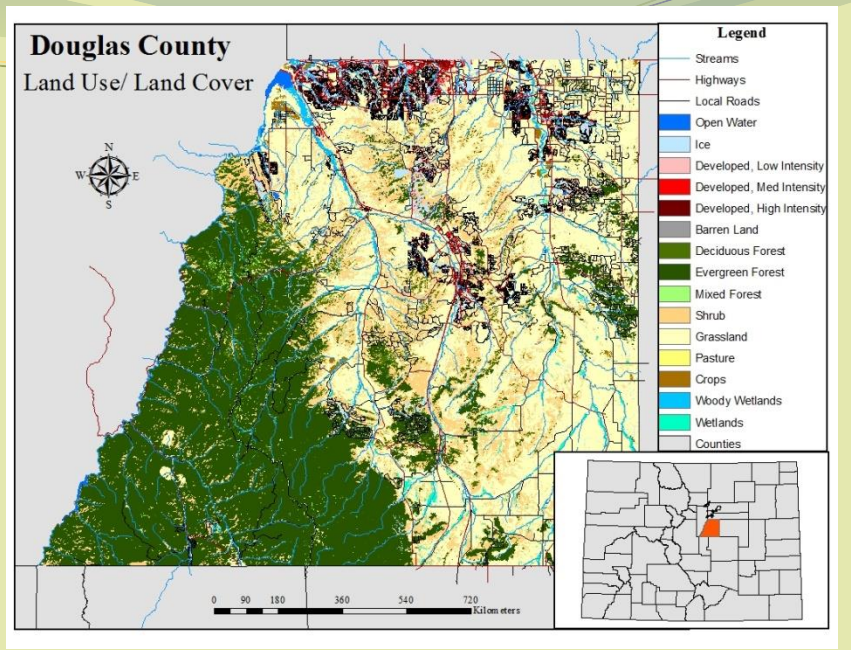
Data

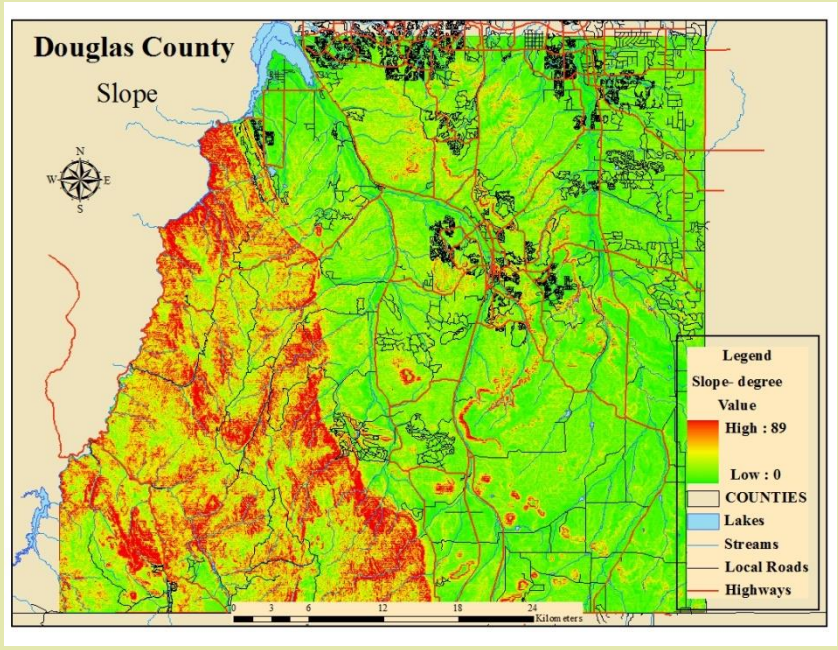

N
Legend
Elevation
Value
High : 2998
Low : 1654

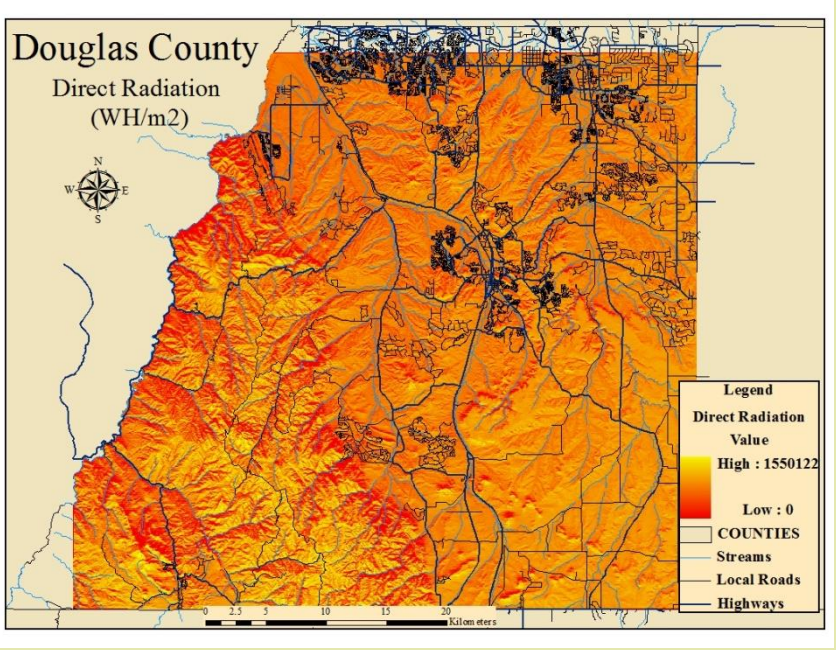

N
Legend
Temperature (Celsius)
<VALUE>
41
42 - 43
44 - 45
46 - 47
48 - 49
50 - 51


N
Legend
Major Roads
LROADS
STREAMS
LAKES
CITIES
Douglas CNTY
COUNTIES
0 2,800 5,600 11,200 16,800 22,400
Meters


Douglas County
Aspect
Legend
Highways
Local Roads
Streams
Lakes
COUNTIES
Flat (-1)
North (0-22.5)
Northeast (22.5-67.5)
East (67.5-112.5)
Southeast (112.5-157.5)
South (157.5-202.5)
Southwest (202.5-247.5)
West(247.5-292.5)
Northwest (292.5-337.5)
North (337.5-360)
0 3 6 12 18 24
Kilometers

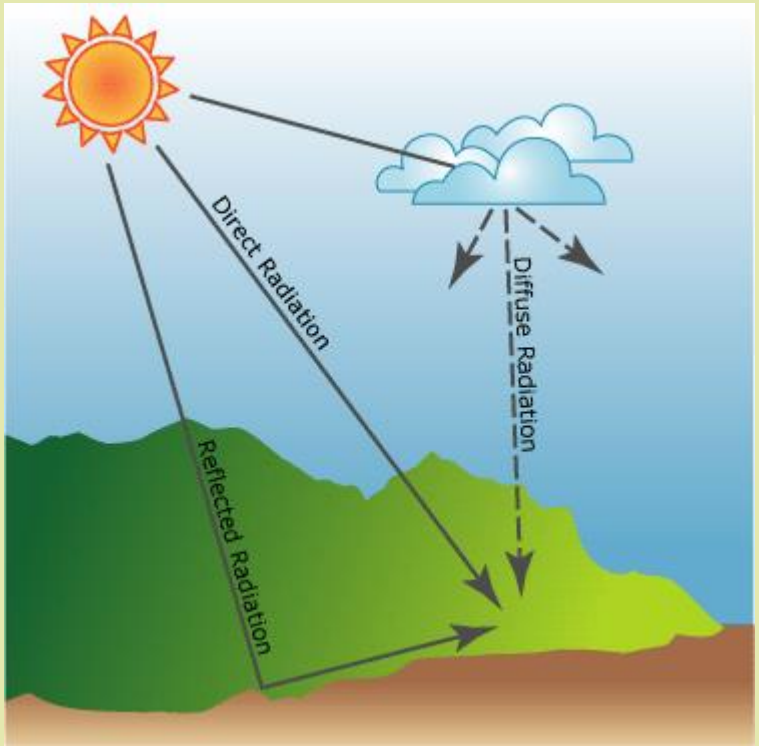

Douglas County
Land Use/ Land Cover
Legend
Streams
Highways
Local Roads
Open Water
Ice
Developed, Low Intensity
Developed, Med Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub
Grassland
Pasture
Crops
Woody Wetlands
Wetlands
Counties
0 90 180 360 540 720
Kilometers


Douglas County
Slope
Legend
Slope- degree
Value
High : 89
Low : 0
COUNTIES
Lakes
Streams
Local Roads
Highways
0 3 6 12 18 24
Kilometers


Douglas County
Direct Radiation
(WH/m2)
Legend
Direct Radiation
Value
High : 1550122
Low : 0
COUNTIES
Streams
Local Roads
Highways
0 2.5 5 10 15 20
Kilometers

Methods

- Solar Radiation Tool
  - $Dir_{tot} = \Sigma Dir_{\theta,\alpha}$
  - $Difn_{\theta,\alpha} = R_{glb} * P_{dif} * Dur * SkyGap_{\theta,\alpha} * Weight_{\theta,\alpha} * \cos(AngIn_{\theta,\alpha})$
- Reclassification
- Analytic Hierarchical Process
- Weighted Combination

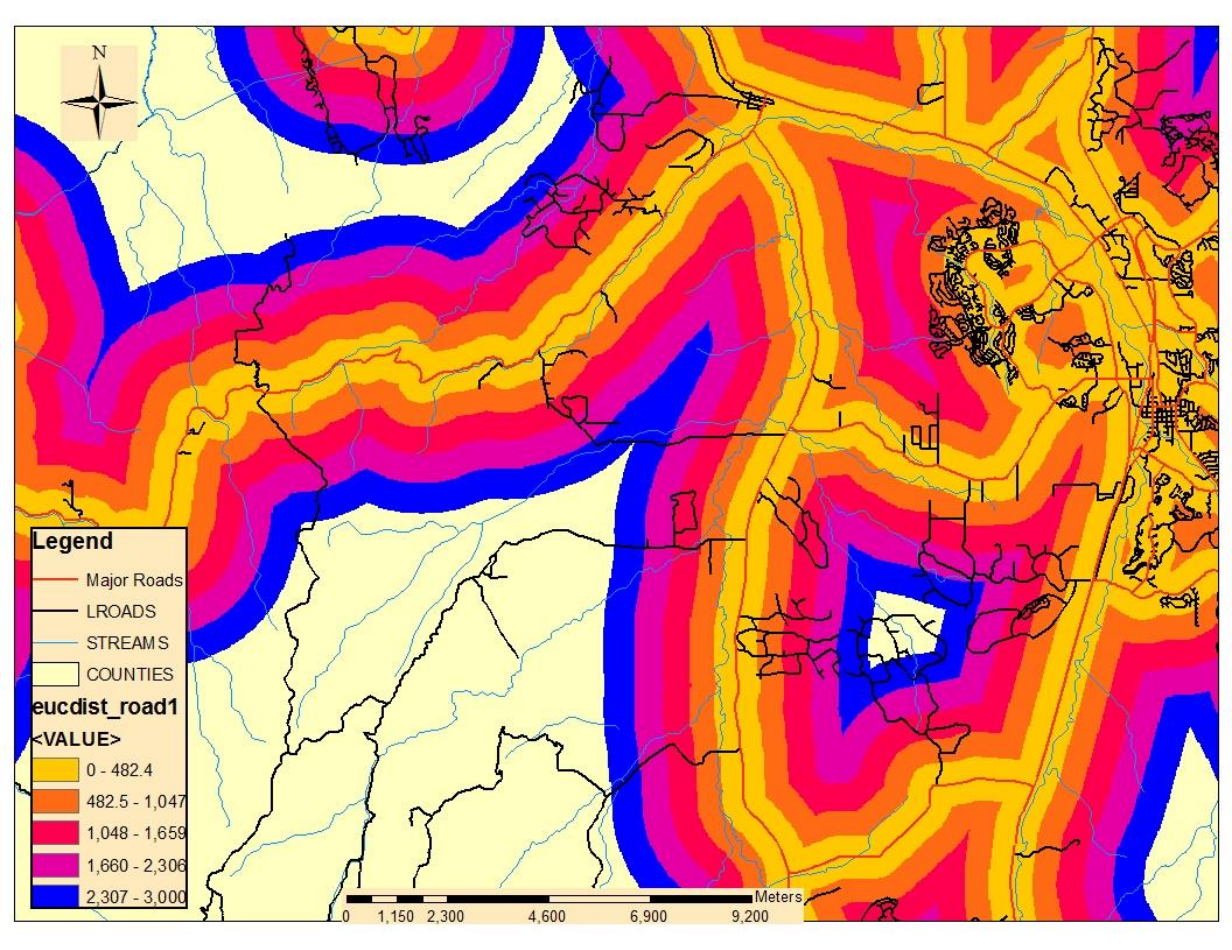


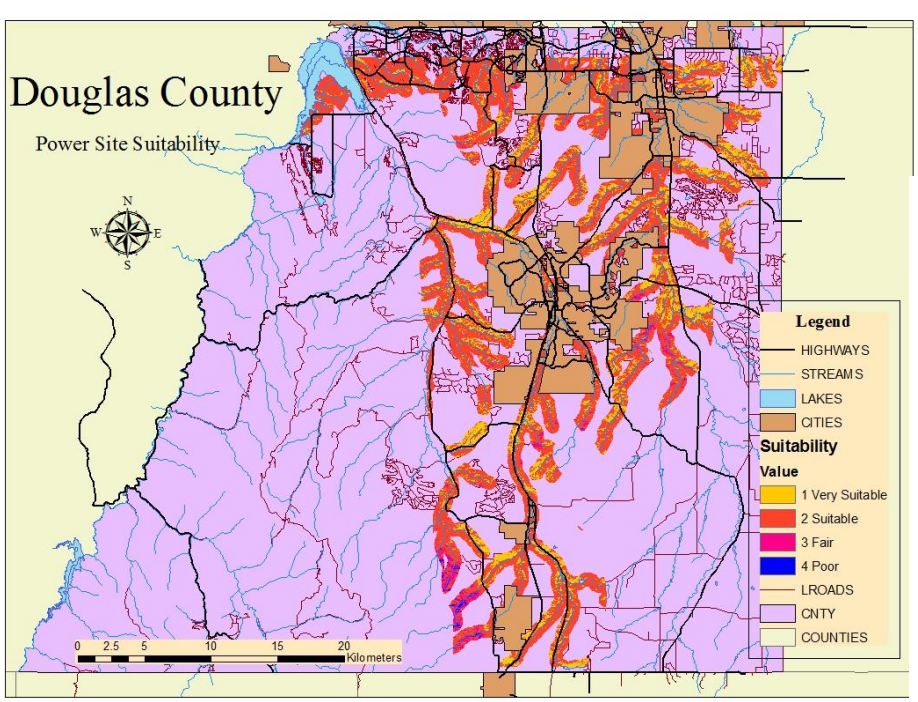
Methods Con't

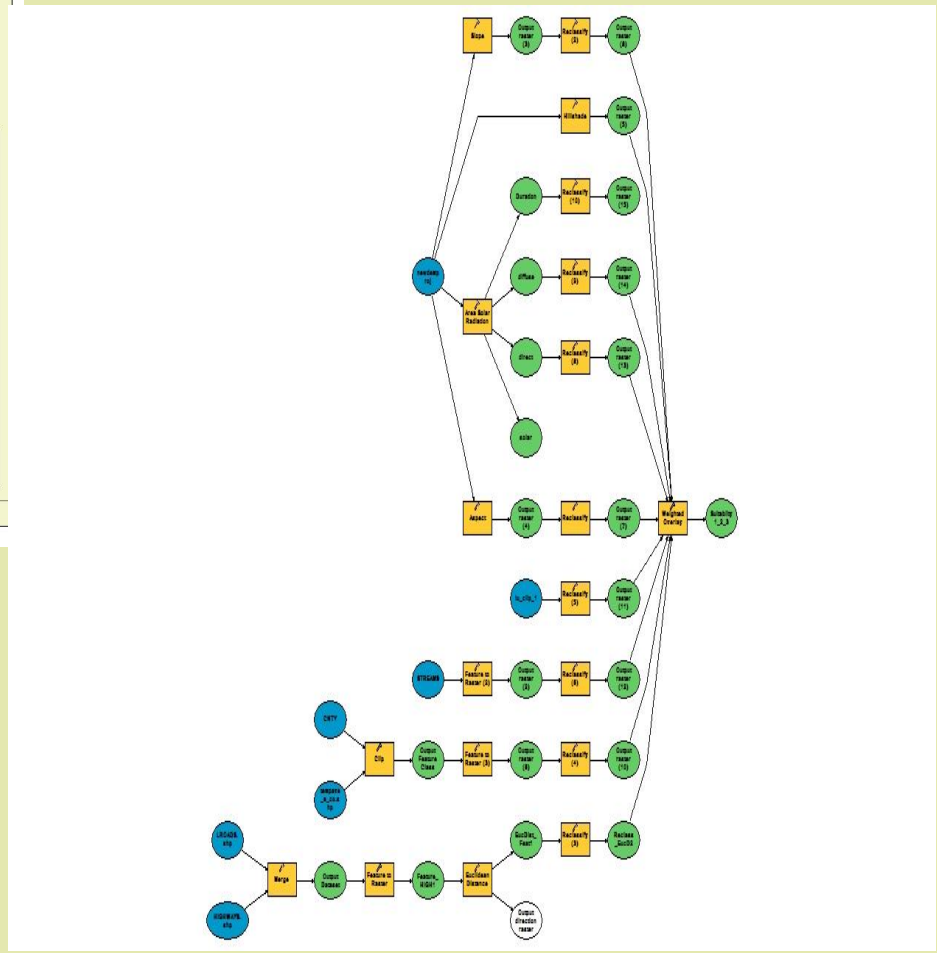
	Environment	Orography	Location	Climate
Environment	1	0.2	3	0.14
Orography	5	1	7	0.33
Location	0.33	0.14	1	0.5
Climate	7	5	2	1
Total	13.48	6.34	13	1.97

- Analytic Hierarchy Process
  - Multi- criteria decision support making process
  - Advantage of deconstructing complex problems into a hierarchy of levels
    - Literature Review
  - Transparent operation
  - Pair- wise combination for site selection that incorporates both quantitative and qualitative data
    - $CI = \frac{\lambda max - n}{n-1}$
    - $CR = \frac{CI}{RI}$

Distance From Roads




Douglas County
Power Site Suitability
N
W
E
S
Legend
HIGHWAYS
STREAMS
LAKES
CITIES
Suitability
Value
1 Very Suitable
2 Suitable
3 Fair
4 Poor
LROADS
CNTY
COUNTIES
0 2.5 5 10 15 20
Kilometers



Conclusion

- Technology is constantly improving= more potential areas
- GIS is a useful and powerful tool for advancement of renewable energy
- Need for model validation
- Use equation to calculate power that can be produced

Hazards Associated with CO_2 Capture and Storage from The AES Cayuga Power Plant

Melissa M. Zelazny

Geo 559

Objective

- Identify hazardous areas from the sequestered CO_2
  - Use Gaussian plume dispersion model developed by Pasquill to find the hazardous areas
  - Use Spatial Analysis tools to identify areas where CO_2 will collect based on topographic lows
- Risk to
  - Human Population (Toxic at 30,000ppm)
  - Ecology Nearby (LULC)

Methods

Concentration to Distance away from fault

Gaussian plume dispersion model

Atmospheric Dispersion Equation Formulas Calculator
Air Pollution Control - Stacks

Solving for plume contaminant concentration at ground level.

$$C(x,y,0) = \frac{Q}{\pi u \sigma_y \sigma_z} e^{-\frac{y^2}{2\sigma_y^2}} e^{-\frac{H^2}{2\sigma_z^2}}$$

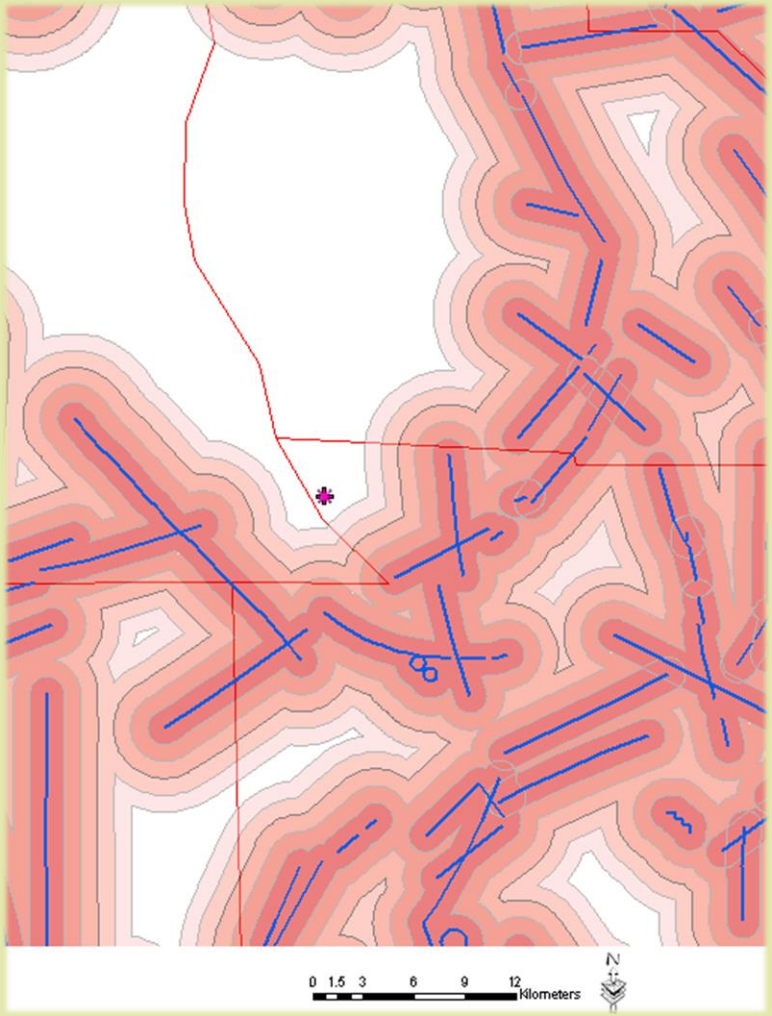
Inputs:

pollution rate emission rate(Q)		gram/second
average wind speed (u)		meter/second
y direction plume standard deviation (σ_y)		meter
z direction plume standard deviation (σ_z)		meter
y position (y)		meter
effective stach height (H)		meter

Calculate

www.ajdesigner.com

Multi-Buffer Ring to display concentration



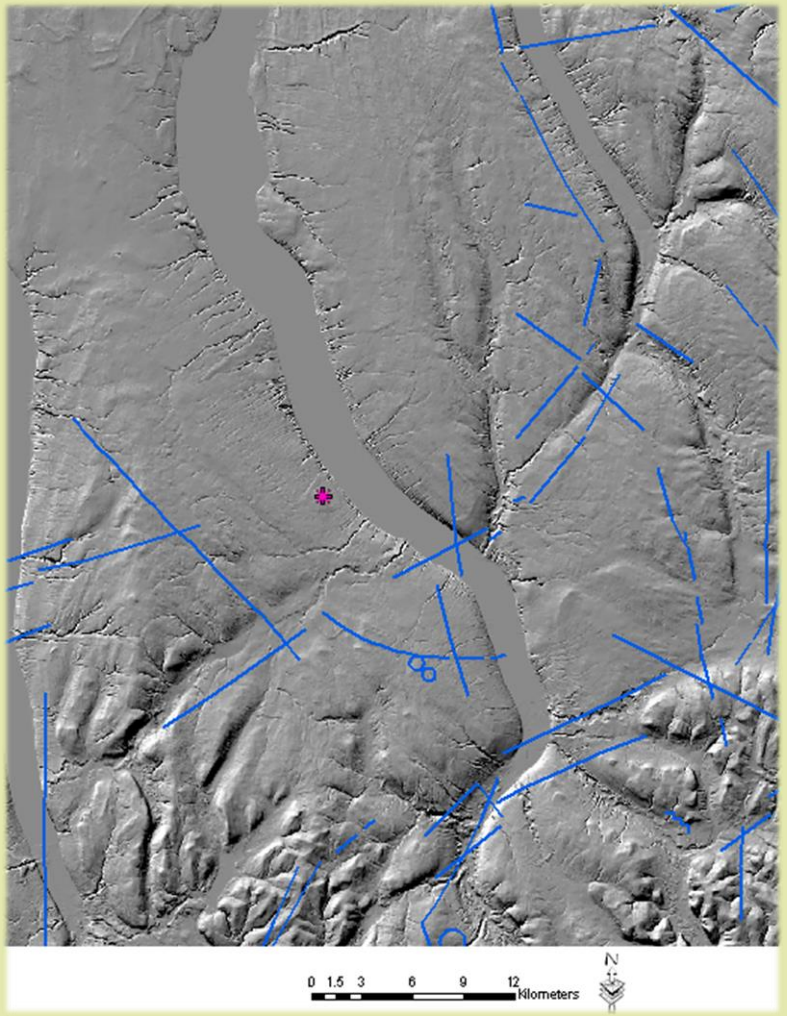
Method
s

Gas accumulation in topographic lows

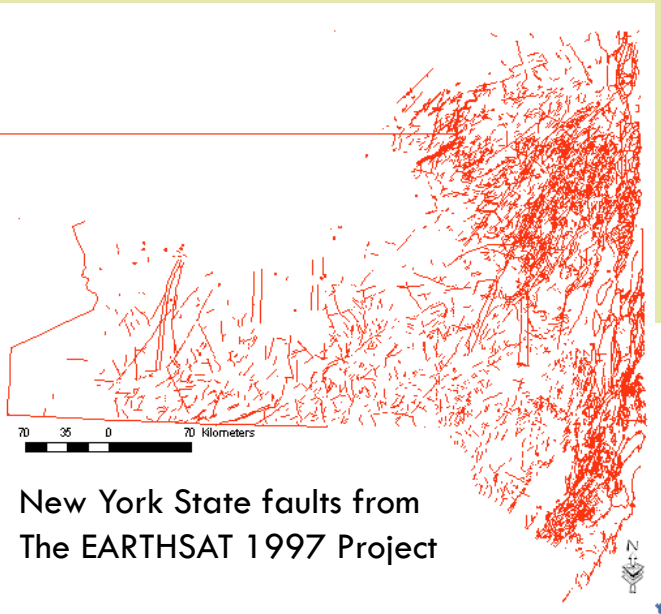
- Apply a fill to the DEM to remove any sinks
- Determine Flow Direction
- Identify areas of Flow Accumulation
- Define the Stream locations
- Determine Stream Order
- From this you can determine where

  the gas will accumulate if a leak

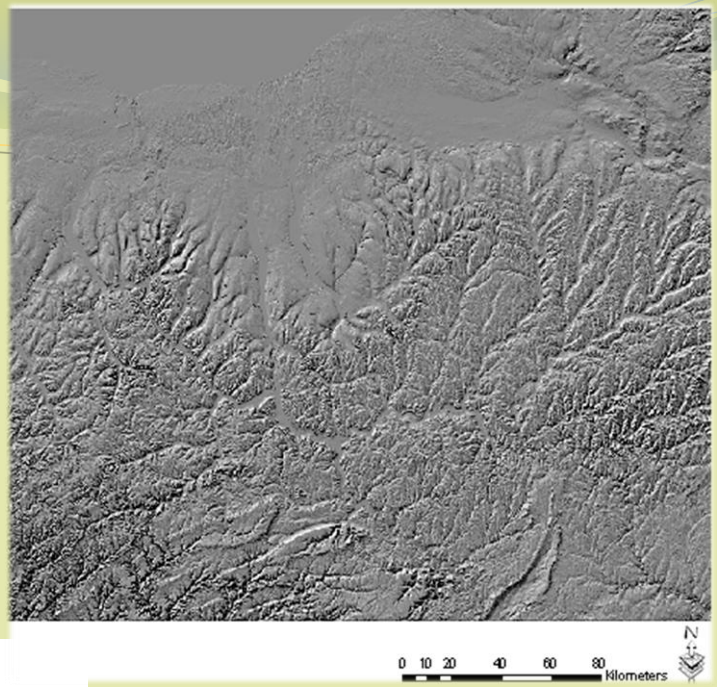
  occurred



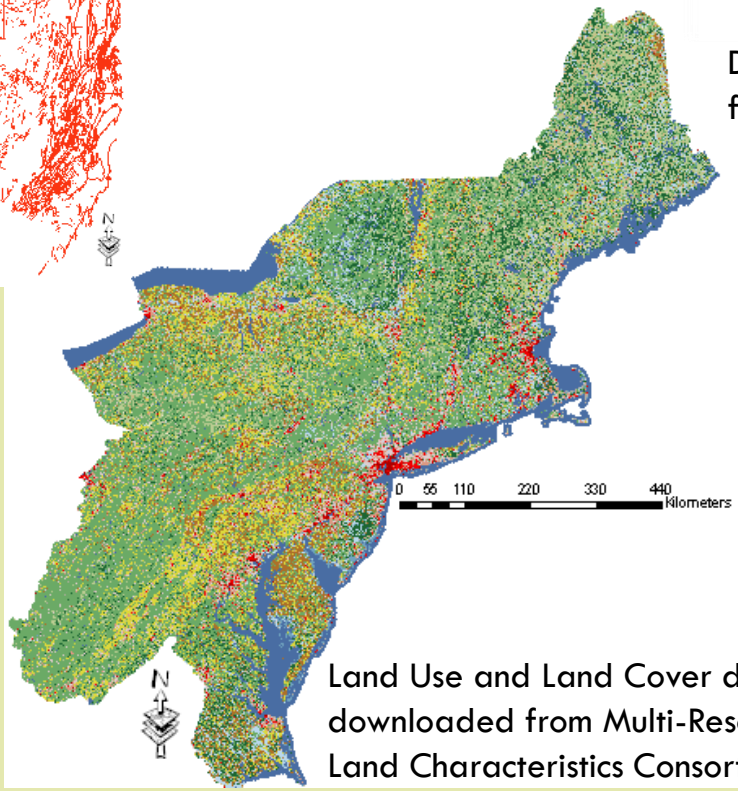
Data



New York State faults from
The EARTHSAT 1997 Project



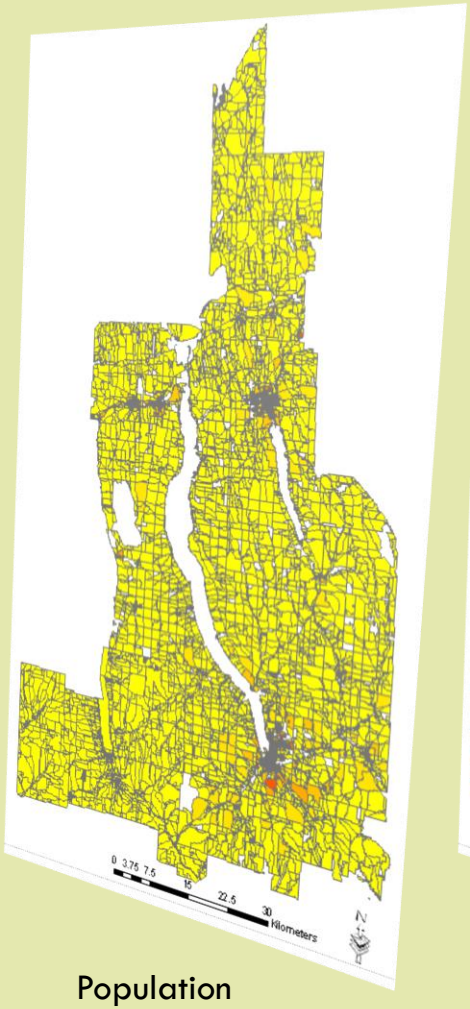
Digital Elevation Model was downloaded from USGS Seamless and processed in ENVI



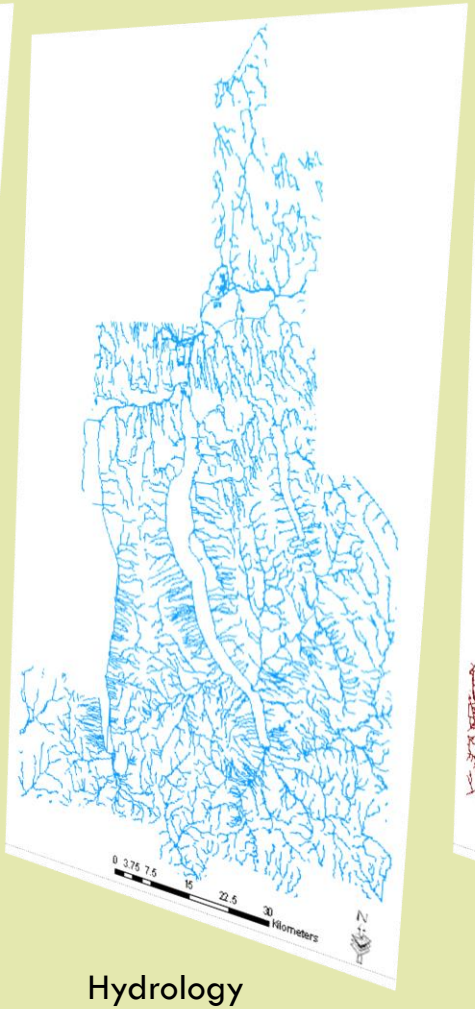
Land Use and Land Cover data downloaded from Multi-Resolution Land Characteristics Consortium (MRLC)

Data

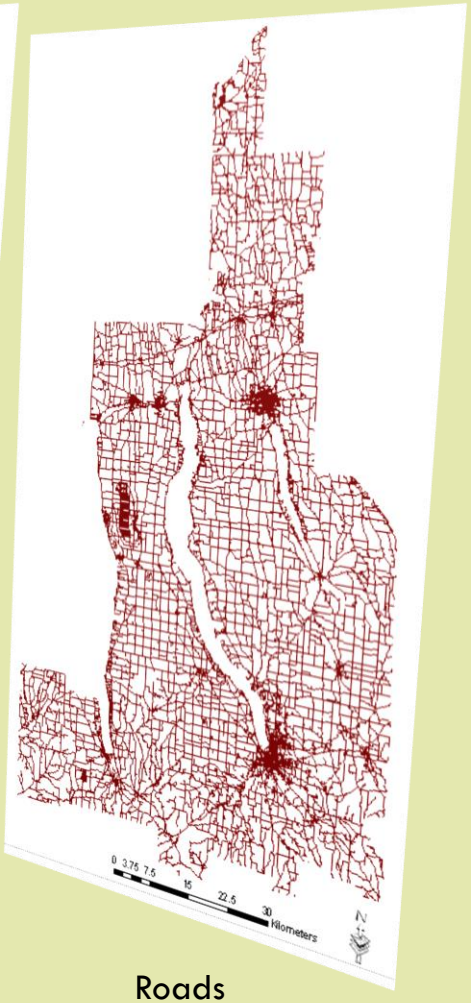
Cornell University Geospatial Information Repository (CUGIR)



Population

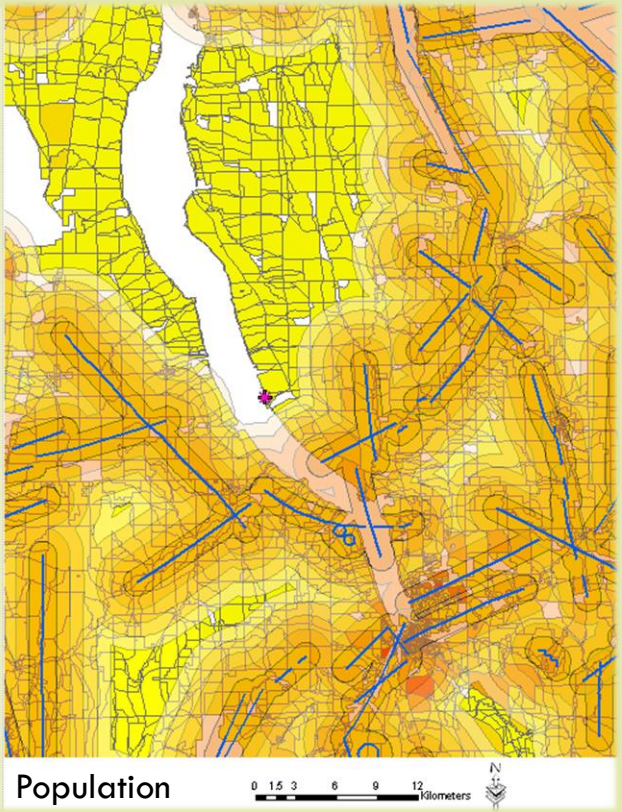


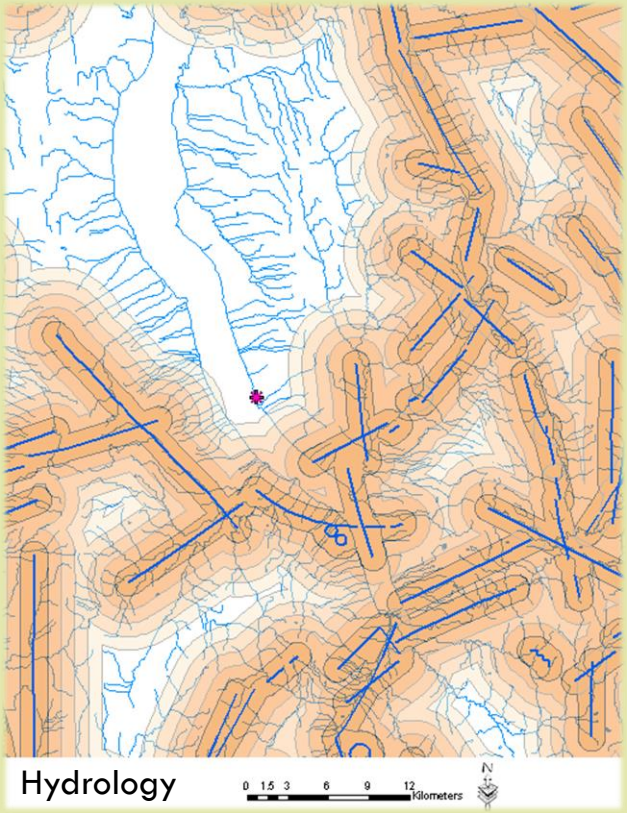
Hydrology

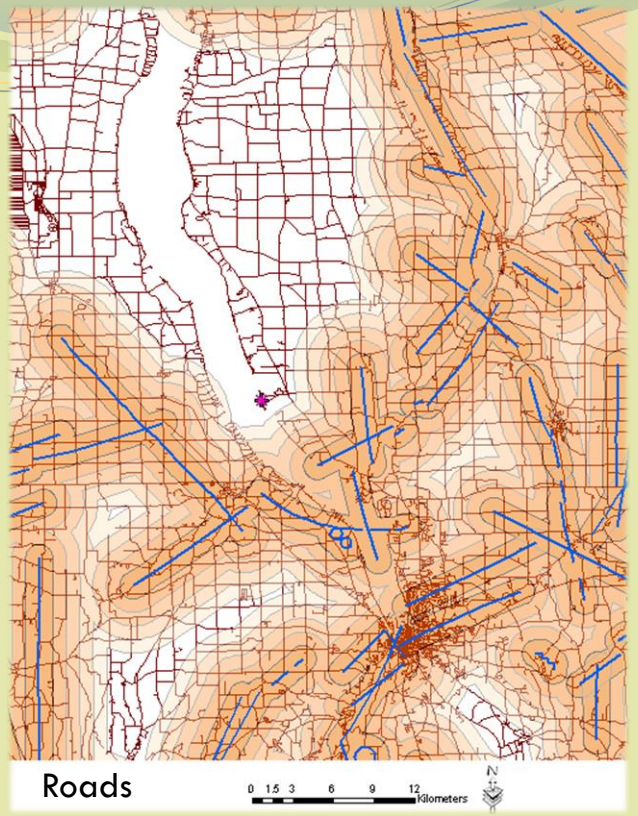


Roads

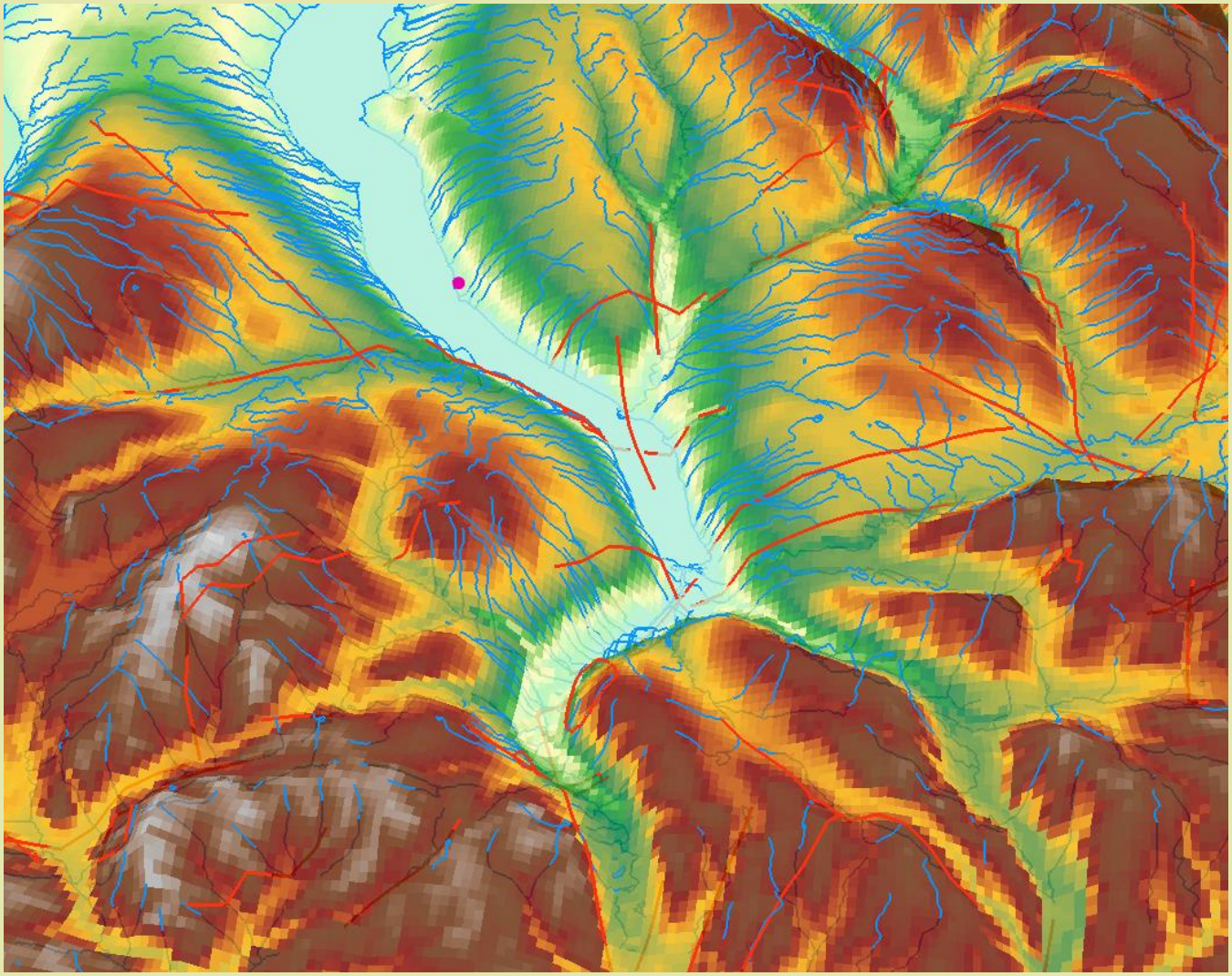
Results


Population
0 1.5 3 6 9 12
Kilometers
N


Hydrology
0 1.5 3 6 9 12
Kilometers
N

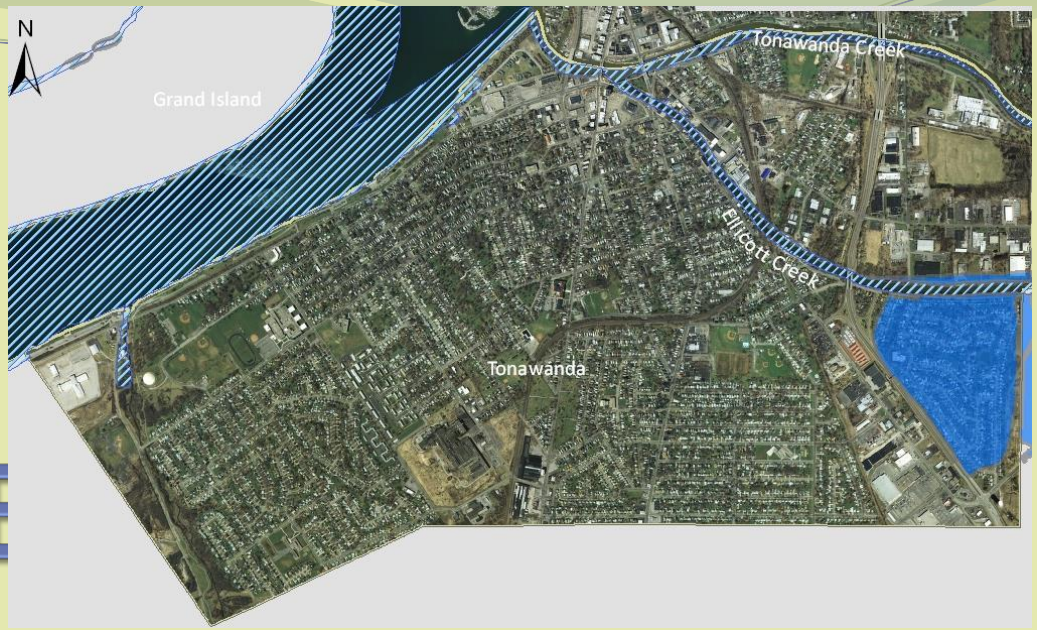

Roads
0 1.5 3 6 9 12
Kilometers
N

3D Image


Legend
DEM
Value
High : 255
Low : 0
Faults
Hydrology
Power Plant

ood

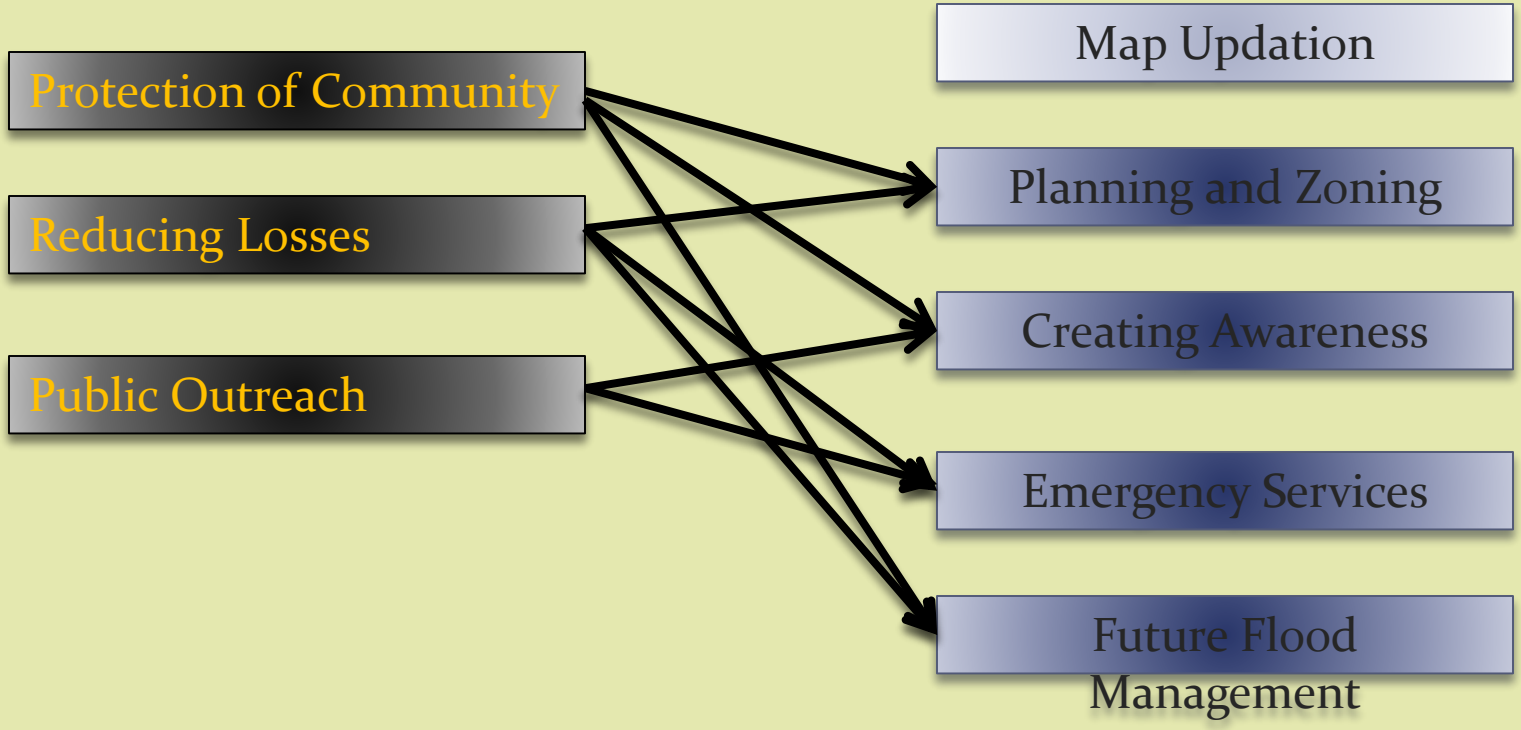
E



Area: 4.1 sq.miles
Population: 14,931 (2007)

Mosmi Yerawar
GEO 559
April 16th 2009

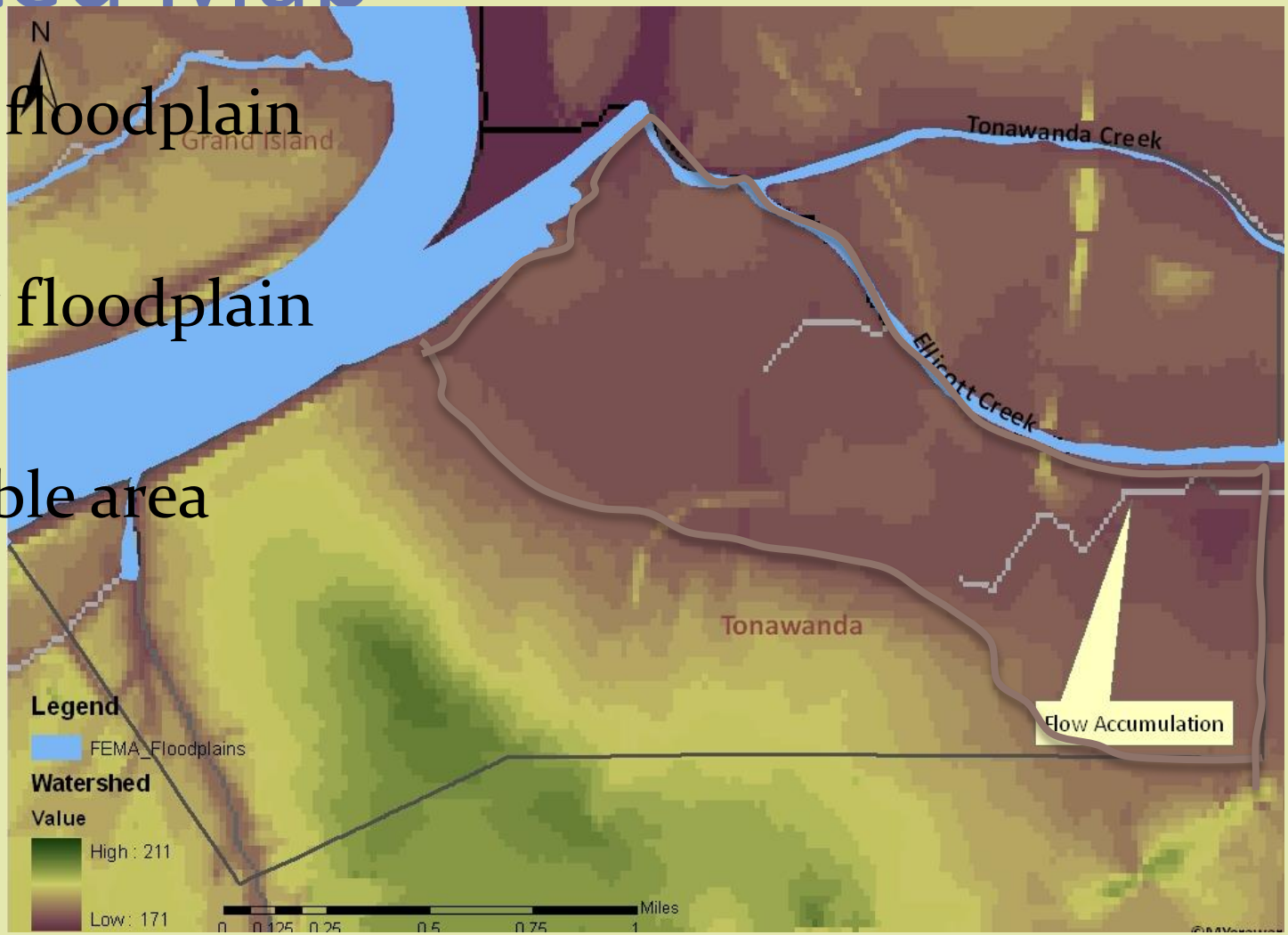
Goals and Objectives:

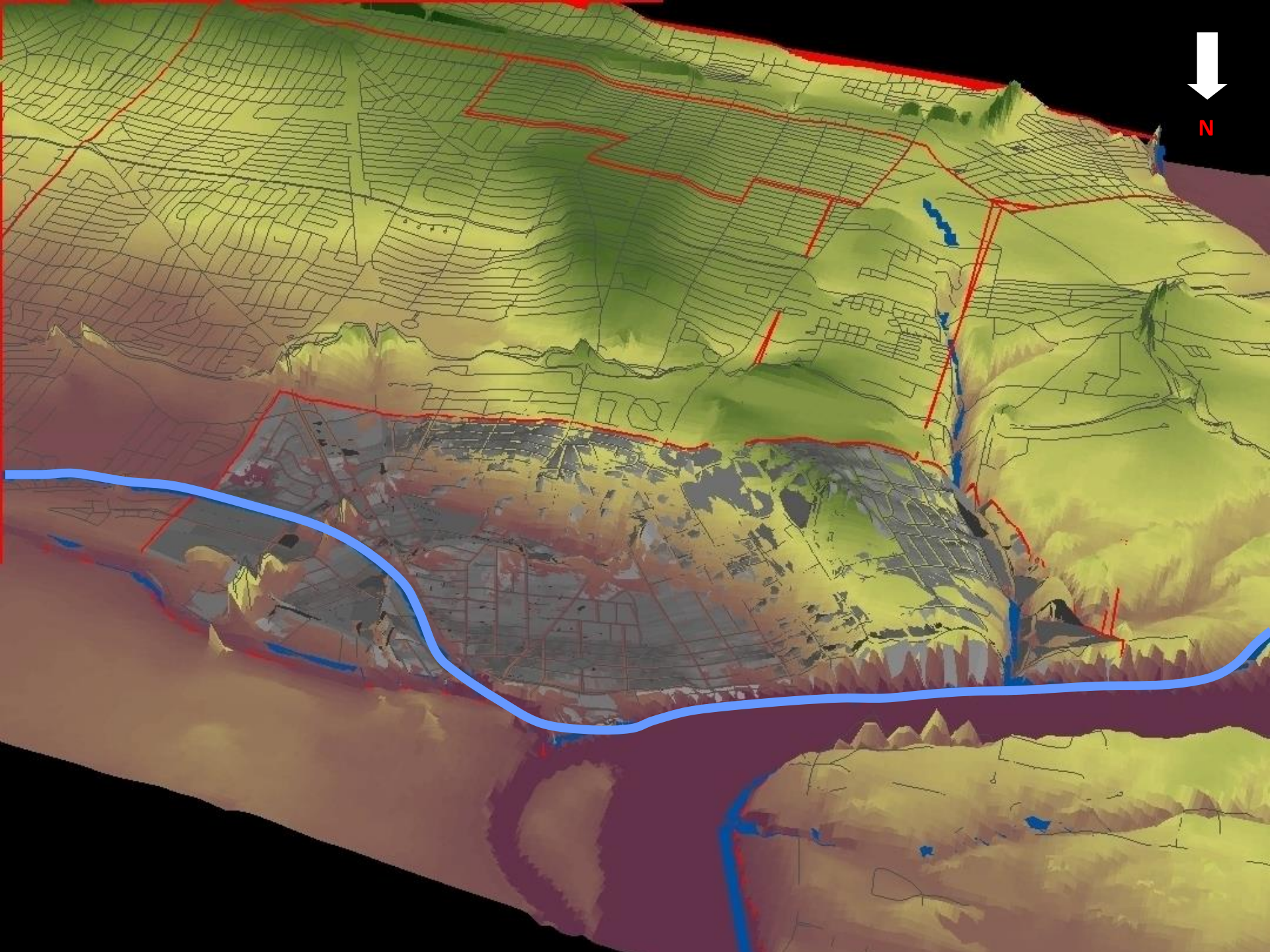


Map Updation is a flexible and continuous process depending upon the data and the technology available.

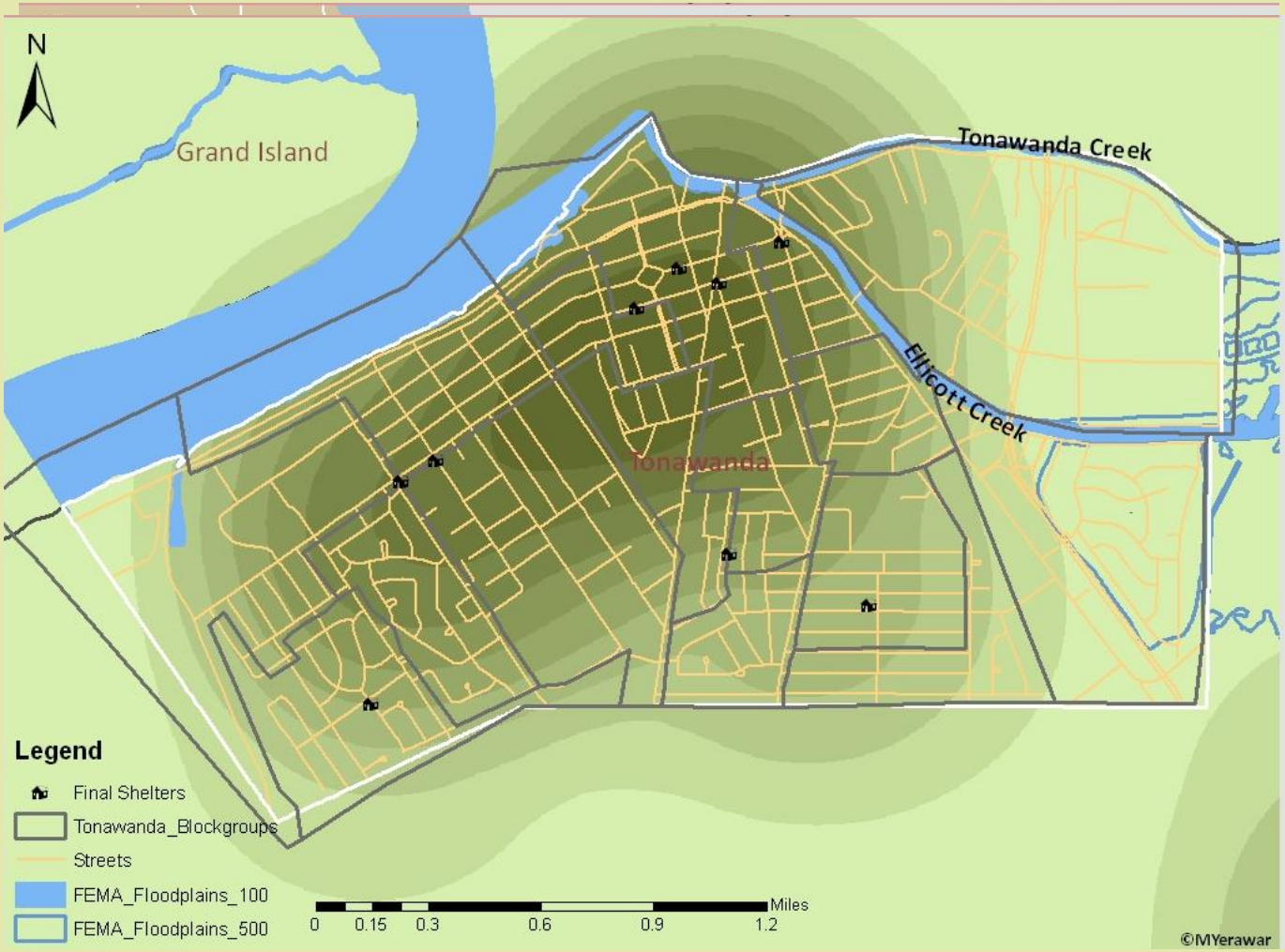
Updated Map

- 100 year floodplain
- 500 year floodplain
- Vulnerable area

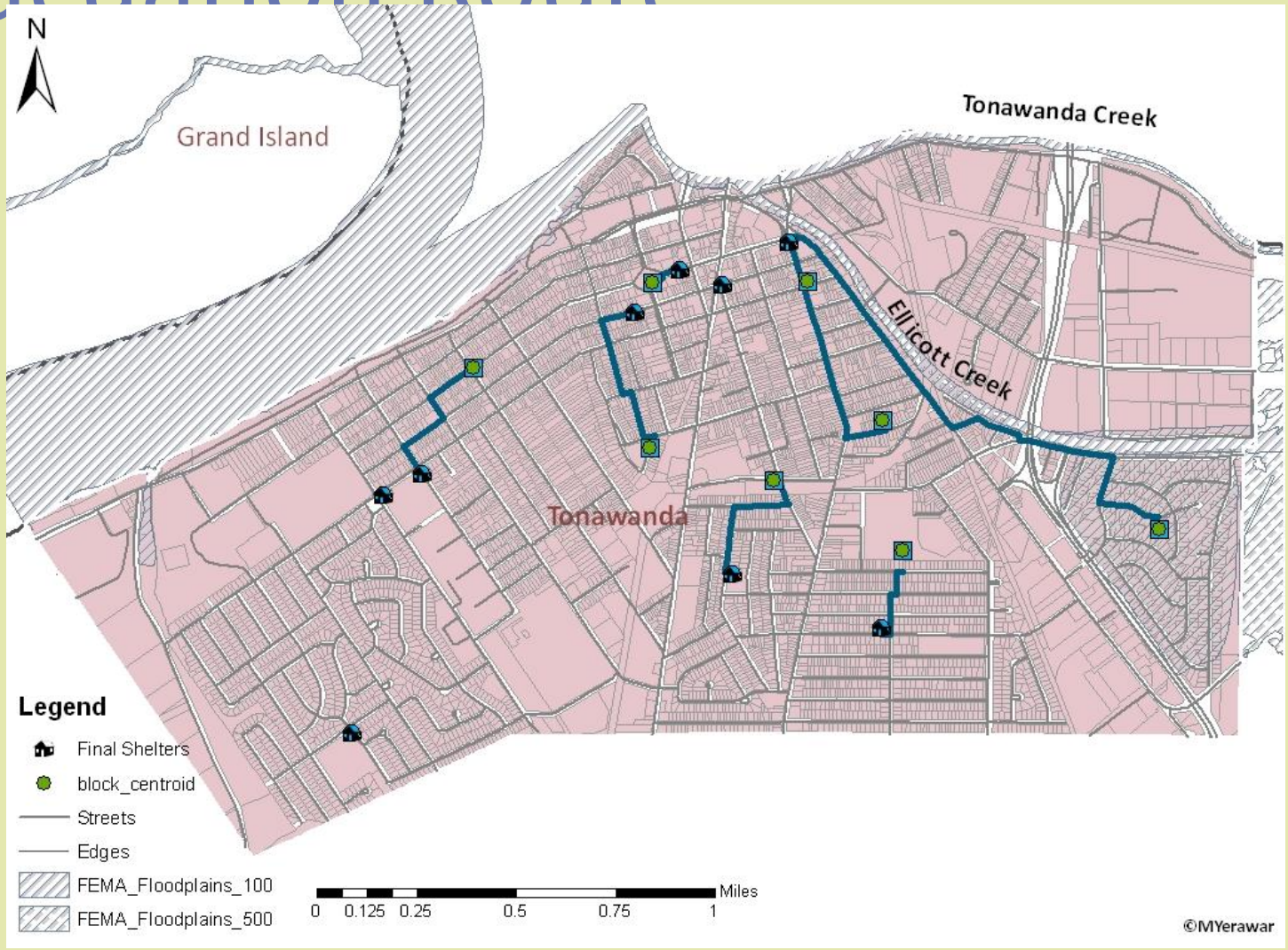



N

Shelters

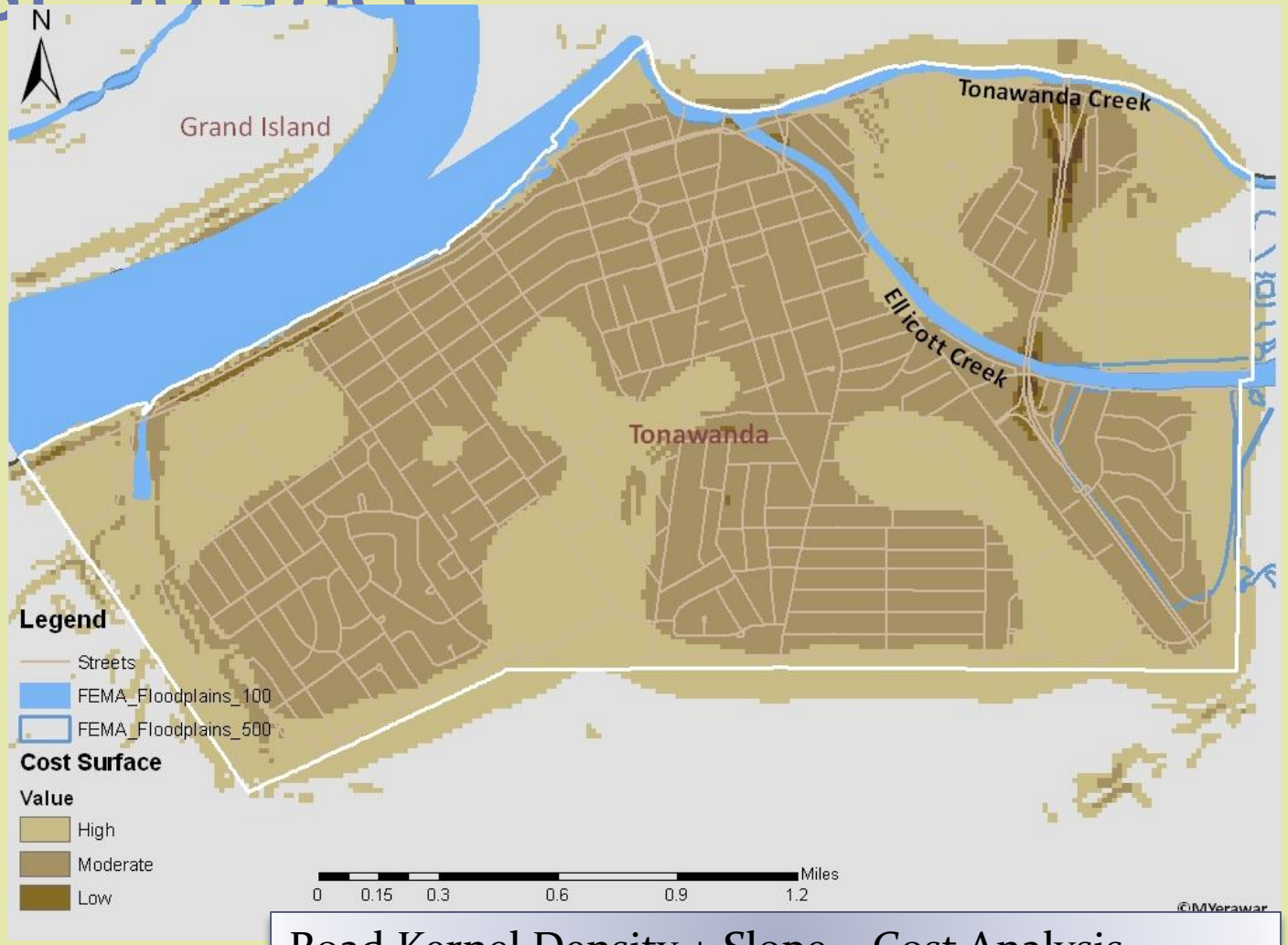

N
Grand Island
Tonawanda Creek
Ellicott Creek
Tonawanda
Legend
Final Shelters
Tonawanda_Blockgroups
Streets
FEMA_Floodplains_100
FEMA_Floodplains_500
0 0.15 0.3 0.6 0.9 1.2
Miles
©MYerawar

Evacuation Route




N
Shelters
Clusters

Cost Surface



Road Kernel Density + Slope = Cost Analysis

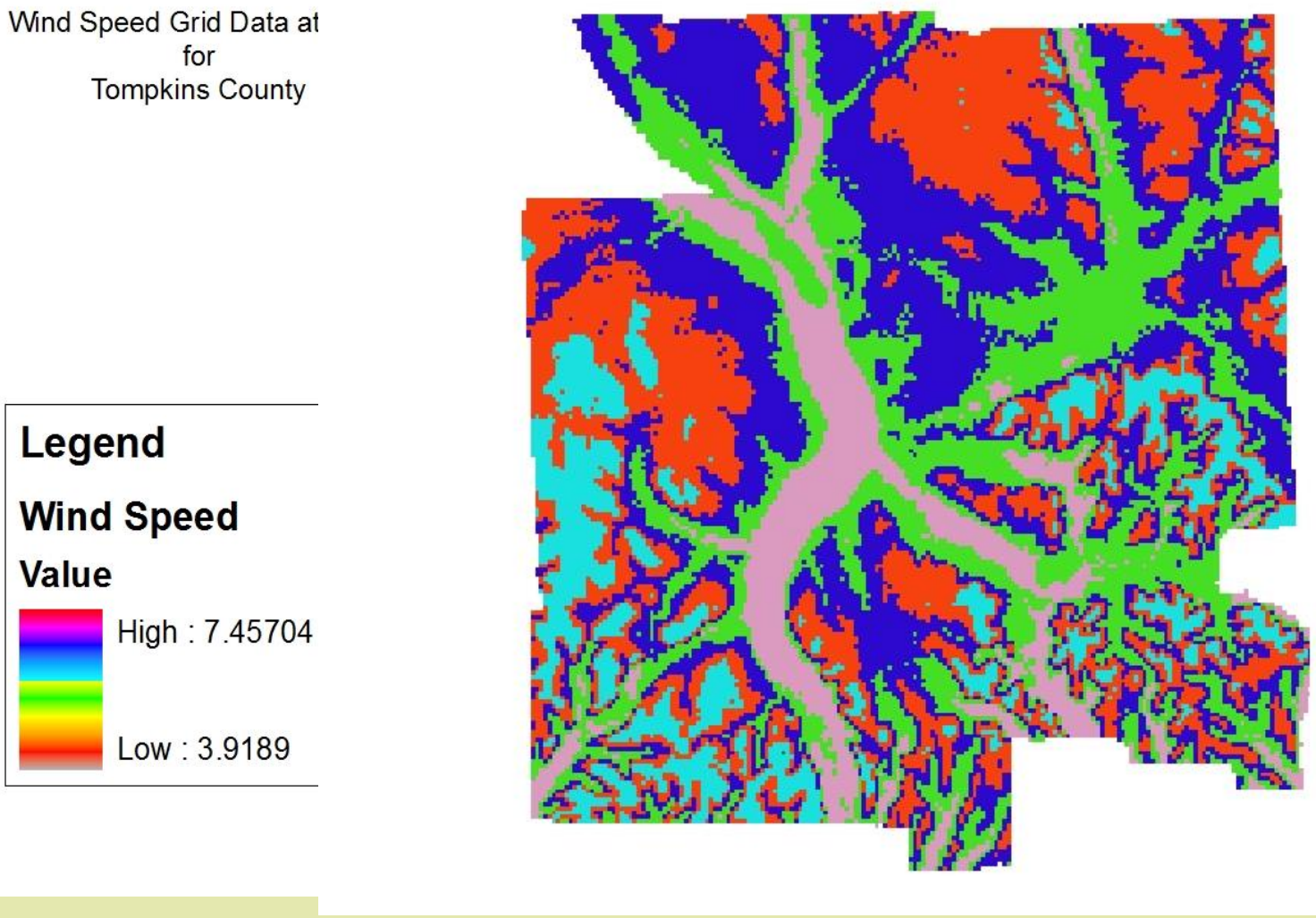
Suitability Analysis for Windmill farms

Neha Jain
GEO 559
Under the guidance of Dr. Ling Bian

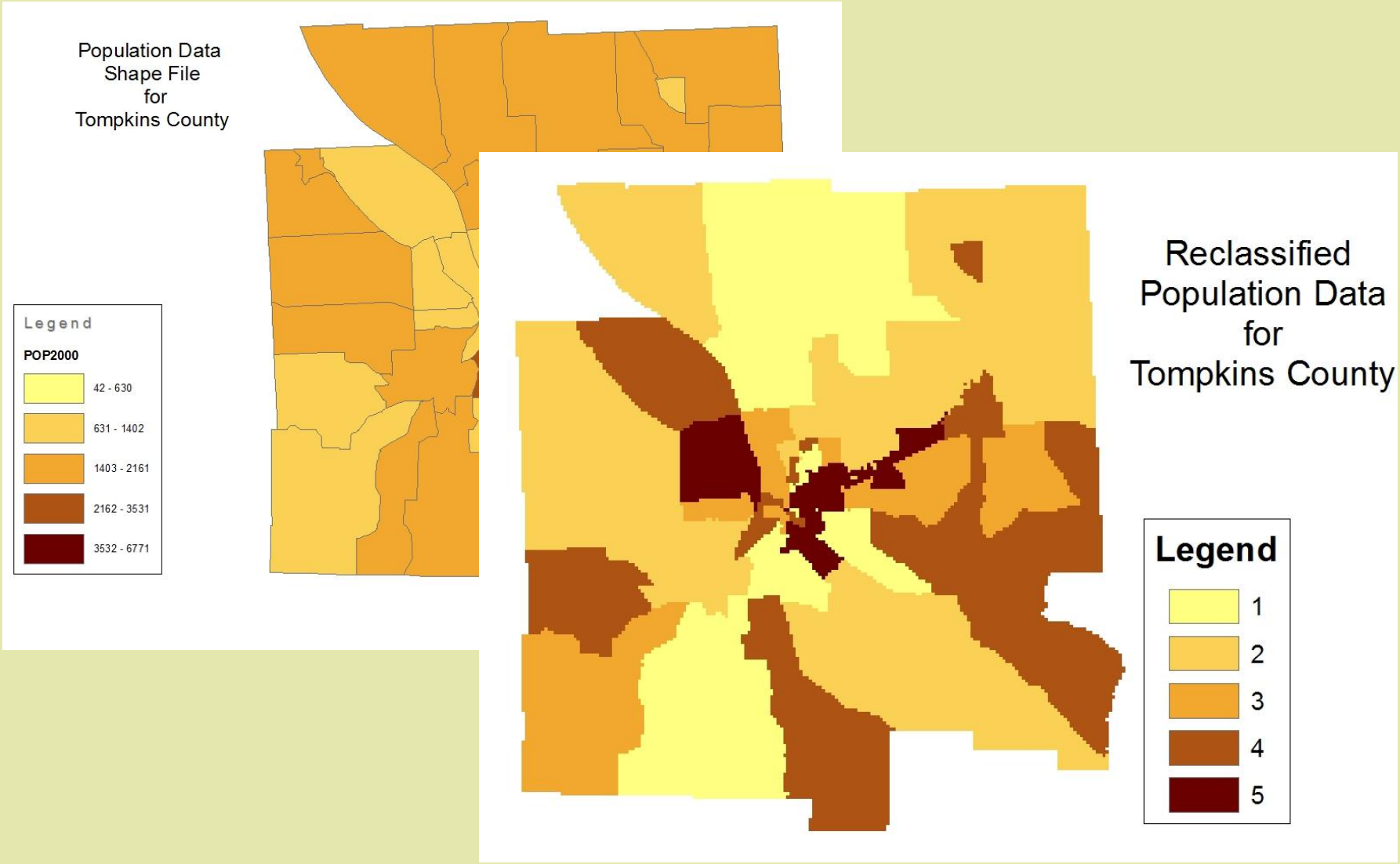
Factors considered in Project

- Wind Speed : The GREATER the BETTER
- Bird Conservation Area : The FARTHER the BETTER
- Population density : The LESSER the BETTER
- Building density : The LESSER the BETTER

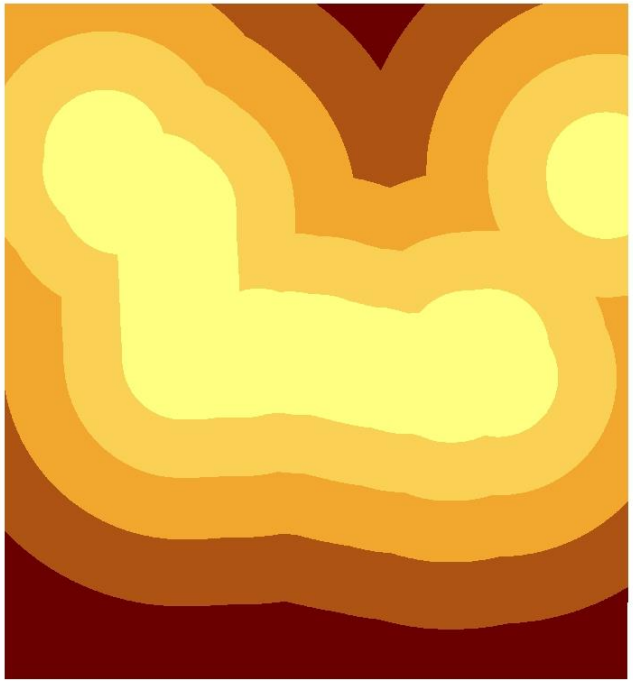
Wind Speed Data at 70 m for Tompkins County

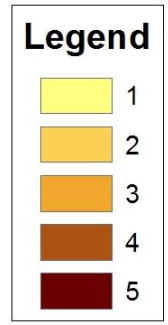


Population Group blocks for Tompkins County

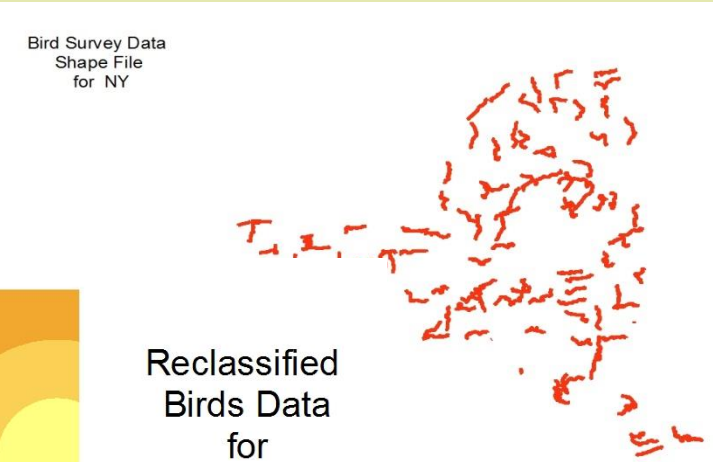


Bird Survey Data for NY State

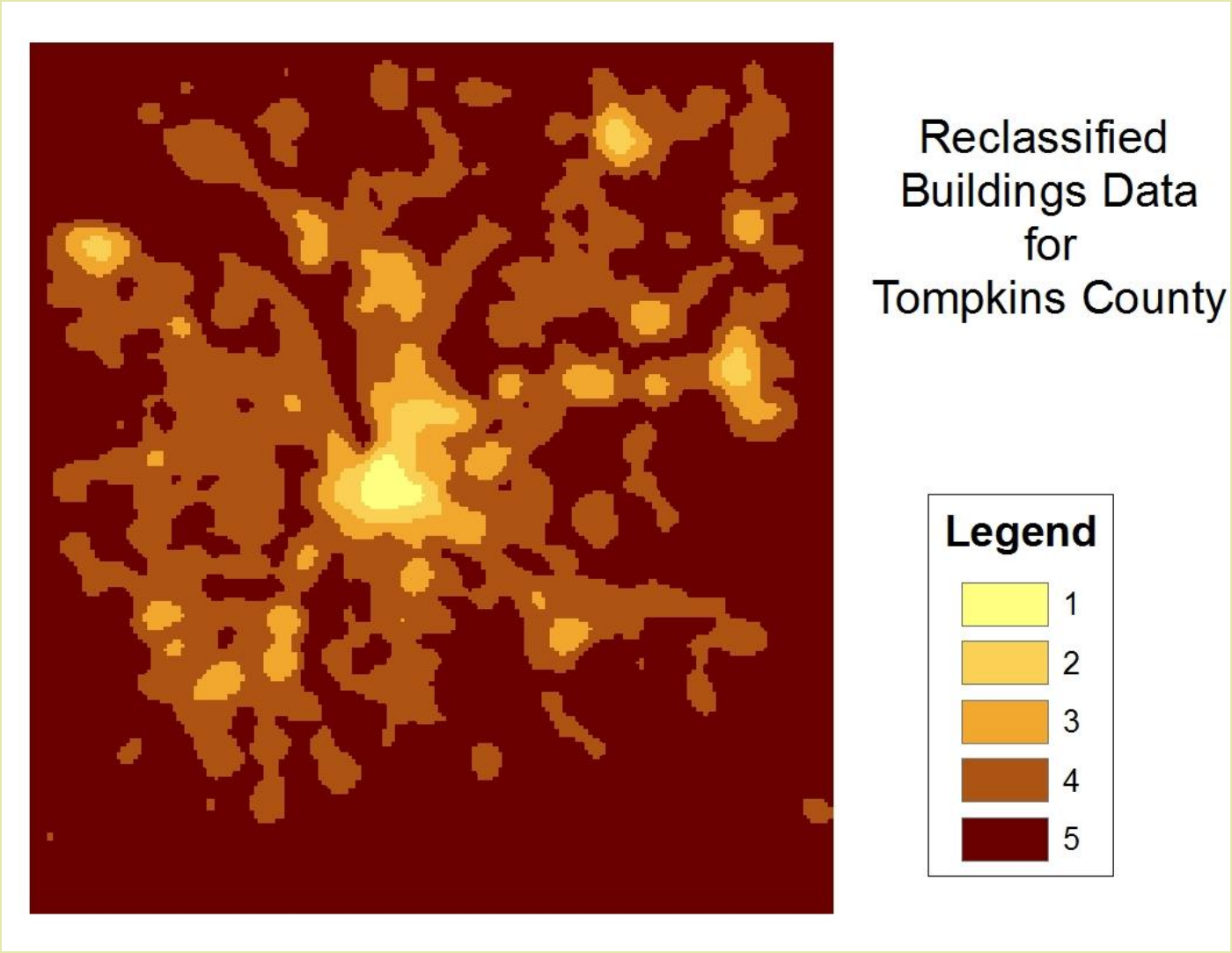




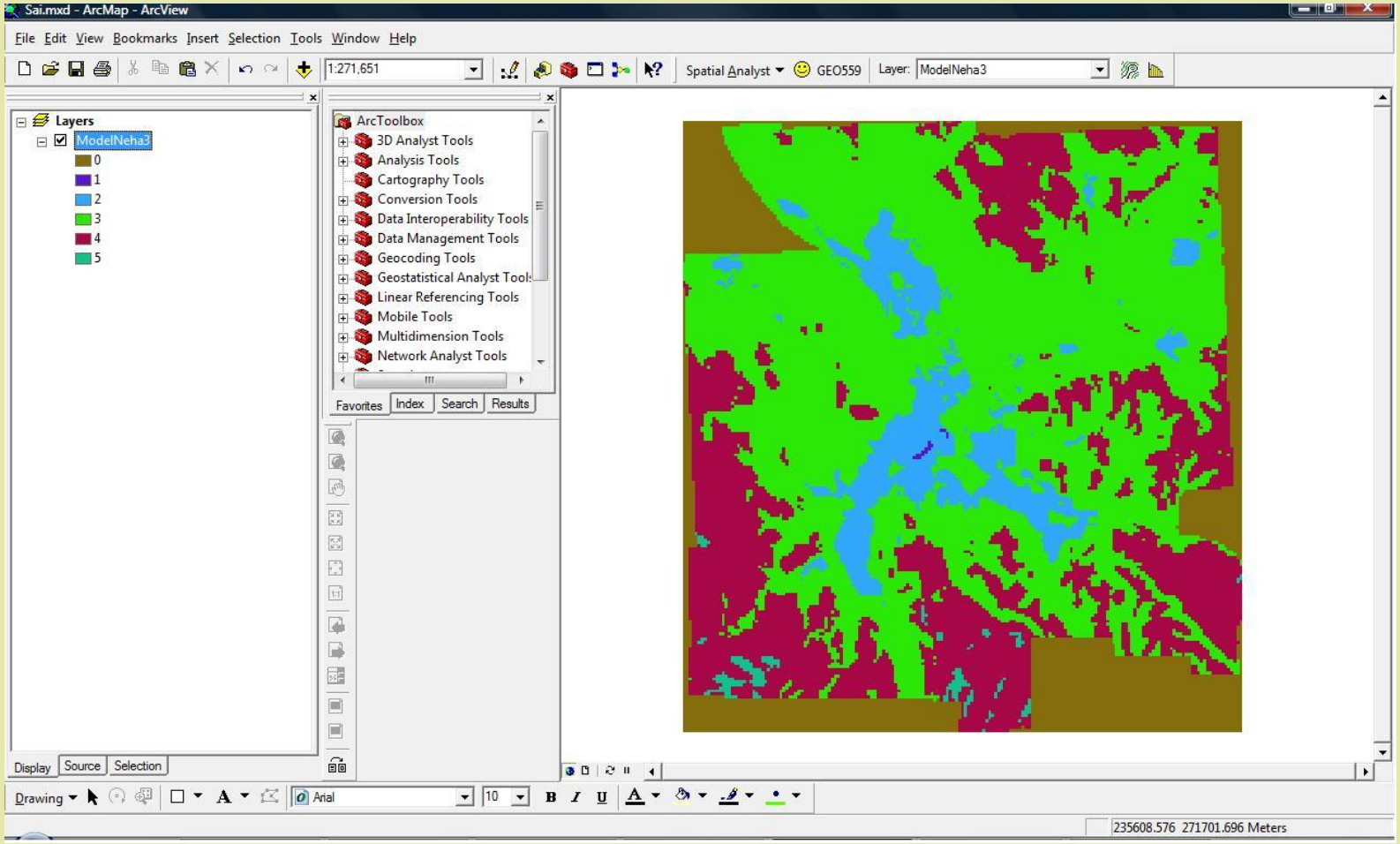
Reclassified
Birds Data
for
Tompkins County



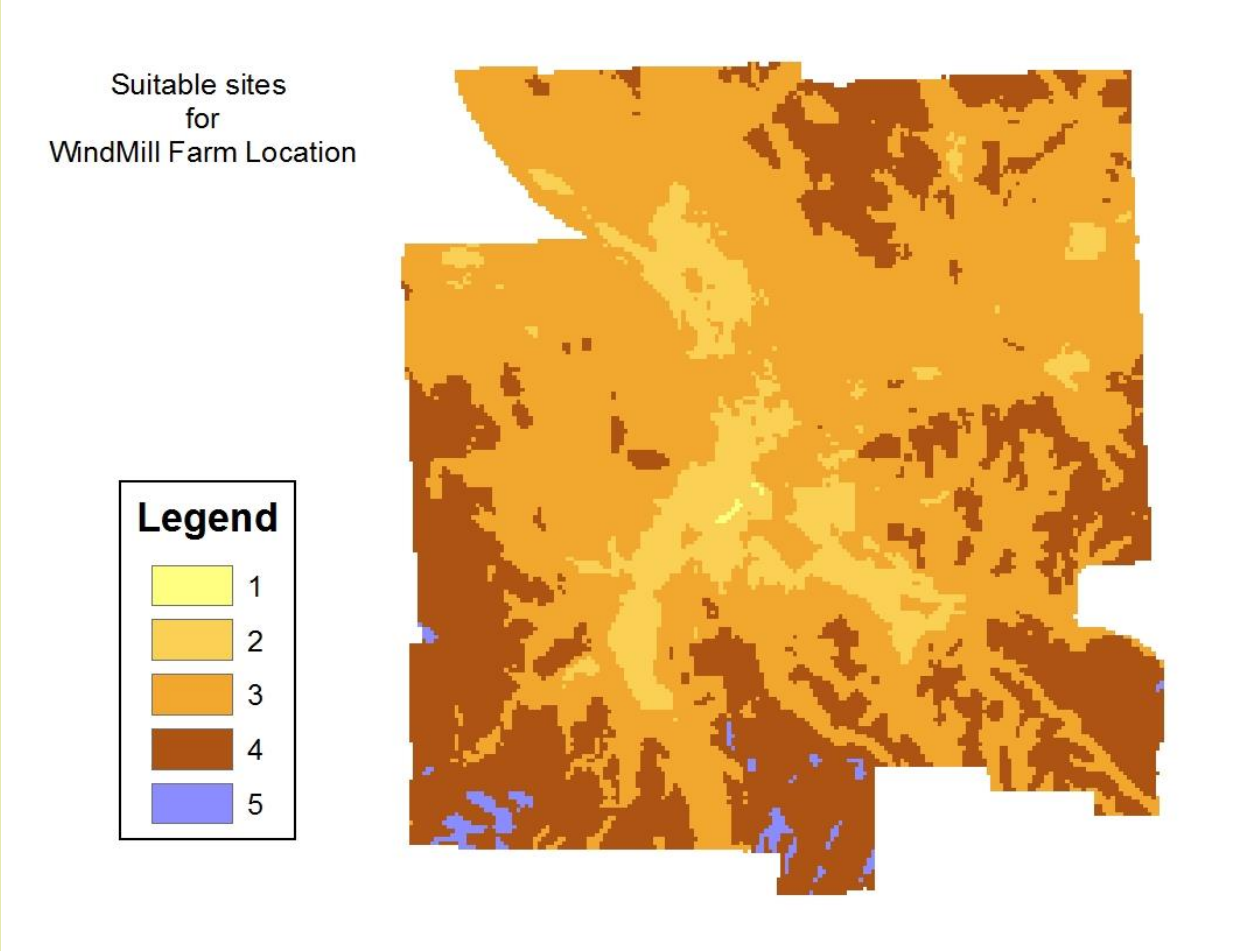
Building Outlines Data Shape file



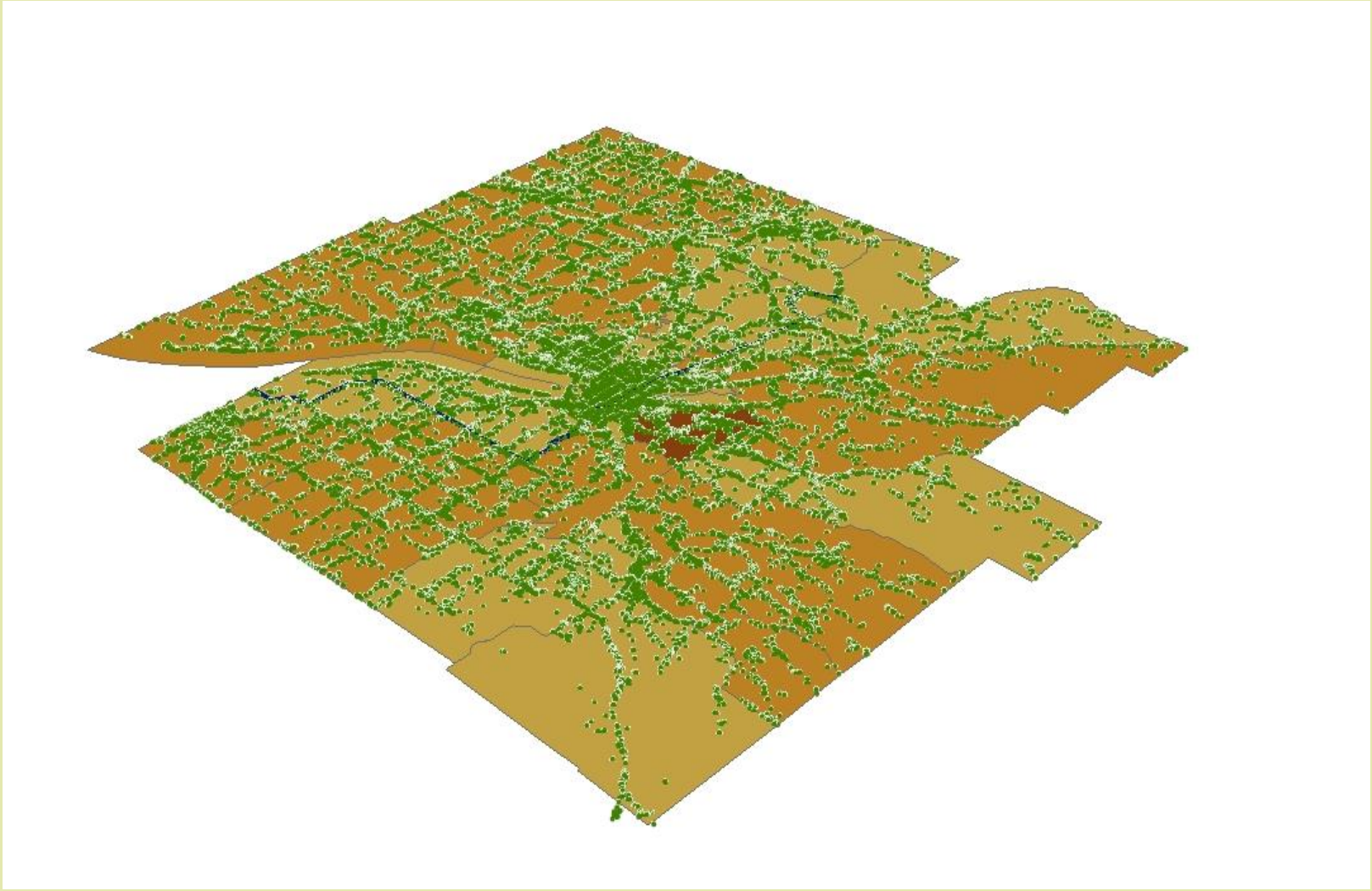
Output


Sai.mxd - ArcMap - ArcView
File Edit View Bookmarks Insert Selection Tools Window Help
1:271,651
Spatial Analyst
GEO559
Layer: ModelNeha3
Layers
ModelNeha3
0
1
2
3
4
5
ArcToolbox
3D Analyst Tools
Analysis Tools
Cartography Tools
Conversion Tools
Data Interoperability Tools
Data Management Tools
Geocoding Tools
Geostatistical Analyst Tools
Linear Referencing Tools
Mobile Tools
Multidimension Tools
Network Analyst Tools
Favorites
Index
Search
Results
Display
Source
Selection
Drawing
Arial
10
235608.576 271701.696 Meters

Lets take a closer look….



3-D View of data



Putting A New Dog Waste Bin In Ellison Park

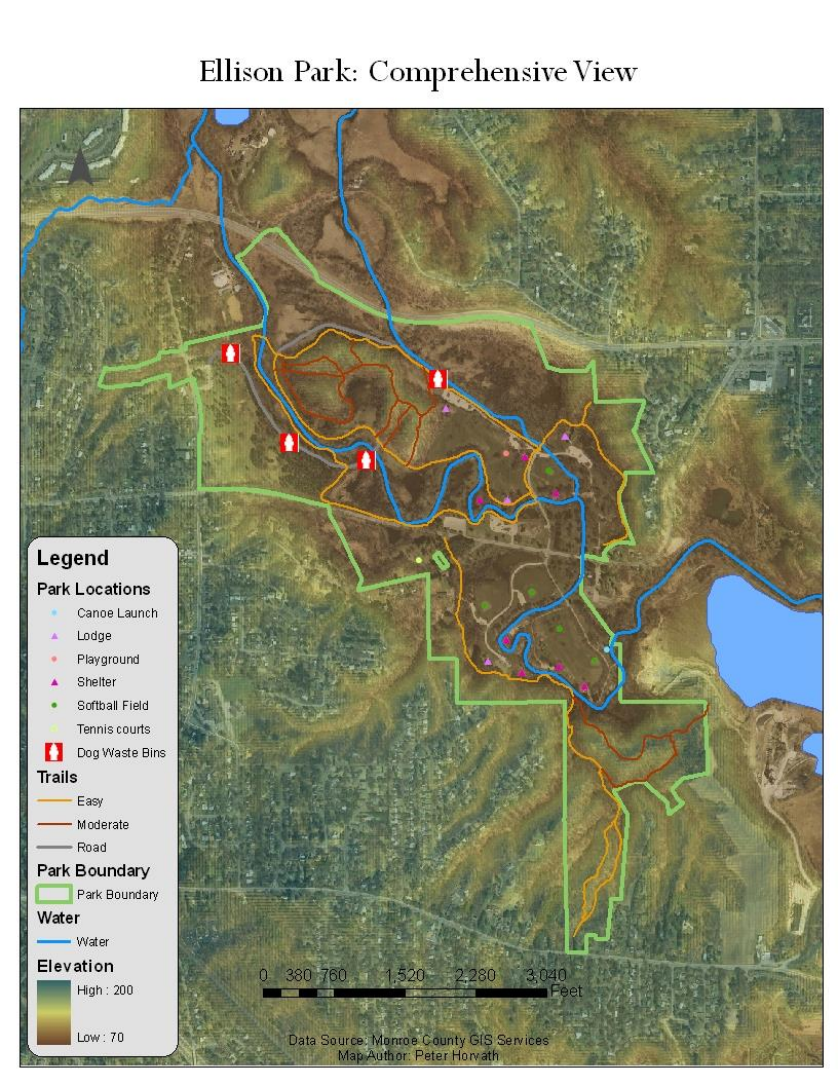
A Suitability Analysis To Optimize Poo Placement

Pete Horvath
4/14/09

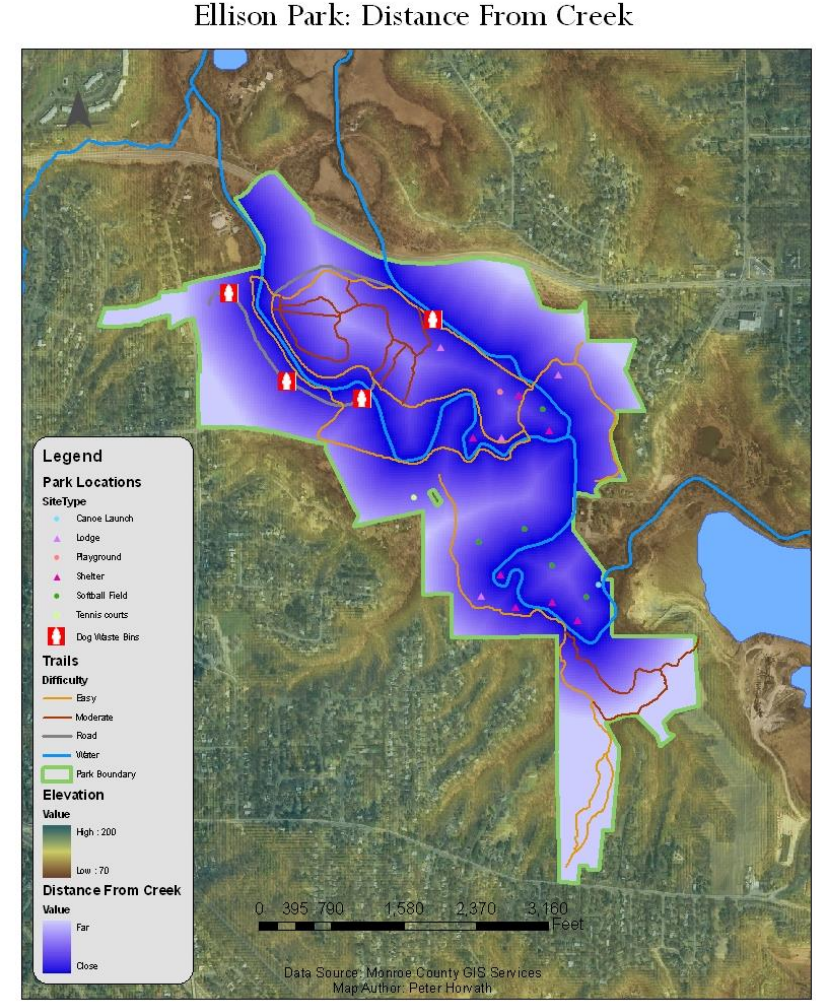
Project Objective

- Dog waste is a potentially devastating problem that can detrimentally effect:
  - The park's natural habitat
  - The level of enjoyment for human visitors
  - The level of enjoyment for dog visitors
- Park management and responsible dog owners can work together to prevent the problem
- 4 dog waste bins presently exist in the park
- If a 5^{th} needs to be added, where should it be placed?

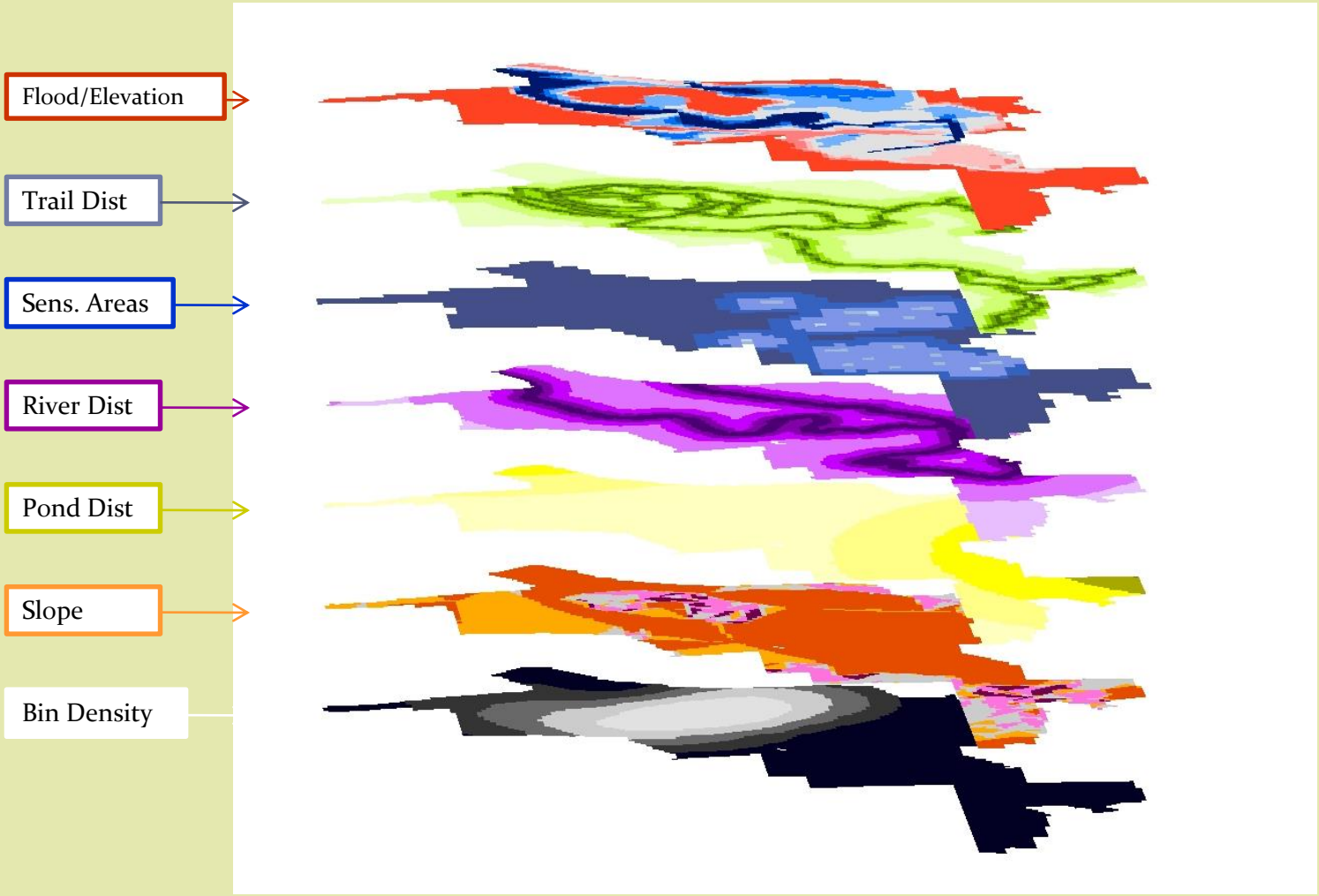
Post-processed Data



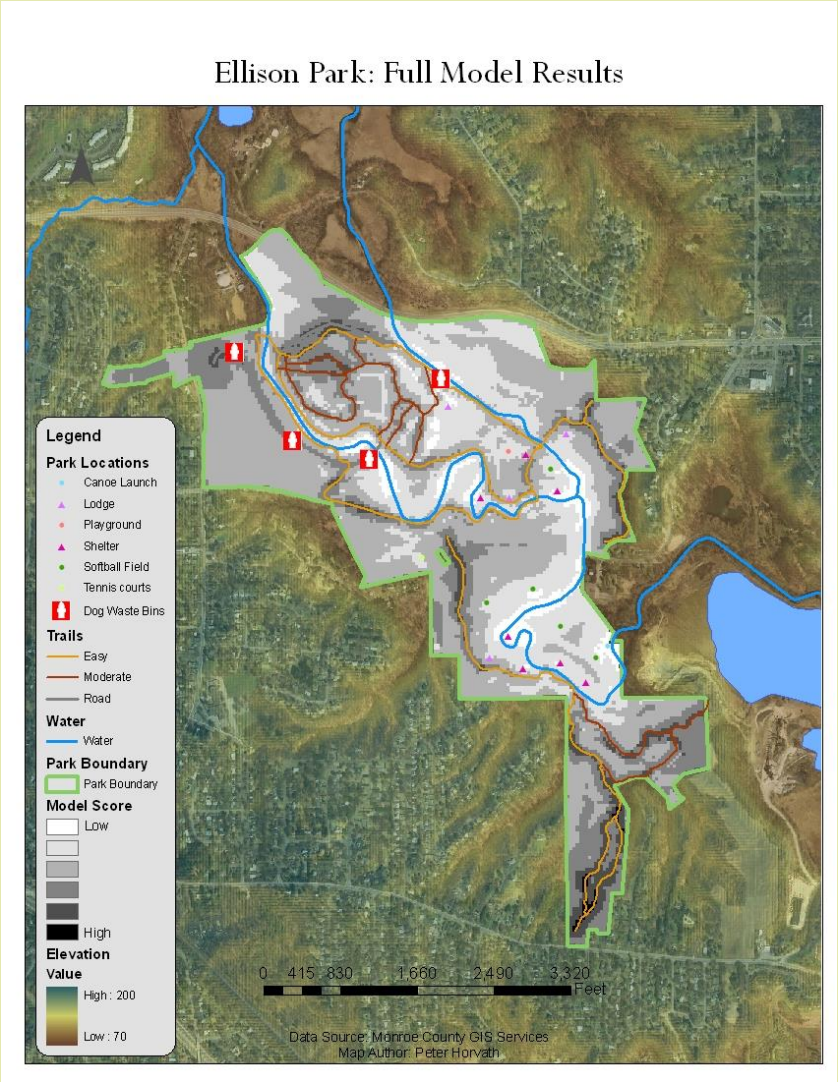
Factor Example 1: Distance to River



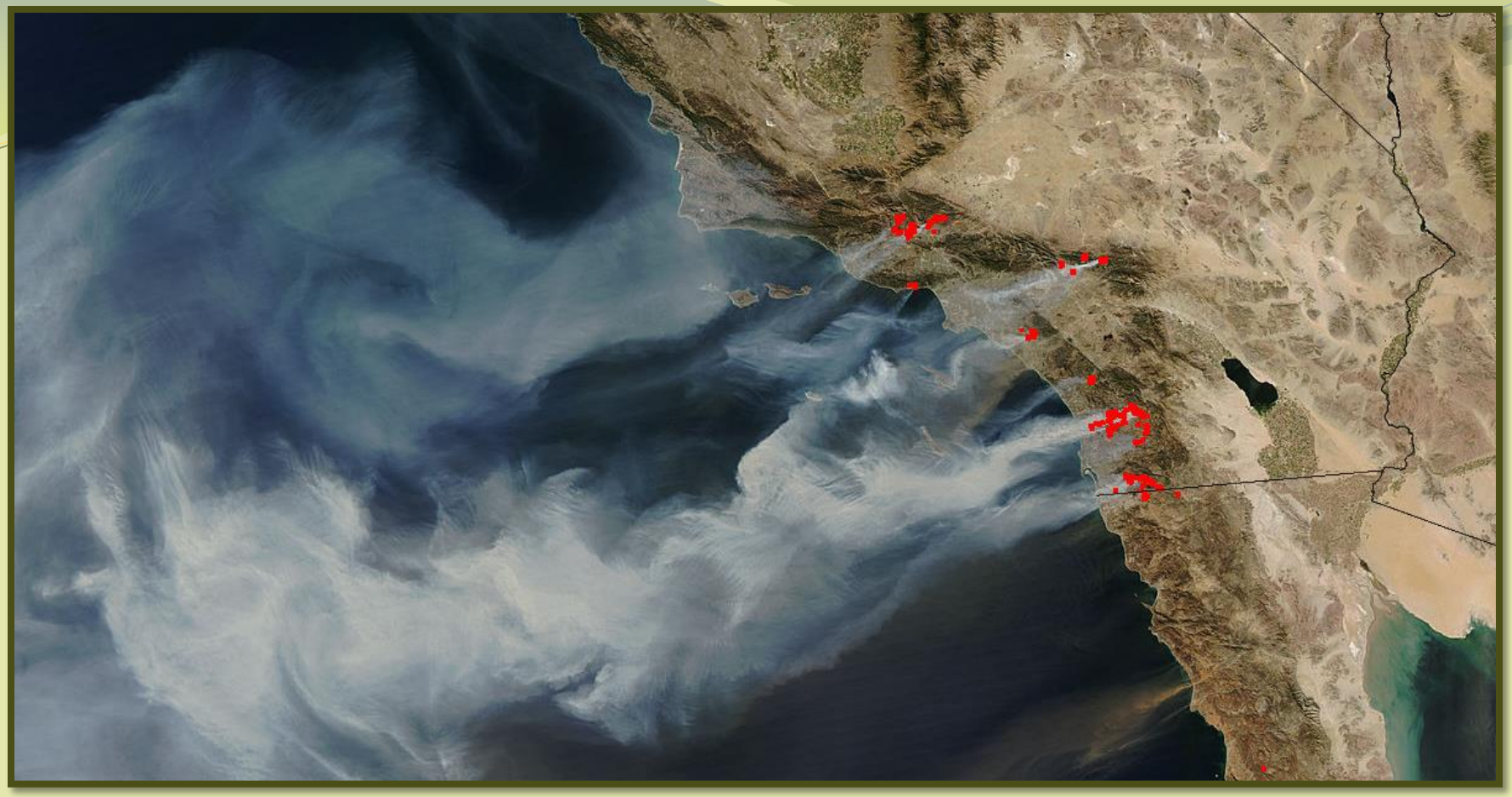
Reclassify and Combine Factors



Results


Ellison Park: Full Model Results
Legend
Park Locations
Canoe Launch
Lodge
Playground
Shelter
Softball Field
Tennis courts
Dog Waste Bins
Trails
Easy
Moderate
Road
Water
Water
Park Boundary
Park Boundary
Model Score
Low
High
Elevation
Value
High : 200
Low : 70
0 415 830 1,660 2,490 3,320
Feet
Data Source: Monroe County GIS Services
Map Author: Peter Horvath

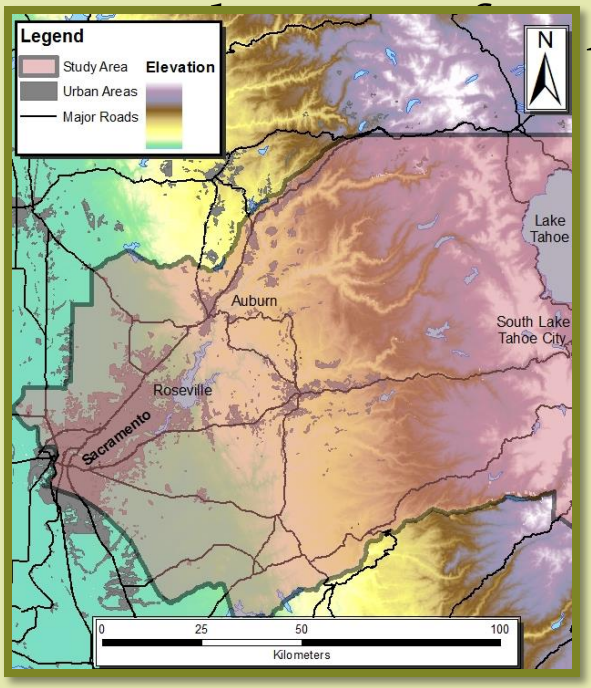
Results: Best Locations I



Raymond Whitlow
GEO 559
4/21/09

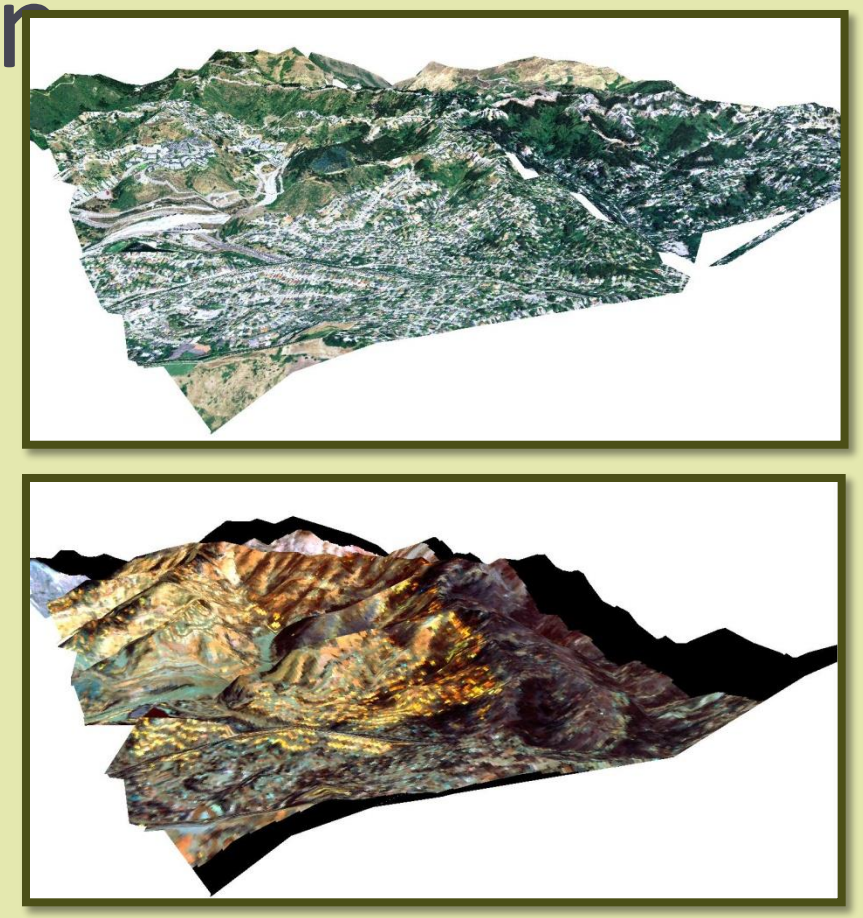
Problem definition

1. Construct a Wildfire Suitability Index
2. Identify Wildland-Urban Interface
3. Determine Risk to Wildland-[illegible] Areas



Study Area:

Placer, El Dorado, & Sacramento Counties
Population: 1.7m
Cities: Sacramento,Roseville, South Lake Tahoe,Auburn

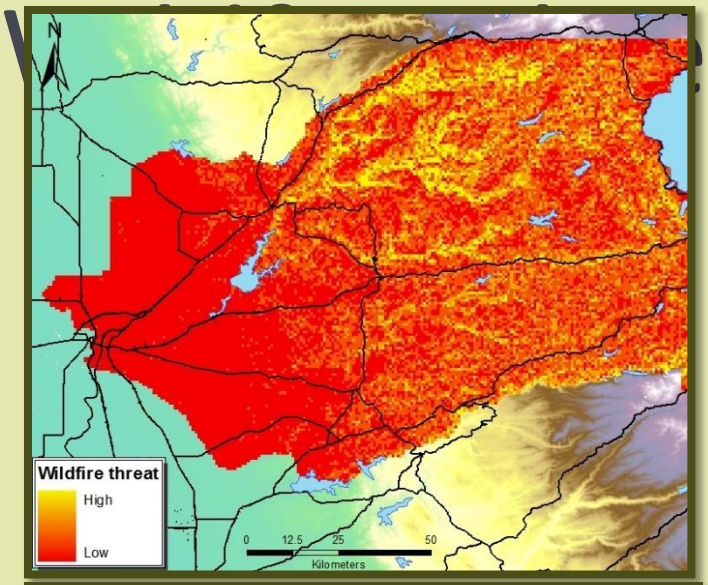


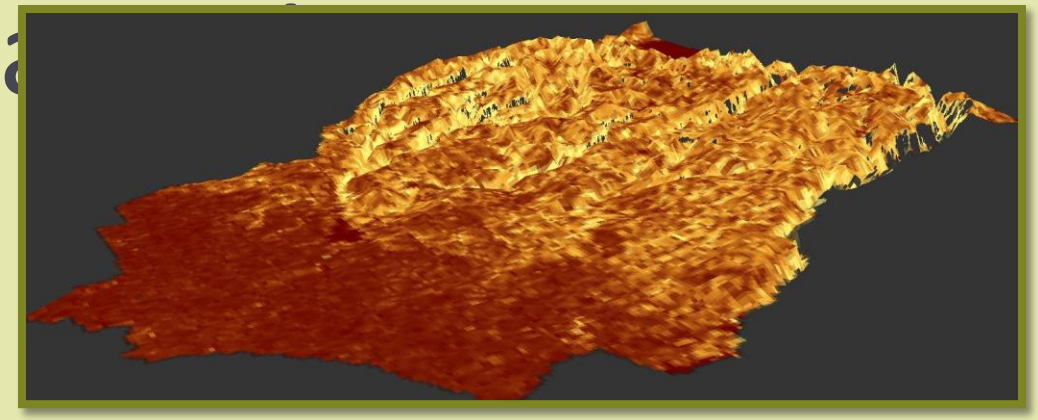
Above: Oakland Hills Fire, 1991: Before and After

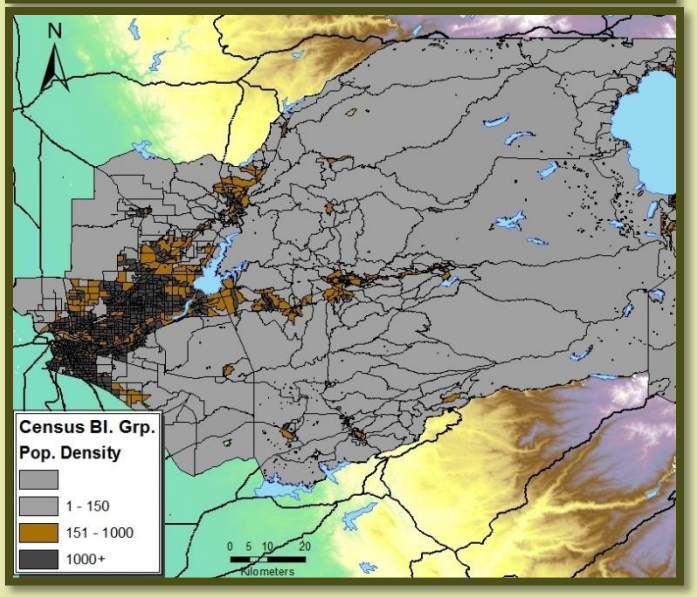
WILDFIRE MODELS

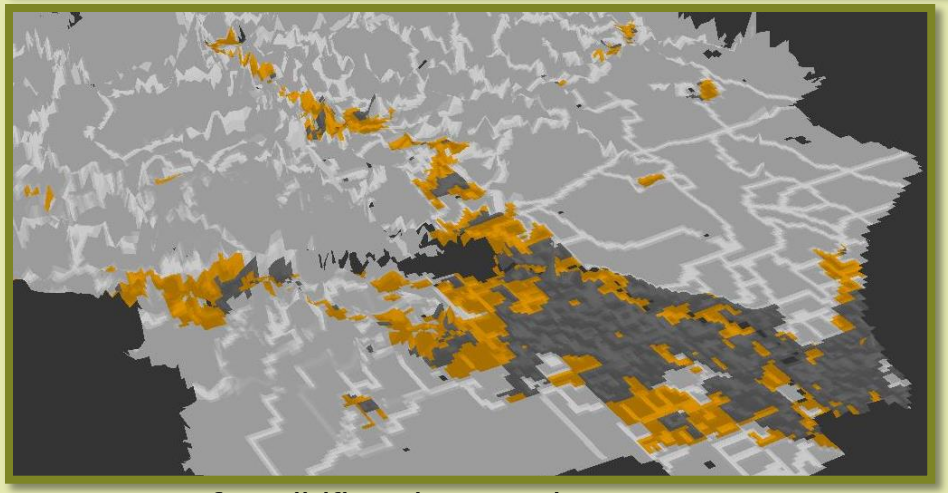
Data

Wildfire Model	Data	Sources
Ignition - Lightning - Human Ignition	**Ignition**	**California Fire Alliance** -Fuel Rank -Slope Rank -Historic Fire Data, 1900-2006 **California Energy Maps** - Wind Intensity **CASIL** - Census Data - LULC - Major & Local Roads **USGS** - SRTM 1 arc sec. - DOQQ 1m -LANDSAT7
Fire Spread **-Fuel Base** **-Wind Speed** -Wind Direction -Precipitation **-Slope** -Crown Fire -Time since last burn -…	**Fire Spread** -Fuel Rank Data -LULC -Wind Intensity Data -DEM -Slope Ranks	
Social Factors *Contributing* **-Urban Interface** *Mitigating* -Fire Response -Defensible Space	**Social Factors** *Contributing* -Census Bl.Grp. Data -LULC *Mitigating* -Local Roads -Satellite Imagery	

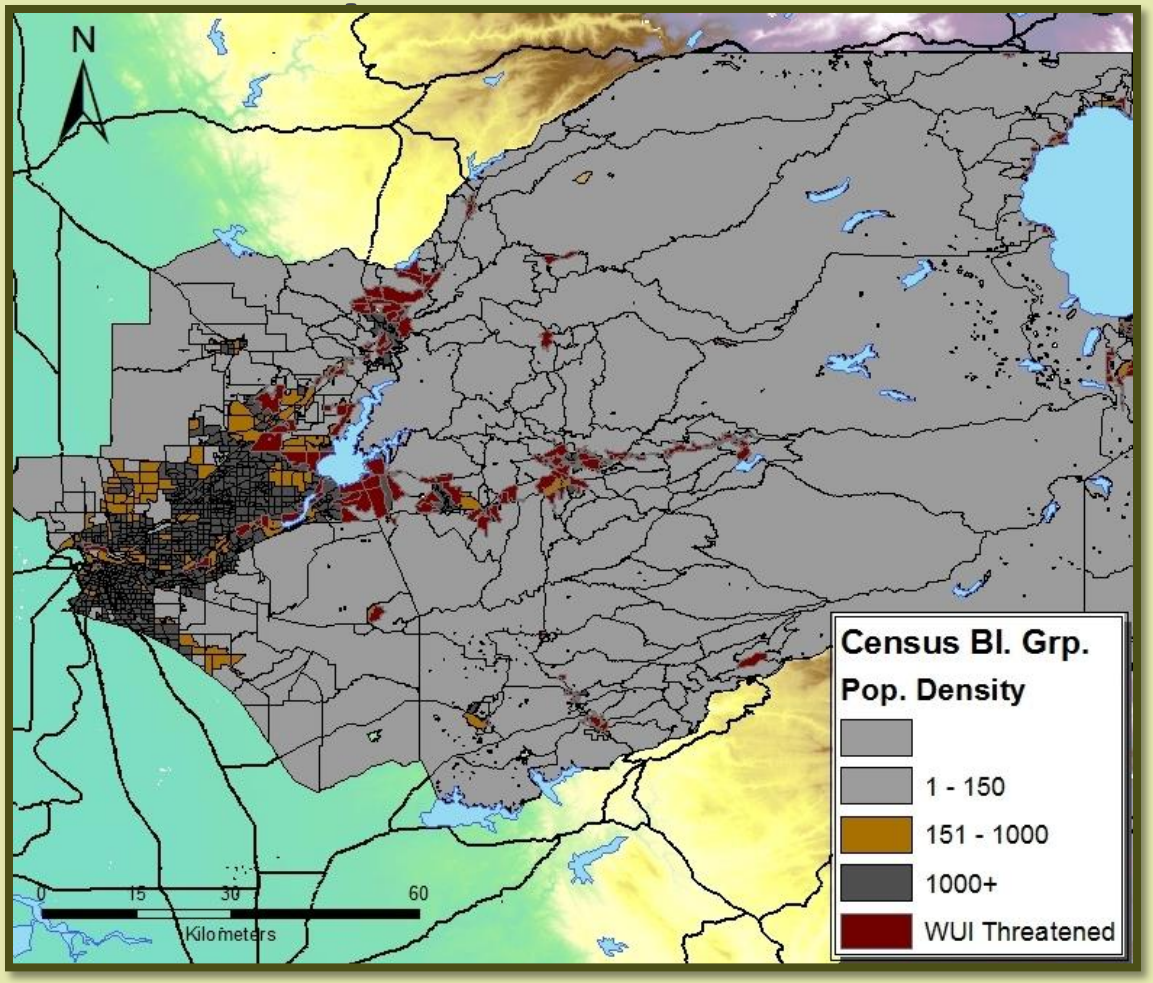


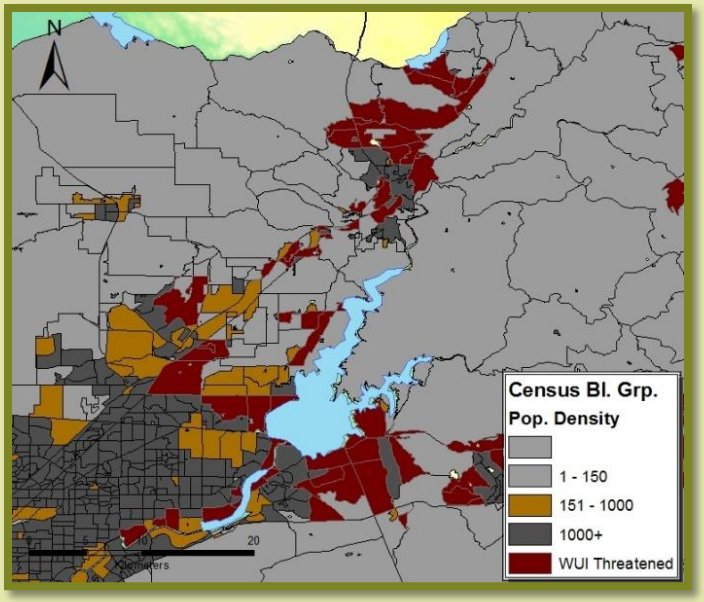






Upper Left: Wildfire Threat Index
Upper Right: Wildfire Threat draped over 3d elevation model
Lower Left: Wildland-Urban Interface
Lower Right: Wildland-Urban Interface draped over 3d Wildfire Threat Model





Threatened Urban Populations:

- Sacramento: 62,920
- Auburn: 7,450
- S. Lake Tahoe: 940
- Placerville: 24,590
- Total: 140,000

GEO 559 – GIS for Environmental Modeling

Applying GIS in Environment Walkability Assessment: Implication for Pedestrian/Transit Planning of the City of Tonawanda

Yan Zhang (Tracy)

April 21, 2009

Introduction

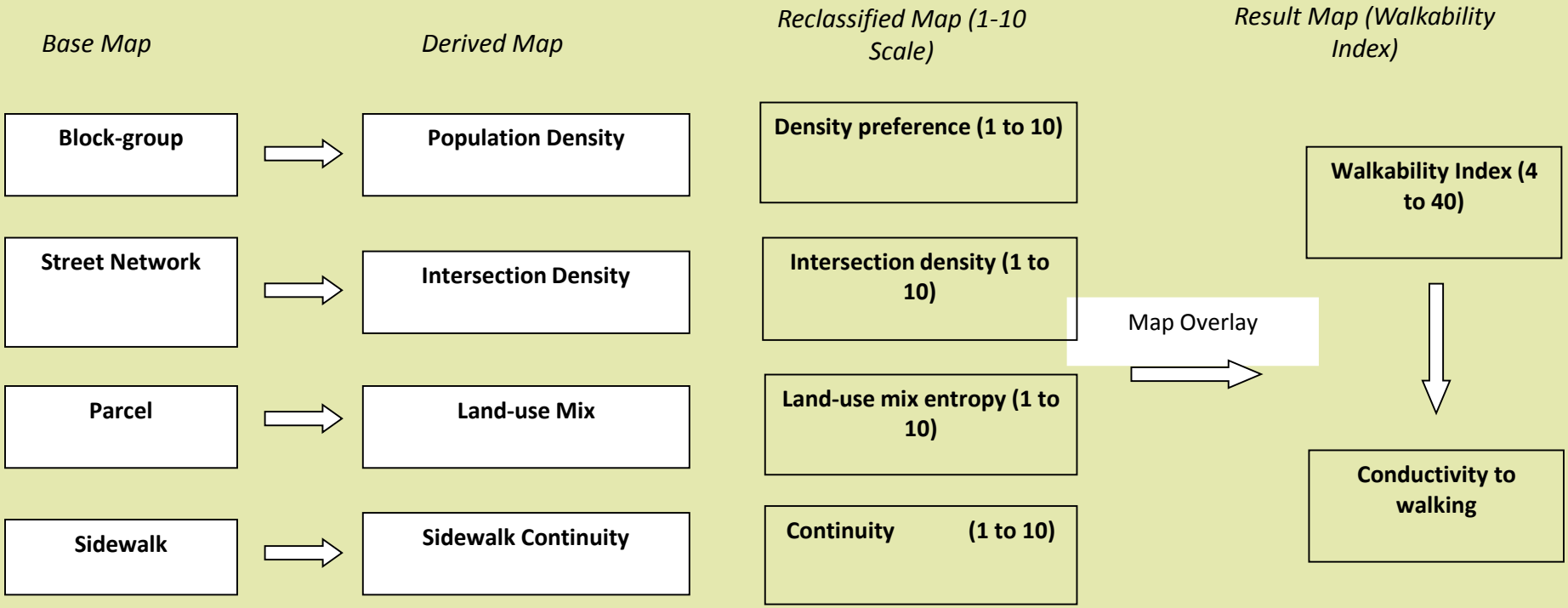
- Many researches are exploiting the correlation between **environment features** and **walking activities**.
- It found that residents living in **compact** neighborhoods **drive less** and **walk more** than otherwise neighborhoods.
- Four variables have been identified: 1) **dwelling density** 2) **street connectivity** 3)**mixture of land use**, and 4) **pedestrian infrastructure and design**.

Overall Goals of Project

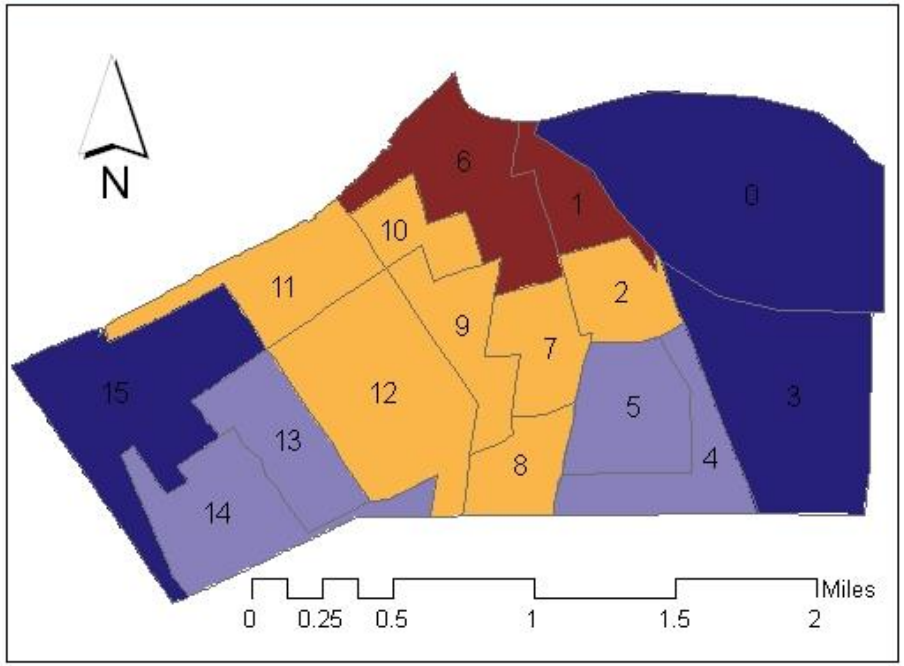
- The application of this project provides planners and city officials an opportunity to

1) **access** the current **environment walkability** in city's context, and
2) **prioritize** the areas for future pedestrian-friendly or transit oriented development.

Gis based walkability index flowchart



Walkability Index

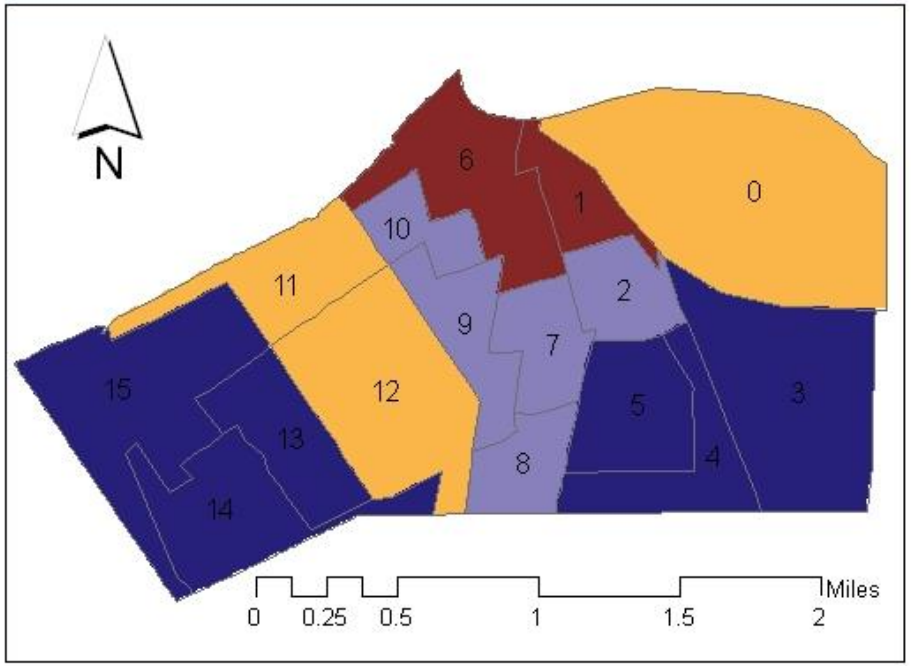


Legend

Environment Walkability

- High Walkability (1, 6)
- Higher Walkability (2,7,8,9,10,11,12)
- Lower Walkability (4,5,13,14)
- Low Walkability (0,3,15)

Socio_economic Status



Legend

SES Status

- Low SES (1, 6)
- Lower SES (2,7,8,9,10)
- Higher SES (0,11,12)
- High SES (3,4,5,13,14,15)