Esri International User Conference | San Diego, CA

Technical Workshops |

Map Makeovers: How to Make Your Map Great!

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Session Goals

- Demonstrate cartographic thinking in action
- Instill confidence to think cartographically

Cartographic Thinking Includes

- Geographically informed rationale for communicating
- Creative minimalist design intent
- Communicating through graphics
- Ensuring readability for your map's intended readers
- Good sensible judgment (in the opinion of others)
- Forced and blatant objectivity
- Clarity

But "cartography" is a cumbersome word…

Basically,

your map should tell a story that your audience can interpret and relate to

Communication first!

- A map must work… overtly if necessary
- Most things worth communicating need to be tailored with clarity of purpose and:
  - Effort… lots of effort
  - Inspiration… It's like opportunity: you need to make your own
  - Experience… speed and confidence
- Strive for self-evidence in communication
  - Water is blue
  - Trees are green
  - Full spectrum color ramps for "heat maps"? Really…

The Makeovers

Fukushima Daiichi

Empirical Bayesian Kriging

??? (Mystery Map)

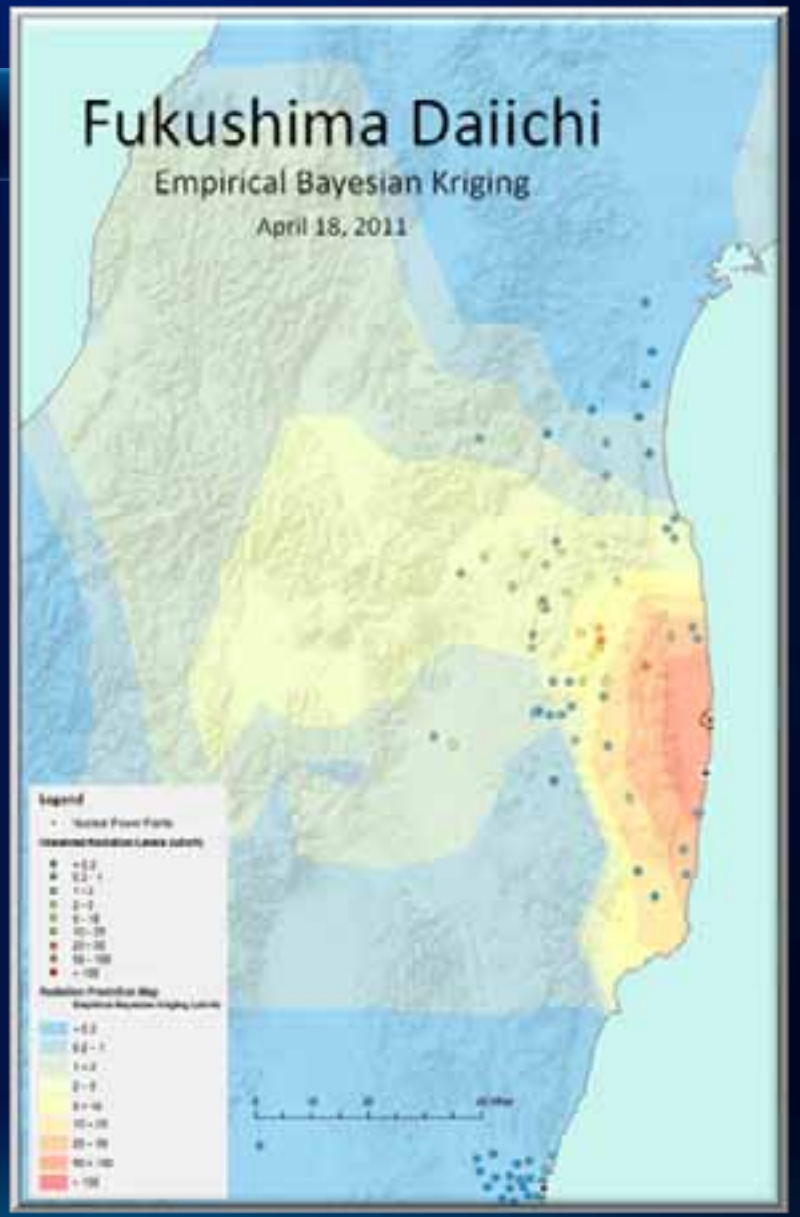
Food Deserts

Fukushima Daiichi

Charlie Frye

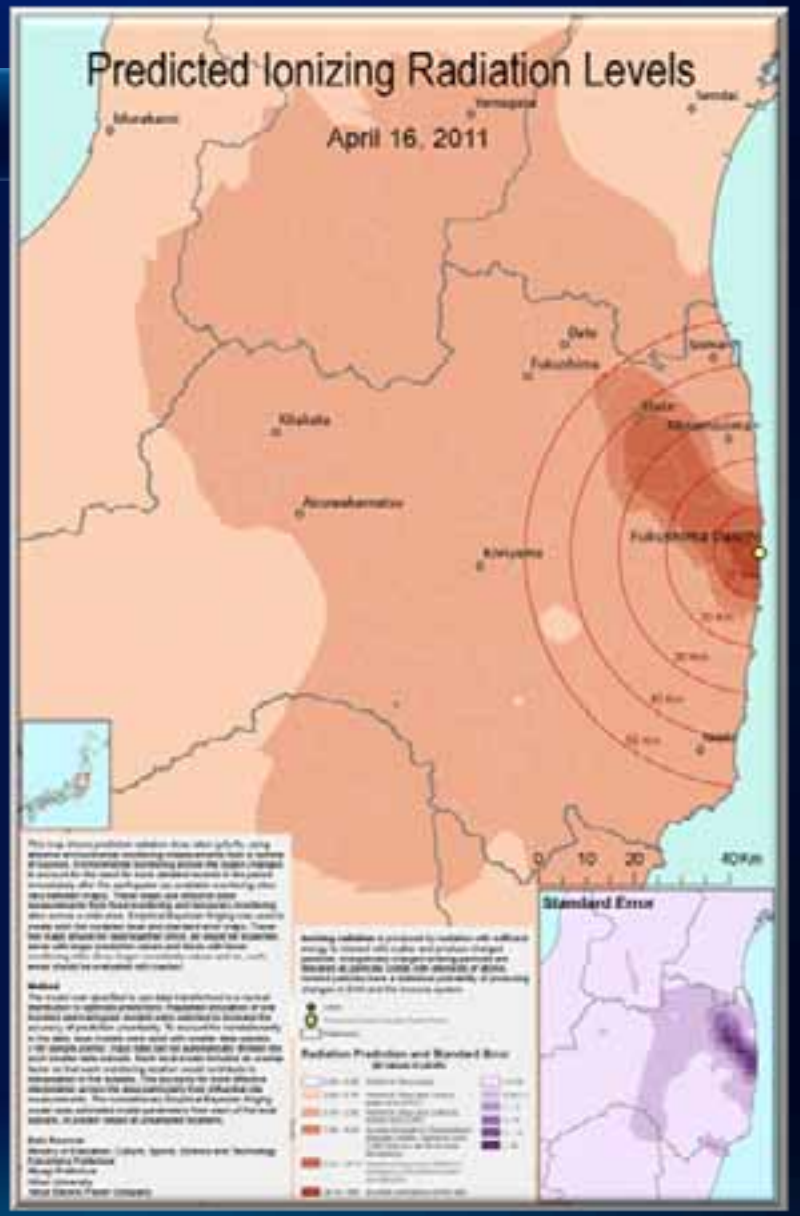
Before

- **What is the story???**



After

- **Shows radiation and danger levels associated with the Fukushima Diachi reactor after the earthquake in Japan**

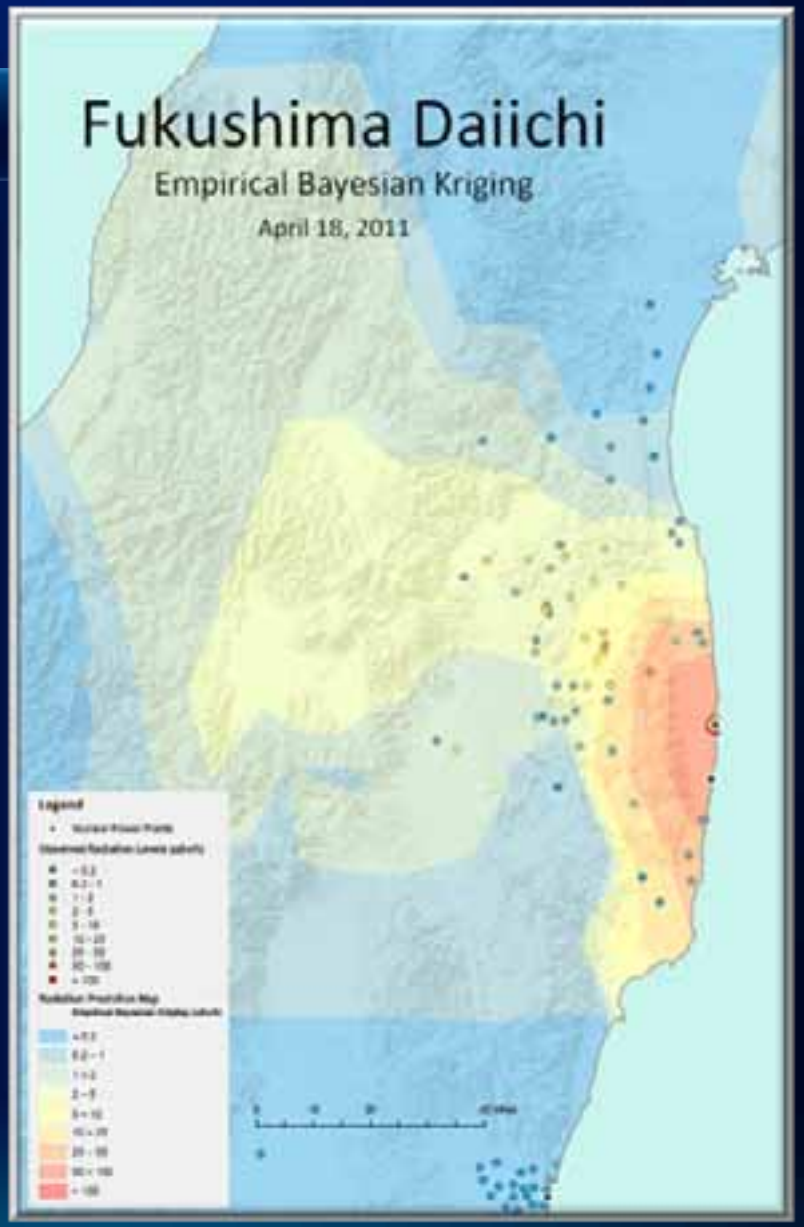


What was changed?

- Colors
- Map elements (legend, etc.)
- Wording

Original Colors

- **Color scheme is confusing**



Final Colors

- **Light-to-dark color sequence shows a pattern**

A Good Title Matters

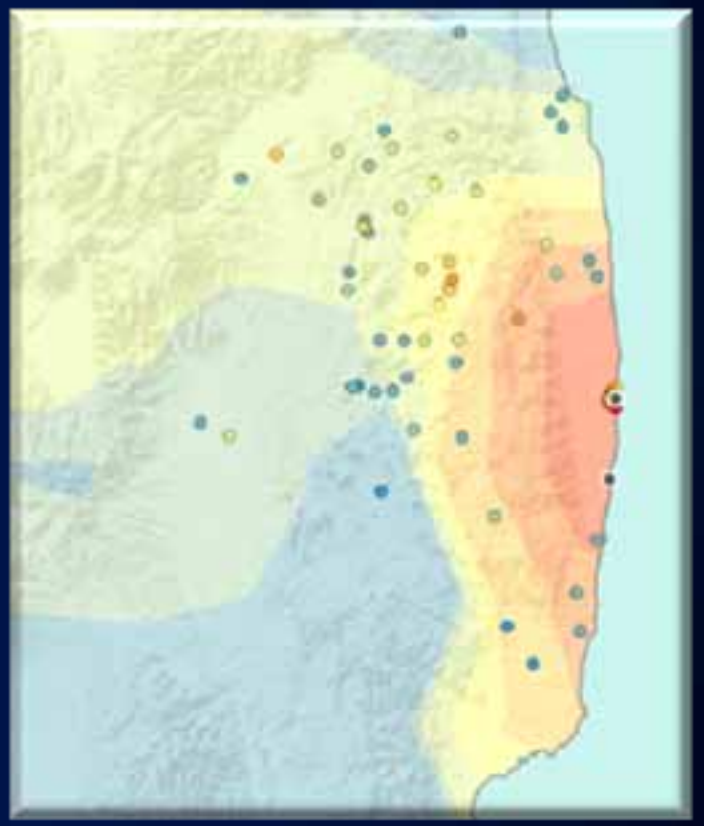
- **Original title doesn't make sense- what does it mean to an educated layperson?**
- **Titles that don't work for thematic maps include:**
  - **The name of the place shown on the map**
  - **The data provider**
  - **The analysis method**

Less obscure, but map's purpose is still unclear

This makes sense

Original Labeling

- Nice art piece!
- What does it mean?
- The dots don’t match???



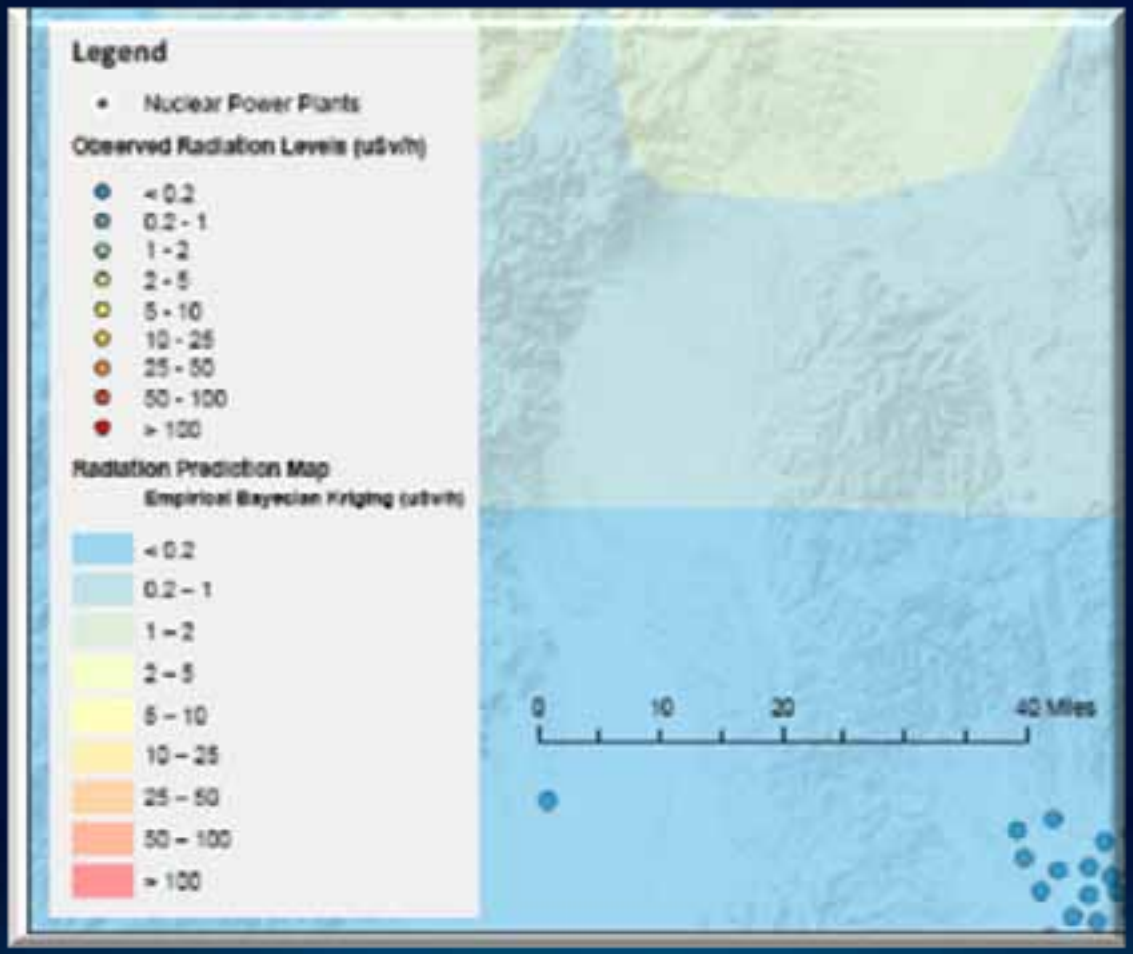
After the color change

- Is this city important?
- Does this reactor matter?
- What are these rings?
- Is the hillshade necessary?

Much clearer

- Certain cities are in the danger zone
- This is the reactor we are worried about
- Rings show distance
- No hillshade

Original map elements

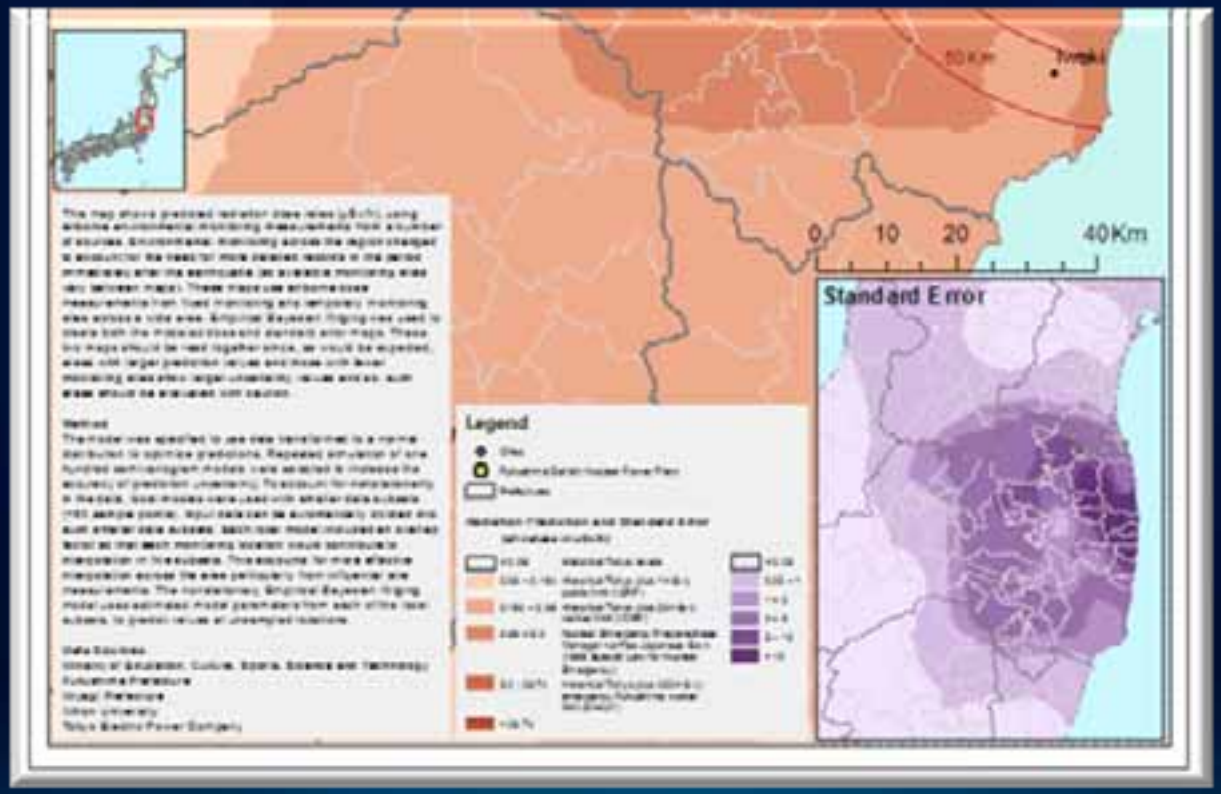


Added map elements

- Added a Standard Error map- why is the error margin significant? Should we panic?
- What are the data sources?
- Where is this located in Japan?

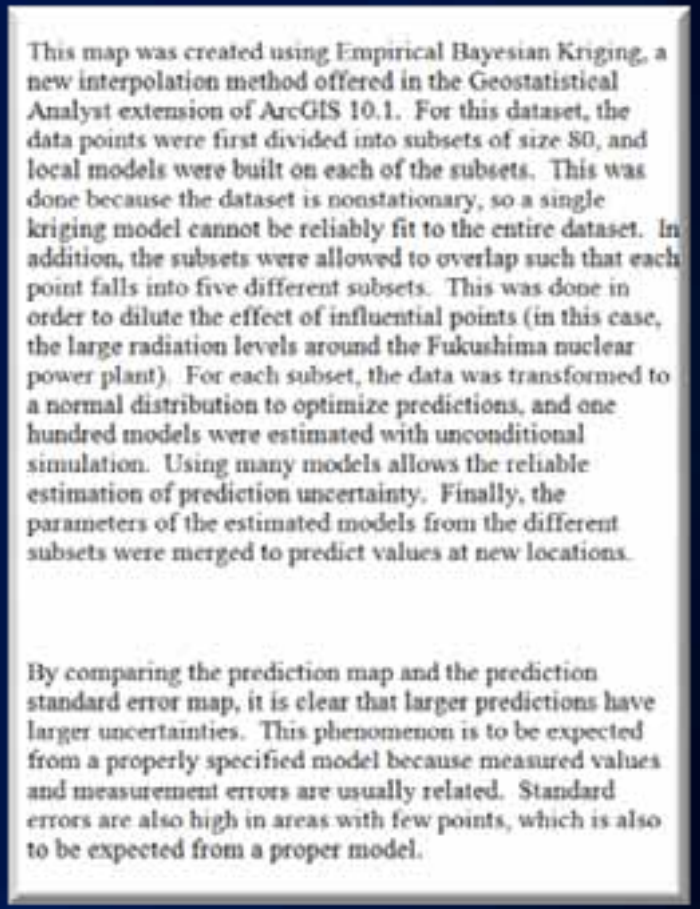
Final map

- Added locator map, explanation of standard error
- Neatly aligned map elements



Brevity v. Accuracy

- This description is specific, but too wordy to fit on the map
- Big paragraphs are hard to read
- Only describes methodology



This map was created using Empirical Bayesian Kriging, a new interpolation method offered in the Geostatistical Analyst extension of ArcGIS 10.1. For this dataset, the data points were first divided into subsets of size 80, and local models were built on each of the subsets. This was done because the dataset is nonstationary, so a single kriging model cannot be reliably fit to the entire dataset. In addition, the subsets were allowed to overlap such that each point falls into five different subsets. This was done in order to dilute the effect of influential points (in this case, the large radiation levels around the Fukushima nuclear power plant). For each subset, the data was transformed to a normal distribution to optimize predictions, and one hundred models were estimated with unconditional simulation. Using many models allows the reliable estimation of prediction uncertainty. Finally, the parameters of the estimated models from the different subsets were merged to predict values at new locations.

By comparing the prediction map and the prediction standard error map, it is clear that larger predictions have larger uncertainties. This phenomenon is to be expected from a properly specified model because measured values and measurement errors are usually related. Standard errors are also high in areas with few points, which is also to be expected from a proper model.

Speak to your audience

- Give the reader's eye a place to go
  - data sources and human impact as well as methodology
- Use simpler, broadly approachable language

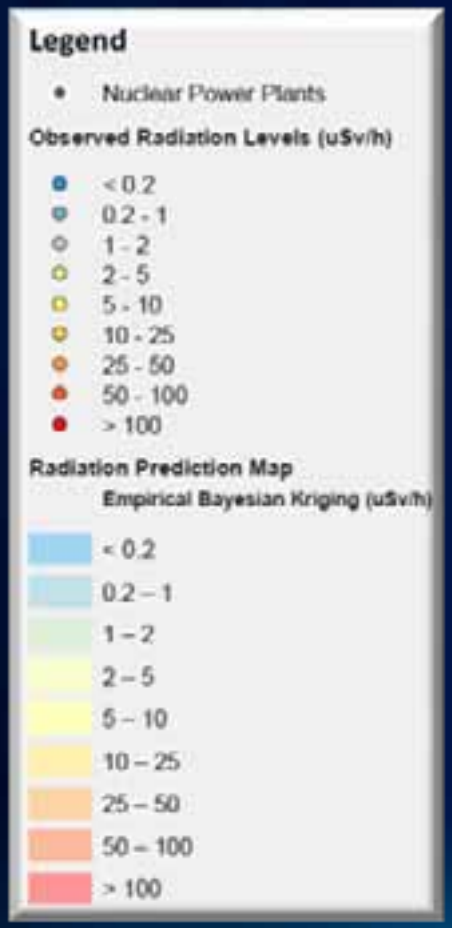
This map shows predicted radiation dose rates (μSv/h), using airborne environmental monitoring measurements from a number of sources. Environmental monitoring across the region changed to account for the need for more detailed records in the period immediately after the earthquake (so available monitoring sites vary between maps). These maps use airborne dose measurements from fixed monitoring and temporary monitoring sites across a wide area. Empirical Bayesian Kriging was used to create both the modeled dose and standard error maps. These two maps should be read together since, as would be expected, areas with larger prediction values and those with fewer monitoring sites show larger uncertainty values and so, such areas should be evaluated with caution.

Method
The model was specified to use data transformed to a normal distribution to optimize predictions. Repeated simulation of one hundred semivariogram models were selected to increase the accuracy of prediction uncertainty. To account for nonstationarity in the data, local models were used with smaller data subsets (~80 sample points). Input data can be automatically divided into such smaller data subsets. Each local model included an overlap factor so that each monitoring location would contribute to interpolation in five subsets. This accounts for more effective interpolation across the area particularly from influential site measurements. The nonstationary Empirical Bayesian Kriging model uses estimated model parameters from each of the local subsets, to predict values at unsampled locations.

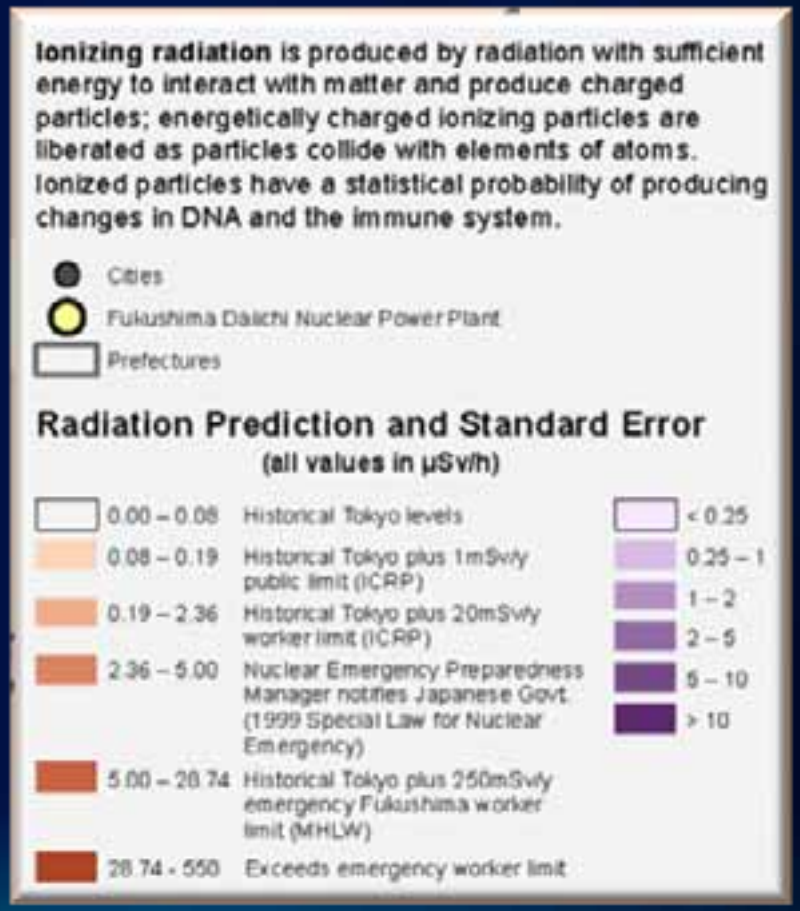
Data Sources
Ministry of Education, Culture, Sports, Science and Technology
Fukushima Prefecture
Miyagi Prefecture
Nihon University
Tokyo Electric Power Company

Relate units to reader

Before

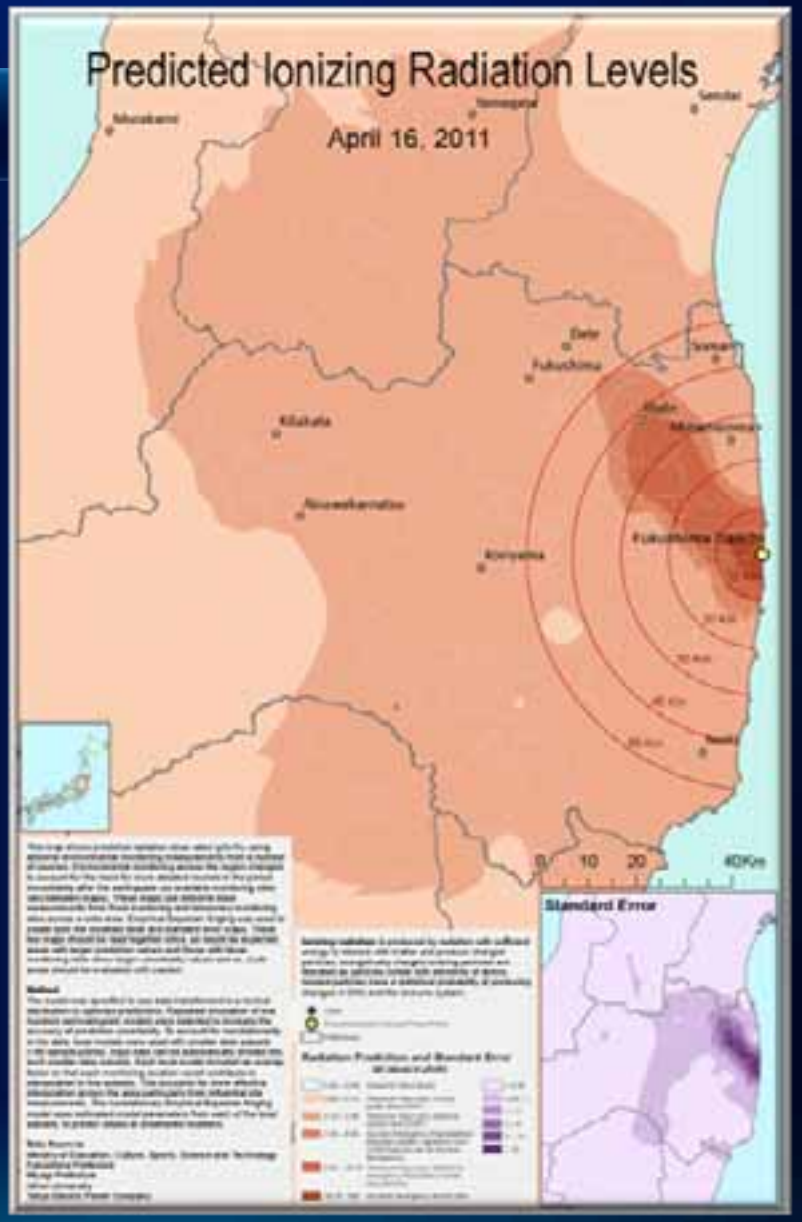


After



Final Result

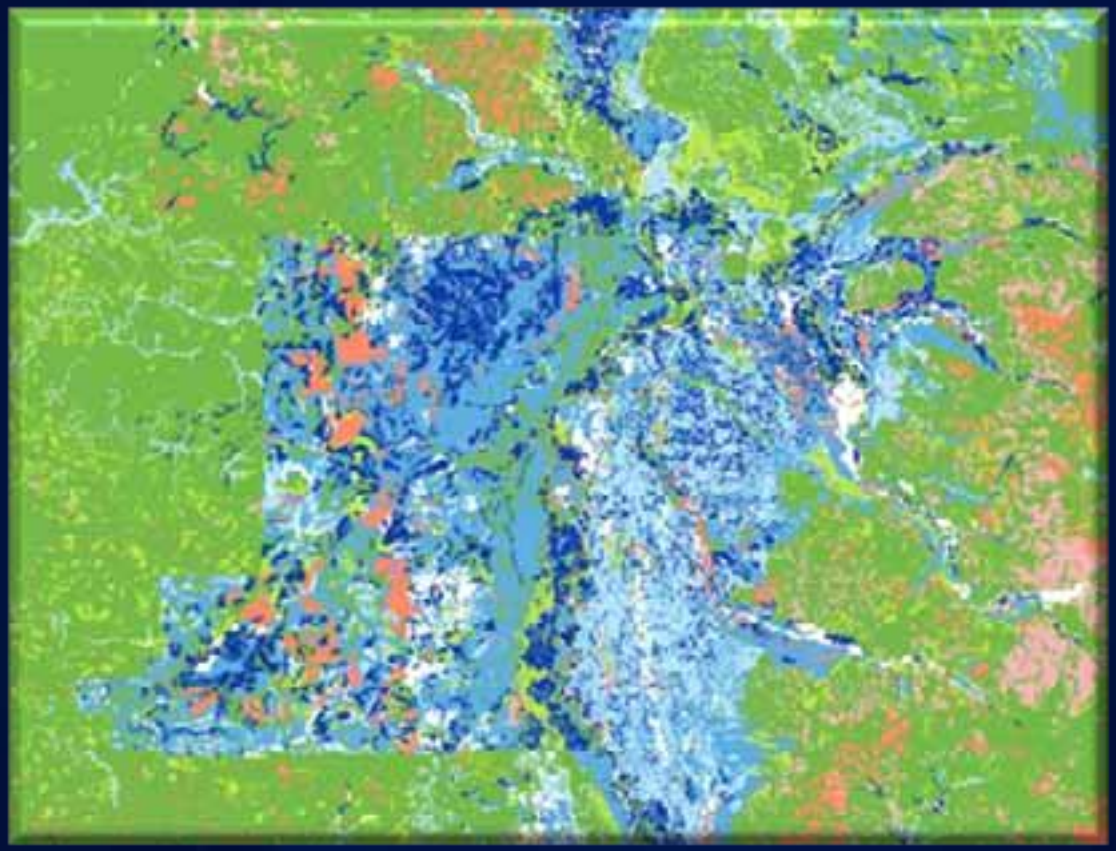
- Color and lightness show a pattern; danger and location are clear
- Map elements add to understanding
- Standard error and methodology explained



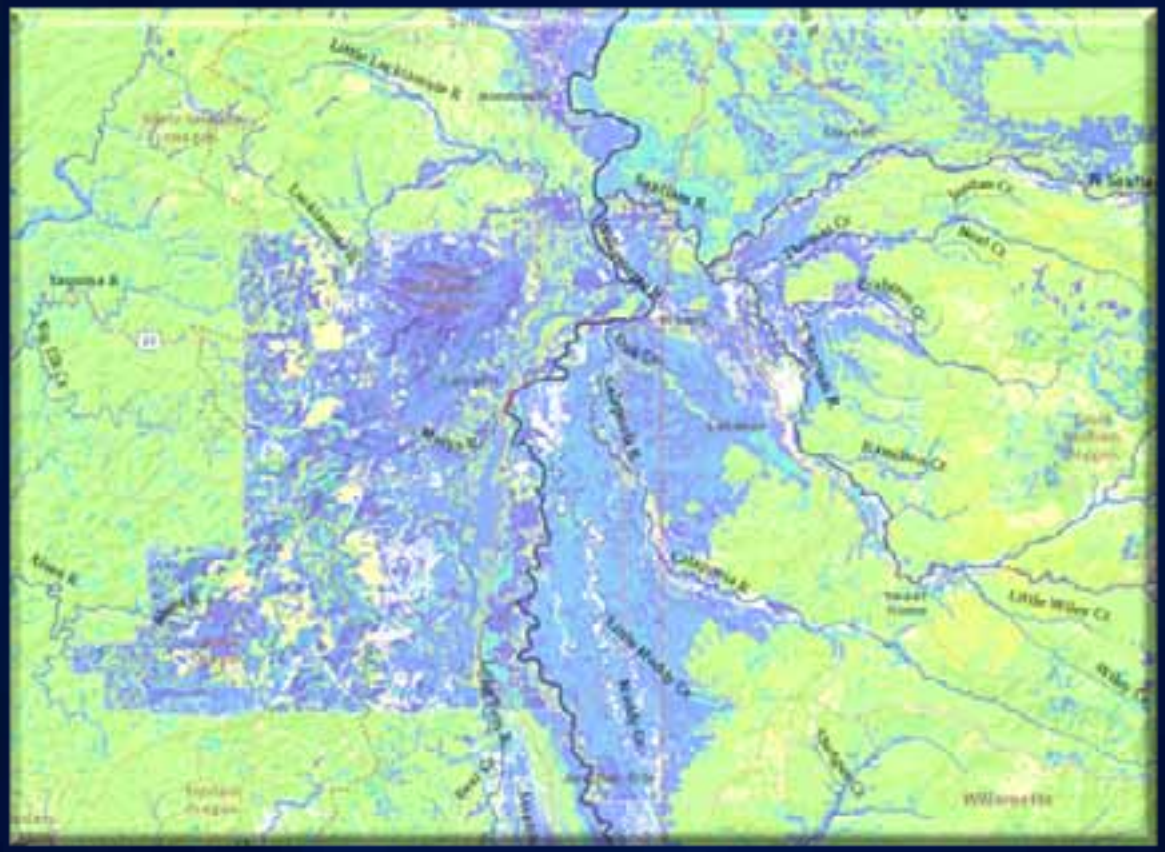
???

Charlie Frye

Before



After

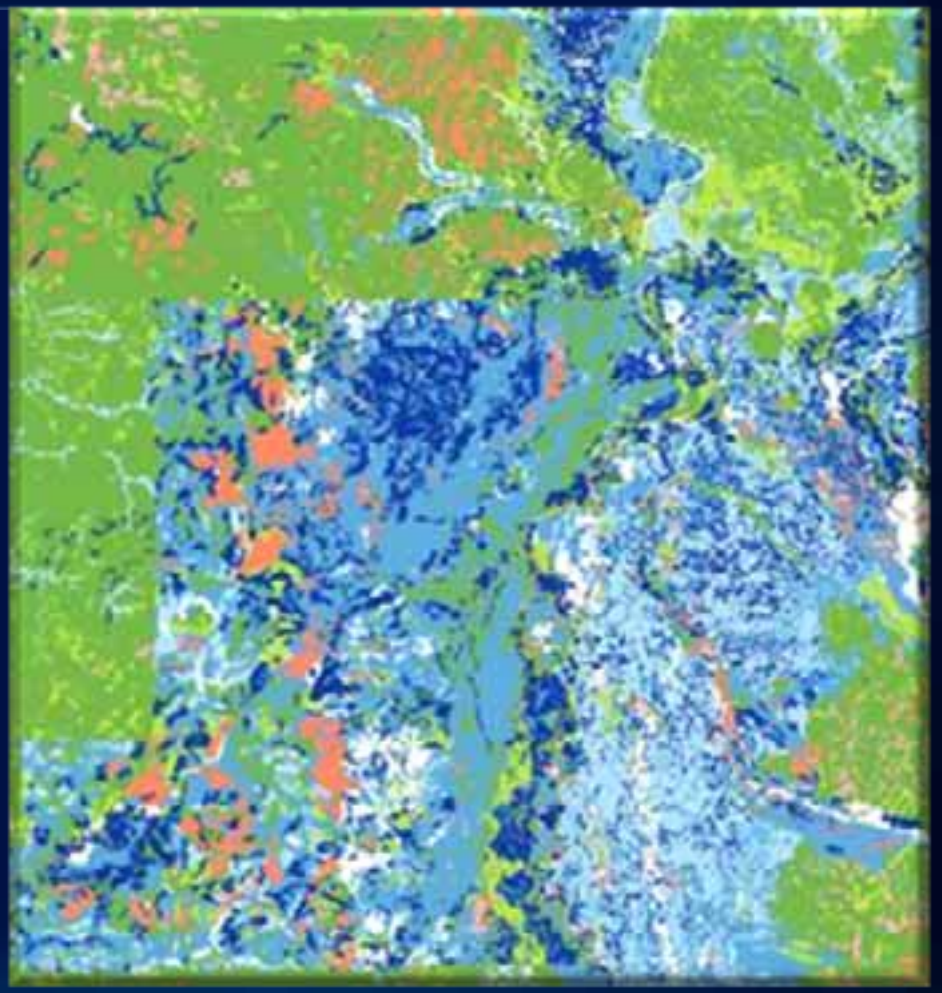


What was changed?

- Color scheme
- Labeling
- Corporate review

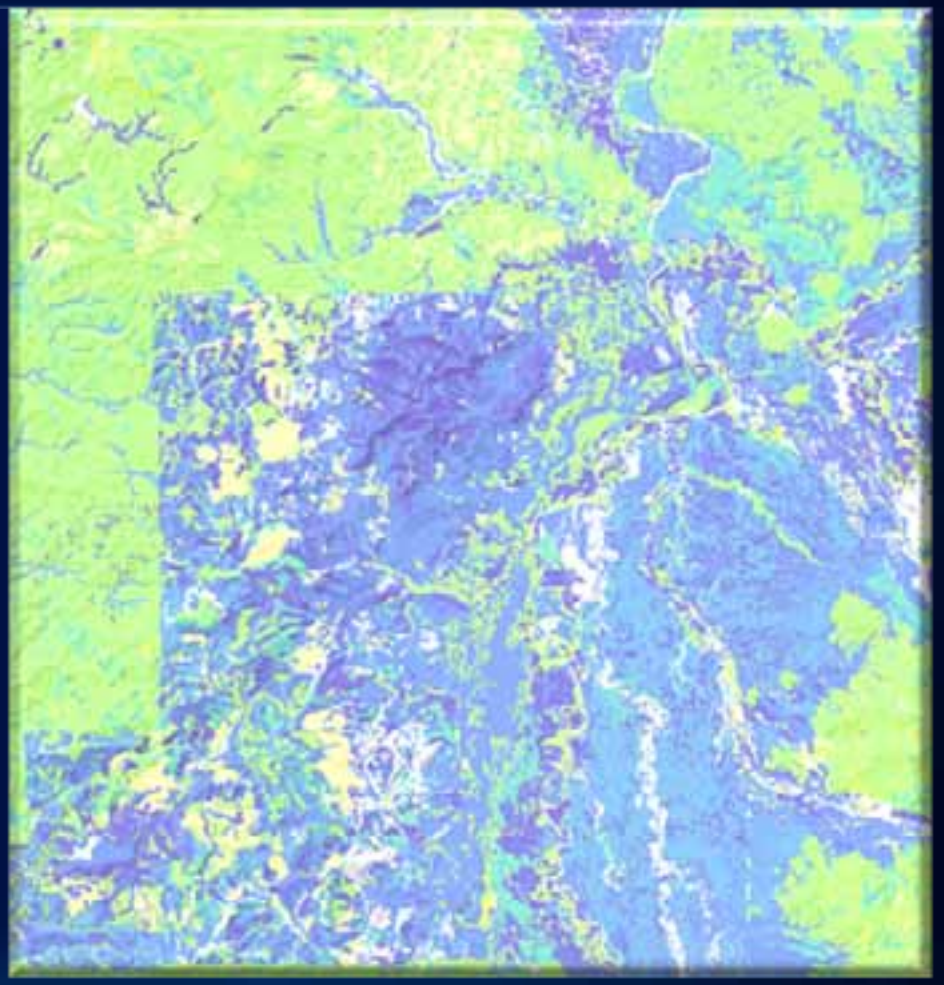
Original Color Scheme

- Qualitative color scheme
- It looks like a land cover map



Final Color Scheme

- Sequential colors show wettest to driest soil
- Readable as drainage classes



Labeling

- What location does this map show?
- Where are the water bodies that affect soil water content?
- Which features are more/less important?

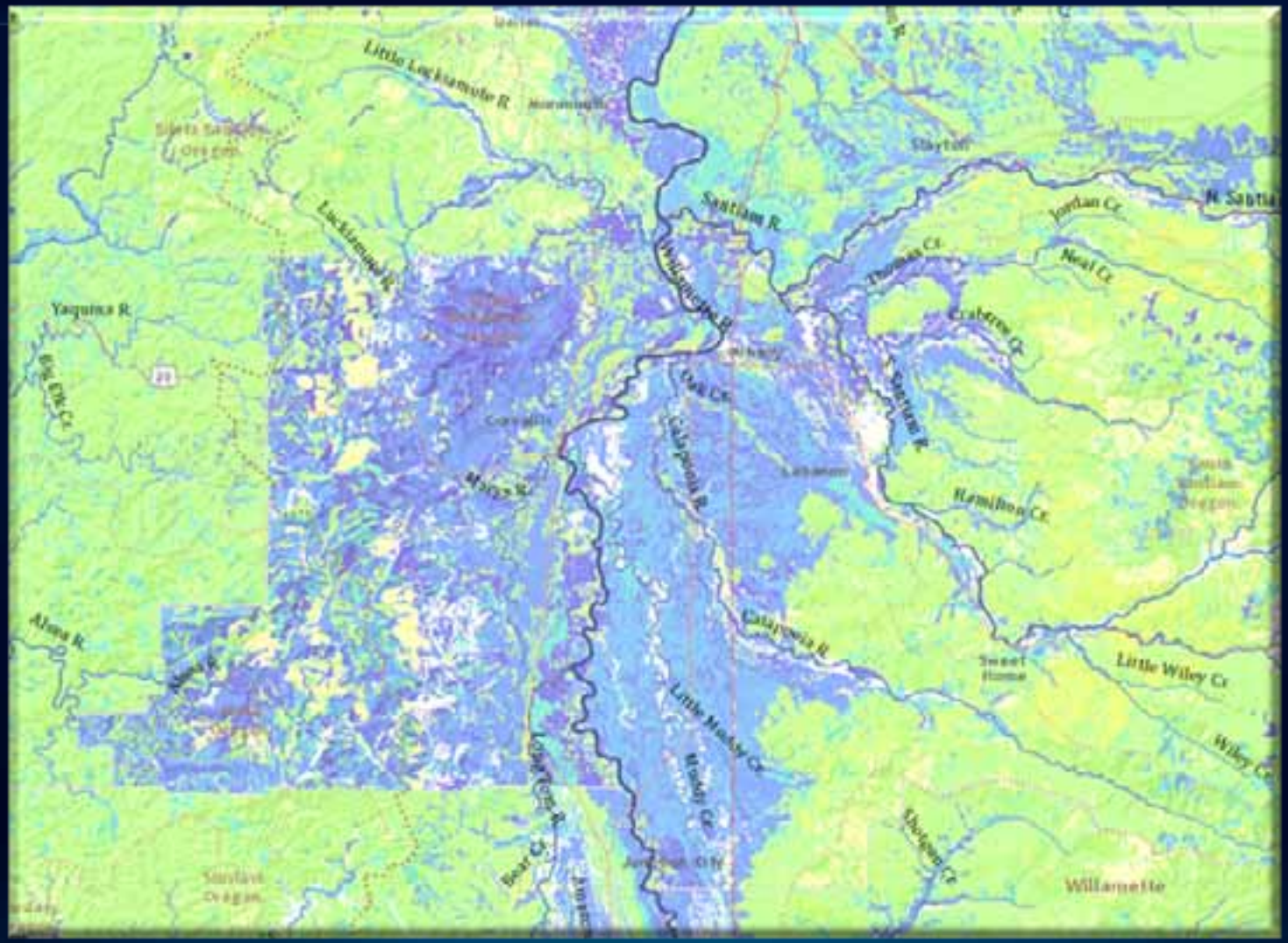
Final Labeling

- Important roads and towns labeled
- Large rivers shown and labeled
- Tributaries shown
- Label colors and sizes follow hierachy

Corporate Review

- **ESRI requires that all maps released to the public be reviewed before publish**

Final Result



Food Deserts

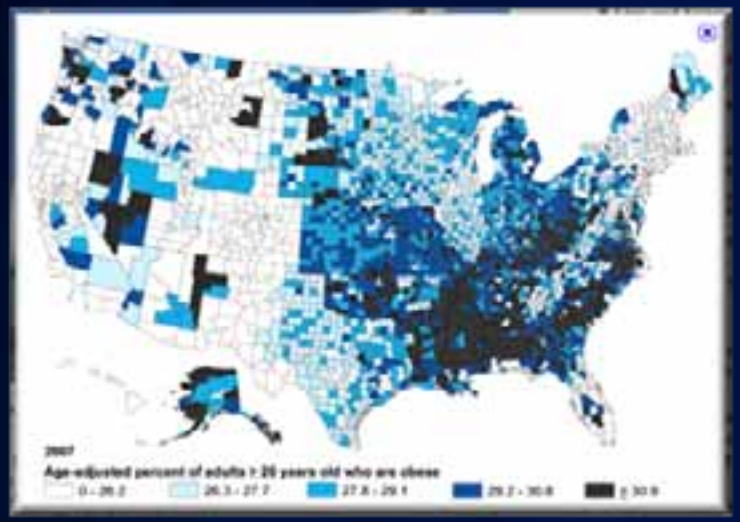
Jim Herries

Food Deserts

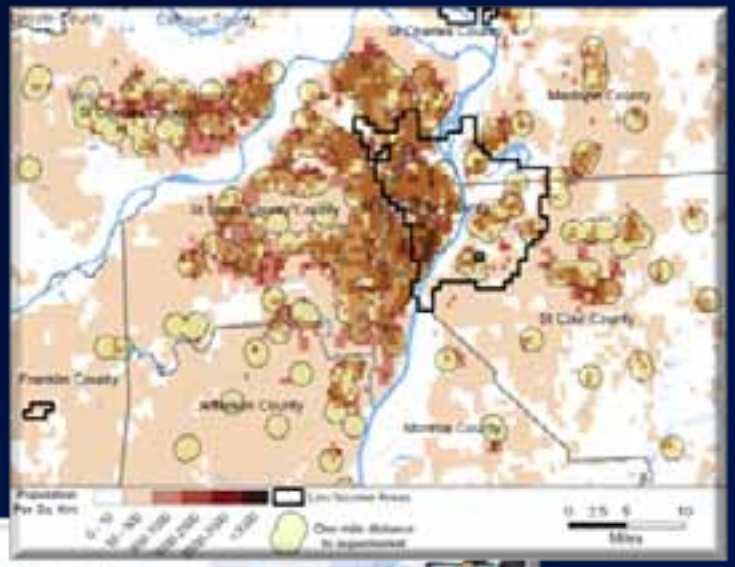
- Defined by areas with limited access to affordable and nutritious food
  - Frequently associated with health issues (obesity)
  - Often associated with demographic characteristics
  - Sometimes includes competing destinations in the definition
  - Clear behavioral choice component
  - Access does not automatically result in good choices

  - …lots of room to define a food desert, so it's important that the map is relatable and connects the reader to a definition.

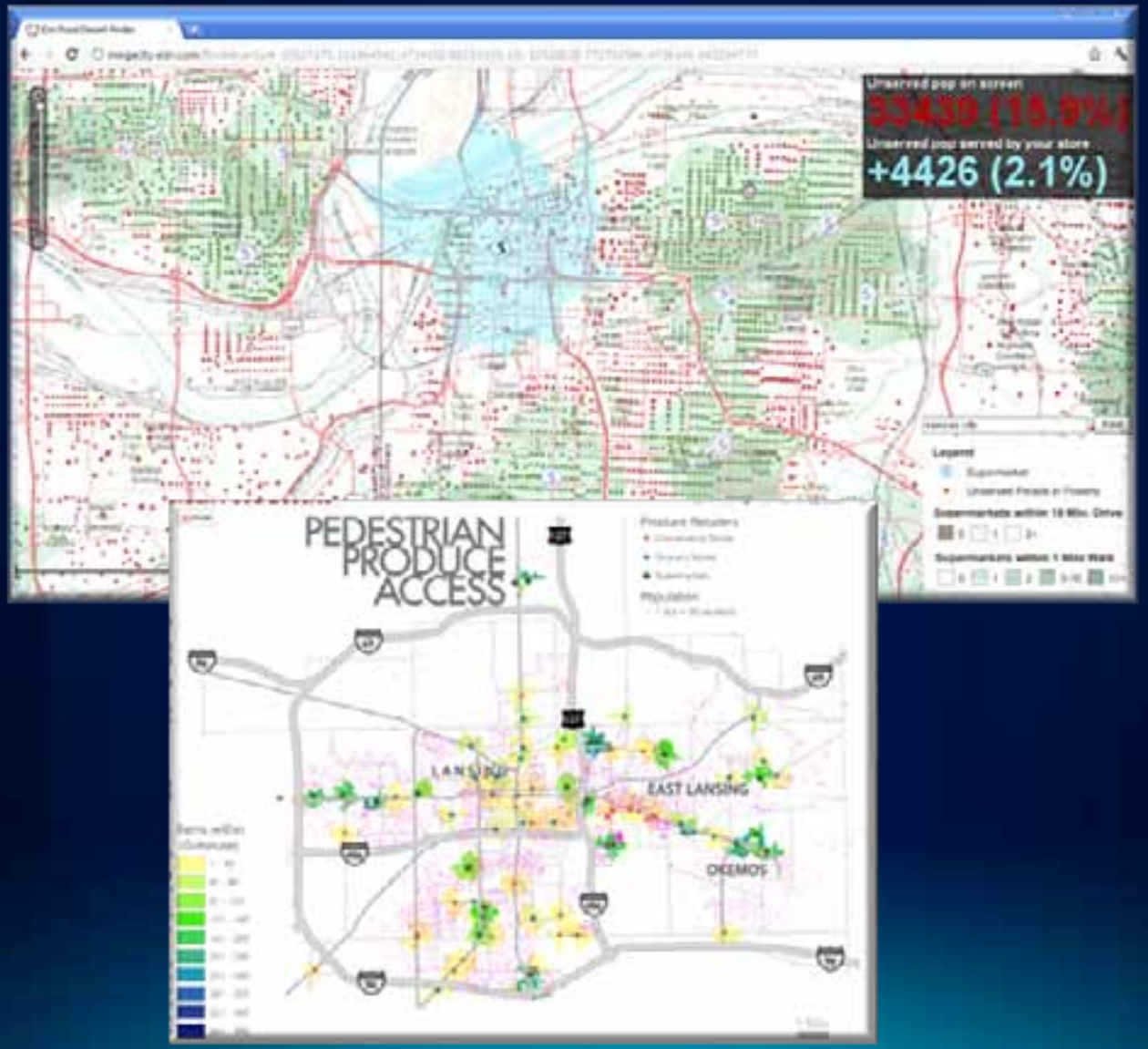
Small Scale Maps



Medium Scale Maps



Large Scale Maps



Scale Matters

- Small and medium scales show national and regional patterns, but are less relatable
- Large scale maps showing neighborhood level information are something the public can relate to
- Would Zillow.com be as successful if it looked like this?
- Not all data is available at the neighborhood level

Before

Ardmore
Narberth
Merion Station
Bala
Fairmount Park
Penn Wynne
Morris Park
Temple University
Philadelphia
Highland Park
Millbourne
Bywood
Cobbs Creek Park
Drexel University
East Lansdowne
Lansdowne
Yeadon
Mount Moriah Cemetery
Holy Cross Cemetery
University of Pennsylvania
Camden
Darby
Collingdale
Colwyn
Sharon Hill
Philadelphia County
Camden County
Cooper River Park
West Collingswood
Roosevelt Park
Philadelphia Naval Business Center
Gloucester City
Oaklyn
Audubon Park
Audubon
Folcroft

After

- **Shows combined effects of socioeconomic status and significant differences in access**

What was changed?

- Methodology
- Colors

Original Methodology

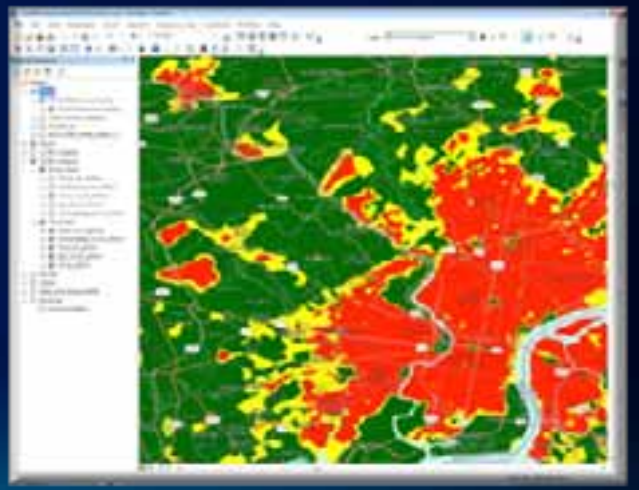
- Which blocks have walk-able access to a supermarket?
- Goal was to put distance measurements in full view
- Partial view of how people access food

Revised Methodology

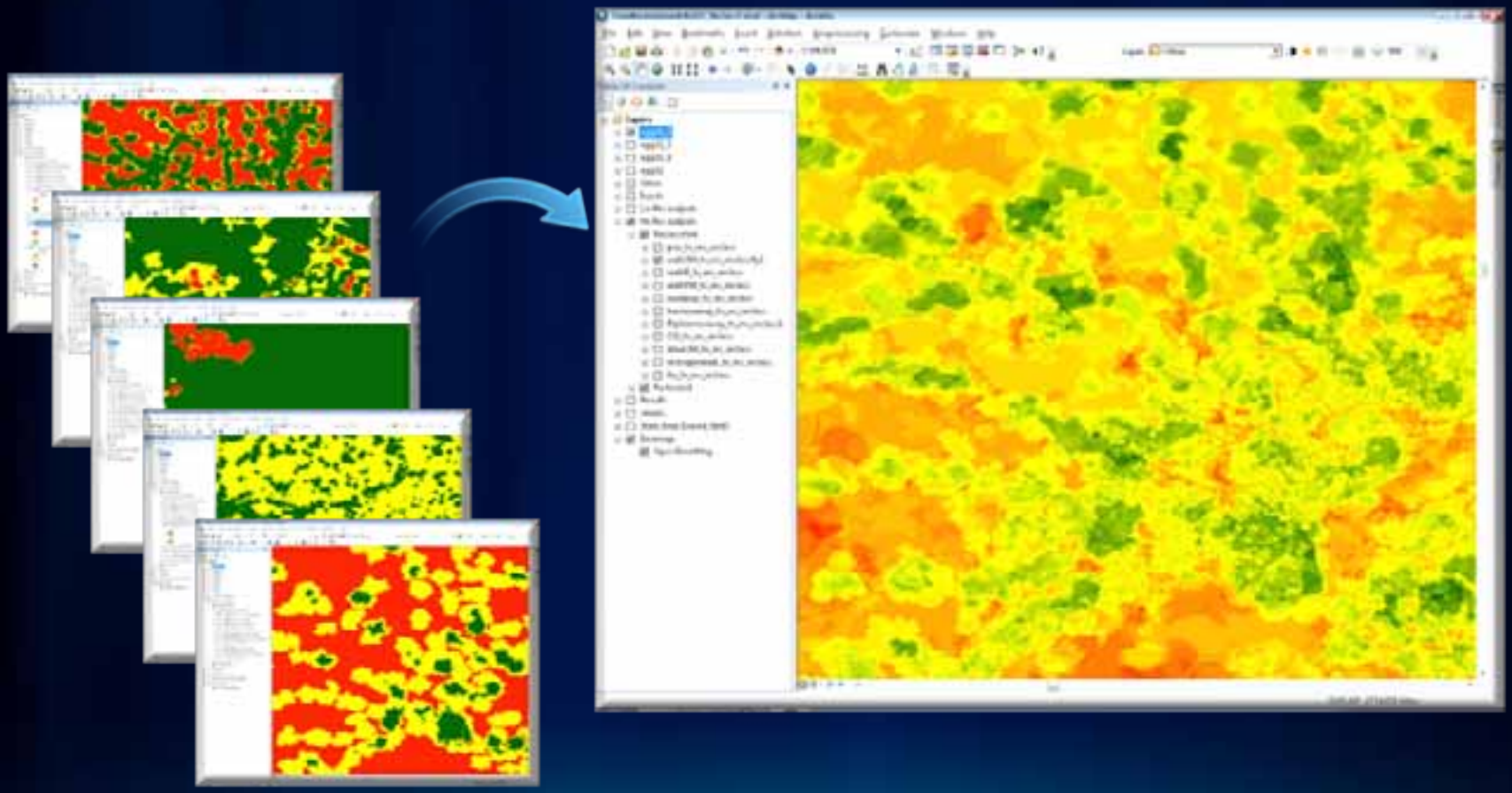
- Goal was to create a single, relatable measure of the food environment
- Distance is only a part of the story
- Assess areas based on multiple criteria
  - Poverty
  - Car ownership
  - % of income spent on food at home
  - Crime
  - Rural population
  - Distance to and number of restaurants and farmers' markets
  - Distance to and number of supermarkets

Classification Approach

- Use census block group data
- Interpolate a continuous surface using Natural Neighbor
- Reclassify the surface into 3 categories:
  - 0 = potential problem area (red)
  - 1 = likely not a problem area (yellow)
  - 2 = definitely not a problem area (green)

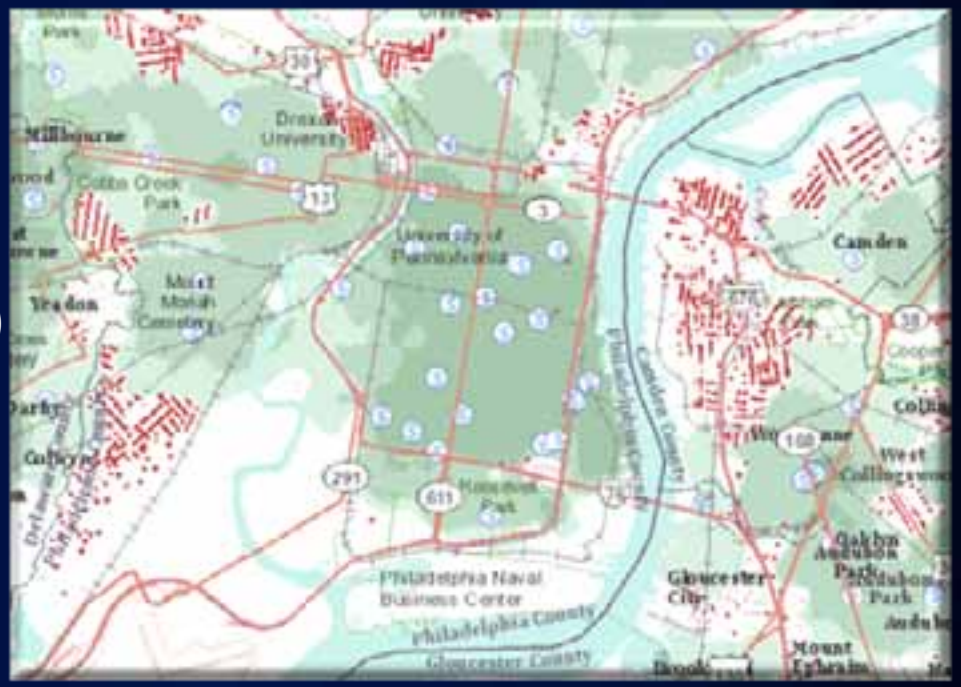


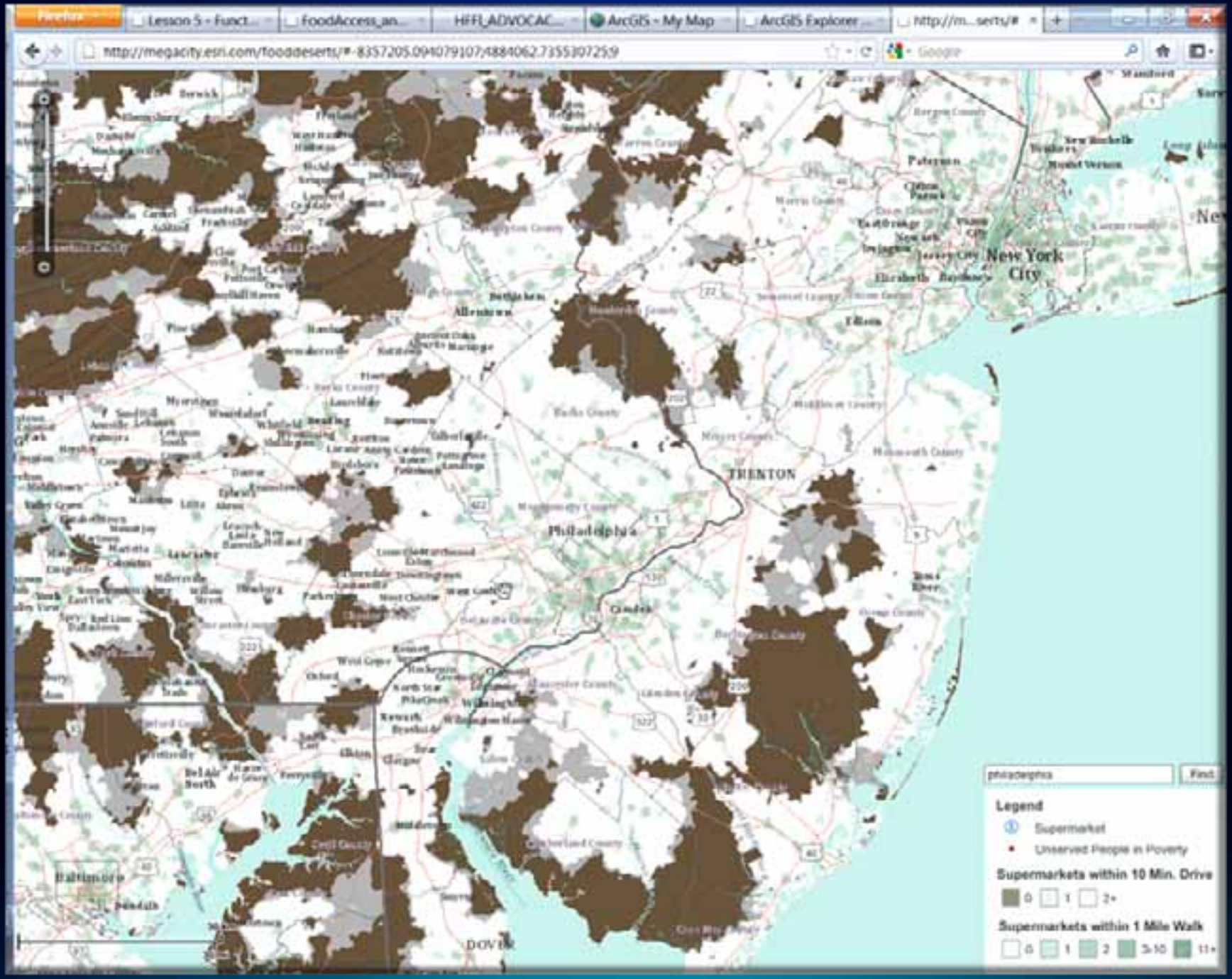
Raster calculator sum

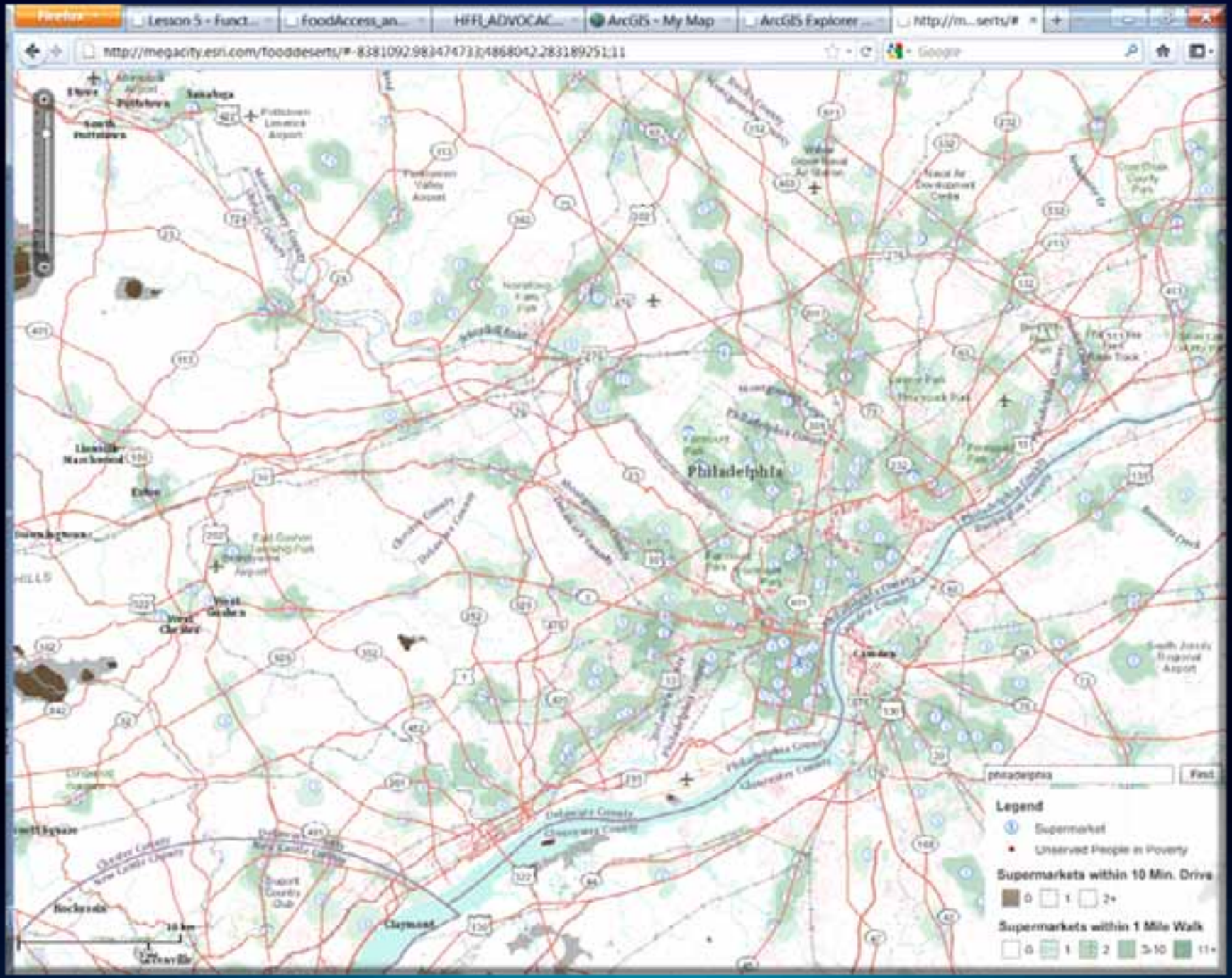


Original Colors

- Color scheme is culturally ambiguous:
  - Green is good
  - Red is bad (in the US)
  - (But red is good in China)
- Candy?
- People in poverty represented as dots
- Two measures of access shown:
  - Walkable
  - Drivable




Lesson 5 - Funct...
FoodAccess_an...
HFFI_ADVOCAC...
ArcGIS - My Map
ArcGIS Explorer ...
http://m...serts/#
http://megacity.esri.com/fooddeserts/#-8357205.091079107,4884062.7355307259
New York City
TRENTON
Philadelphia
DOVER
philadelphia
Find
Legend
Supermarket
Unserved People in Poverty
Supermarkets within 10 Min. Drive
0
1
2+
Supermarkets within 1 Mile Walk
0
1
2
3-10
11+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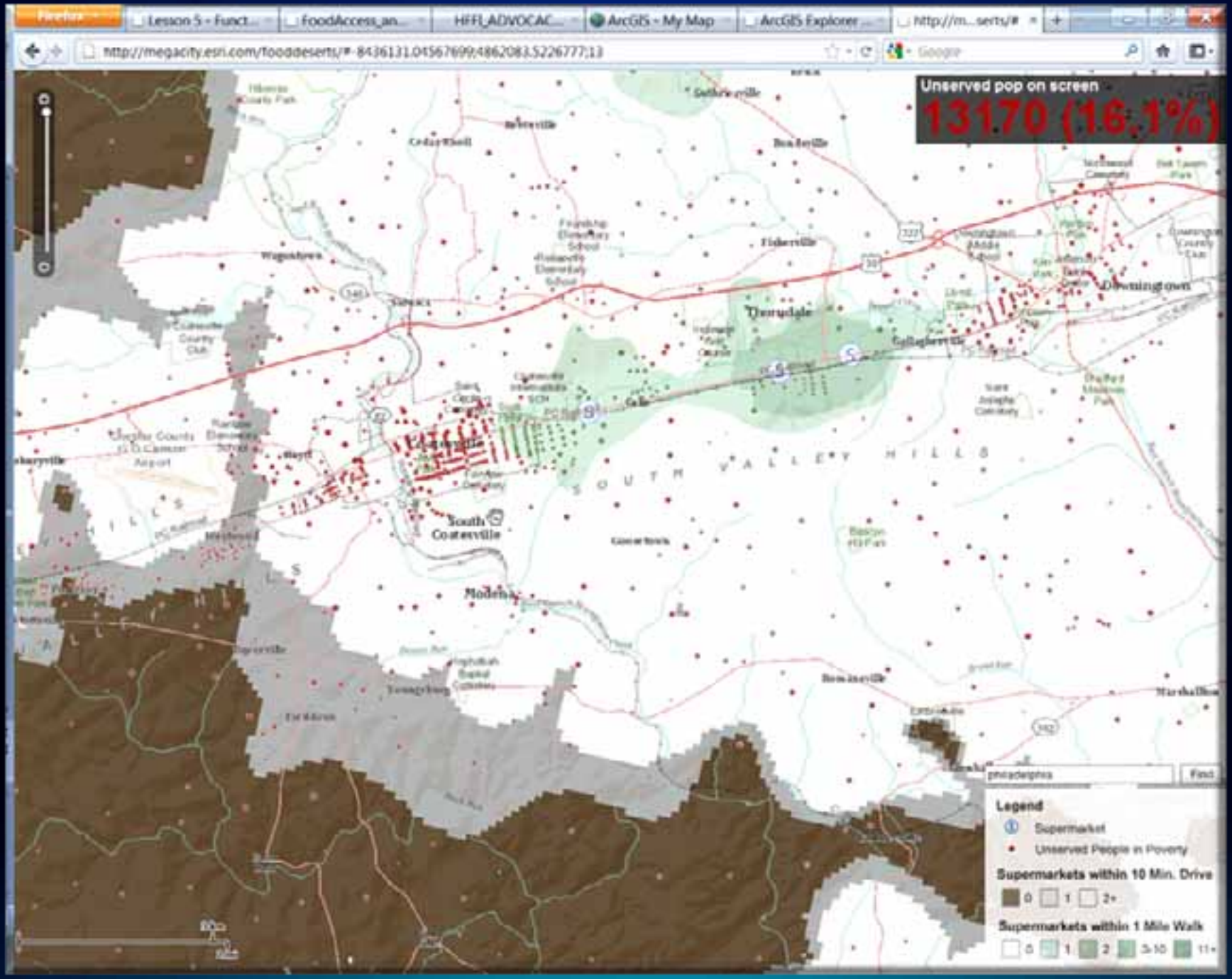
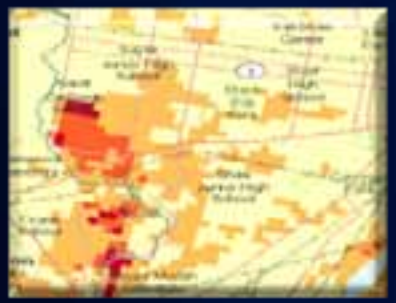
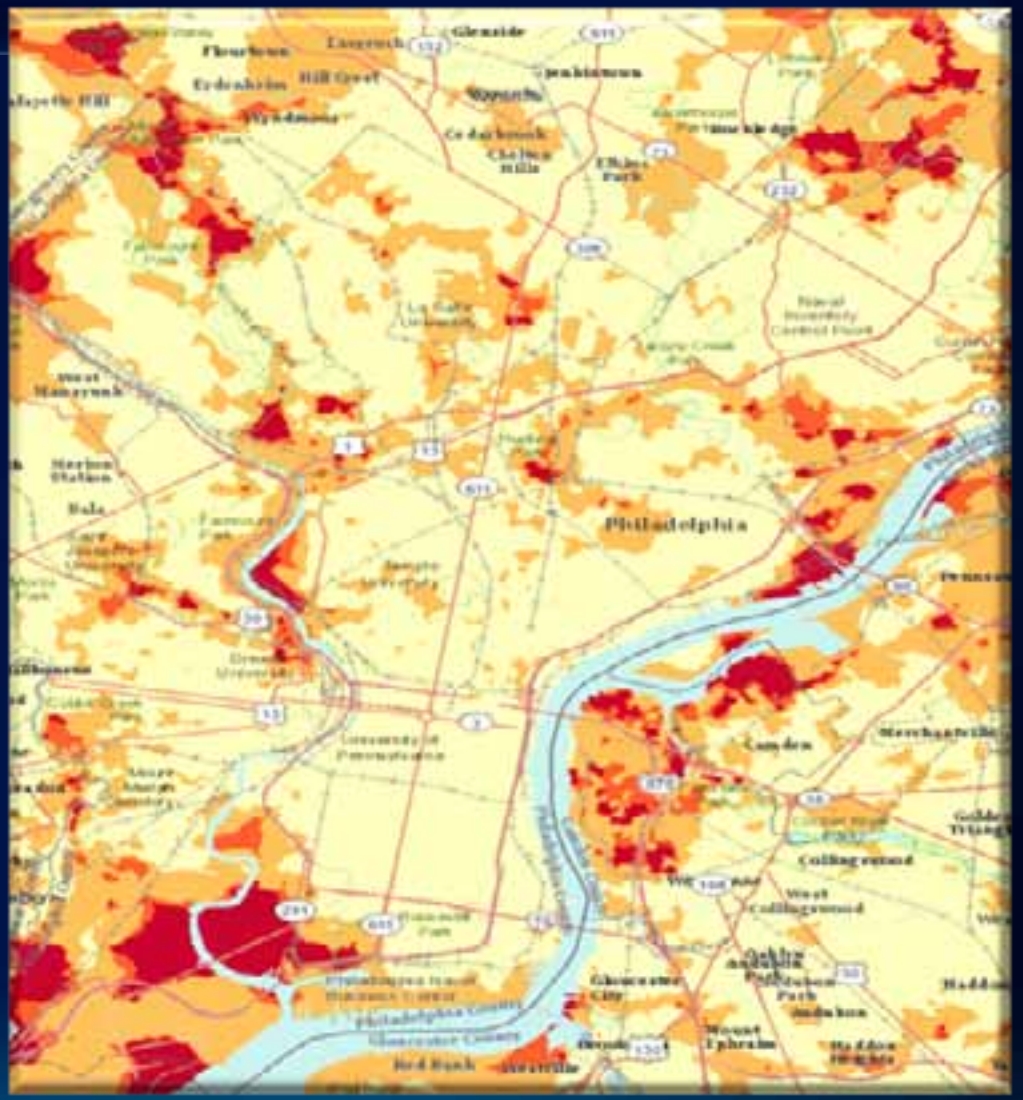
ArcGIS Explorer ...
http://m...serts/#
http://megacity.esri.com/fooddeserts/#-8381092.98347473,4868042.28318925,11
Philadelphia
Legend
Supermarket
Unserved People in Poverty
Supermarkets within 10 Min. Drive
0
1
2+
Supermarkets within 1 Mile Walk
0
1
2
3-10
11+


Unserved pop on screen
13170 (16.1%)
Legend
Supermarket
Unserved People in Poverty
Supermarkets within 10 Min. Drive
Supermarkets within 1 Mile Walk
SOUTH VALLEY HILLS
Coatesville
Modena
Downingtown
Exton
Find

Almost Done

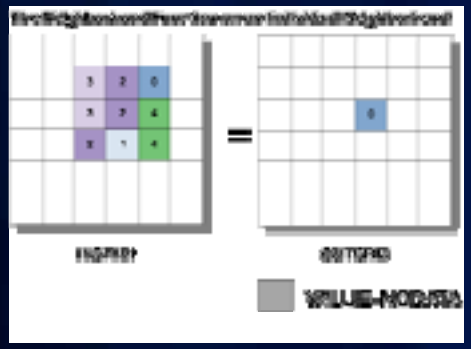
- Pre-shaded relief image and text
- Colors look like food
- Bilinear interpolation

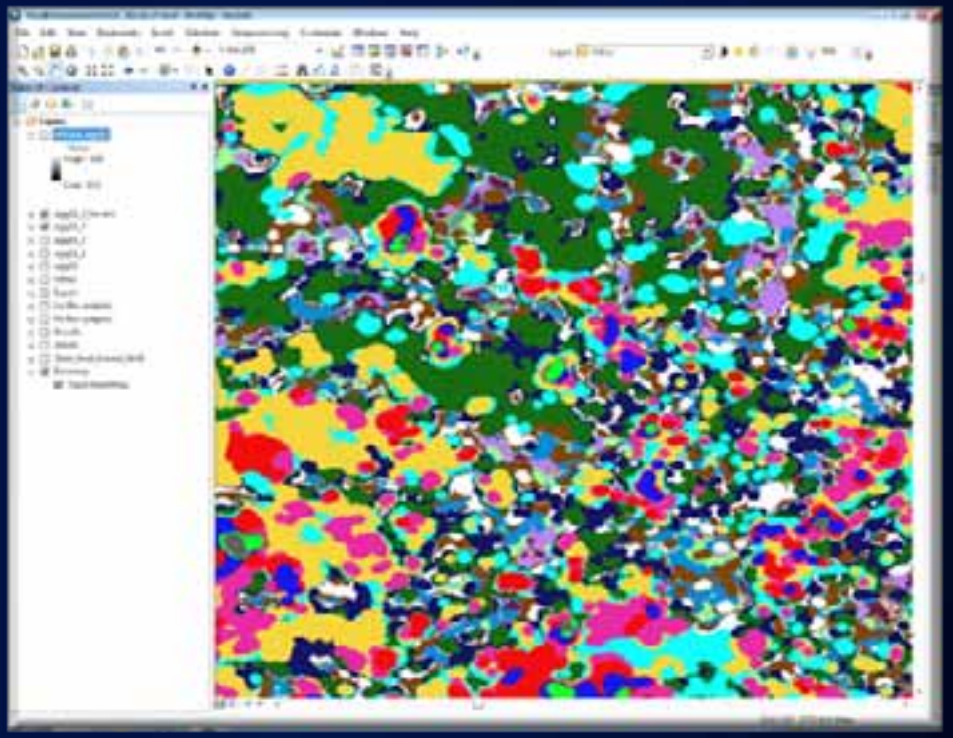




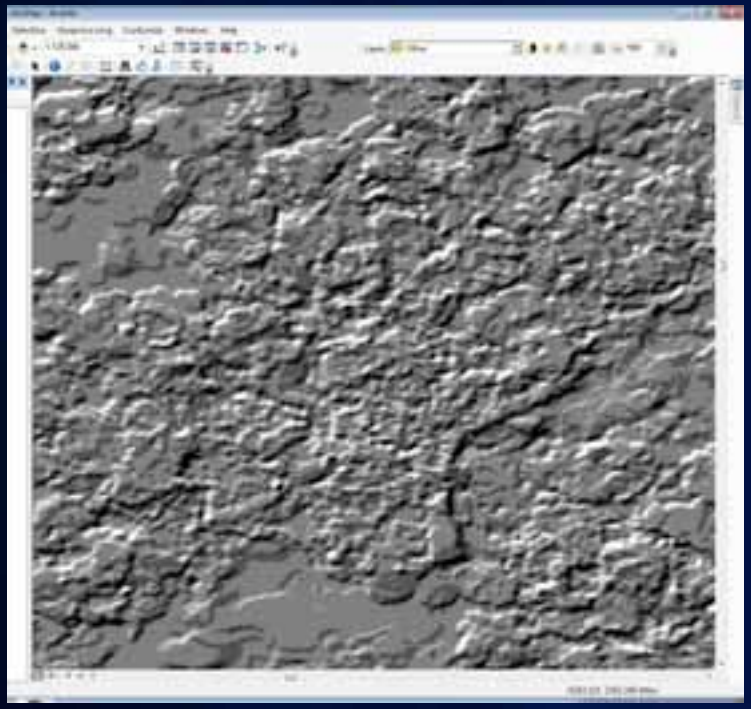
Focal Statistics

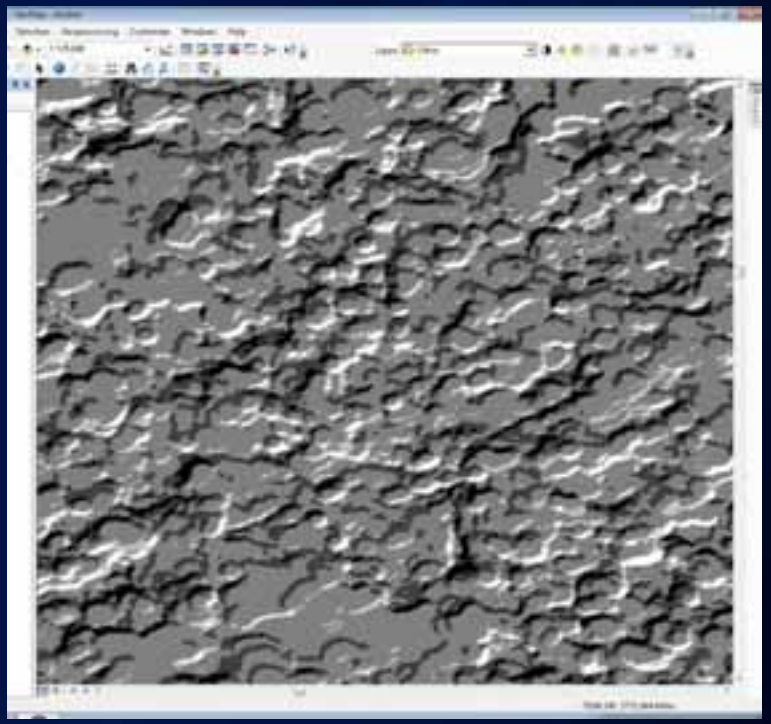
- **FocalMin smoothes the surface used as input for the hillshade and emphasizes the troughs**





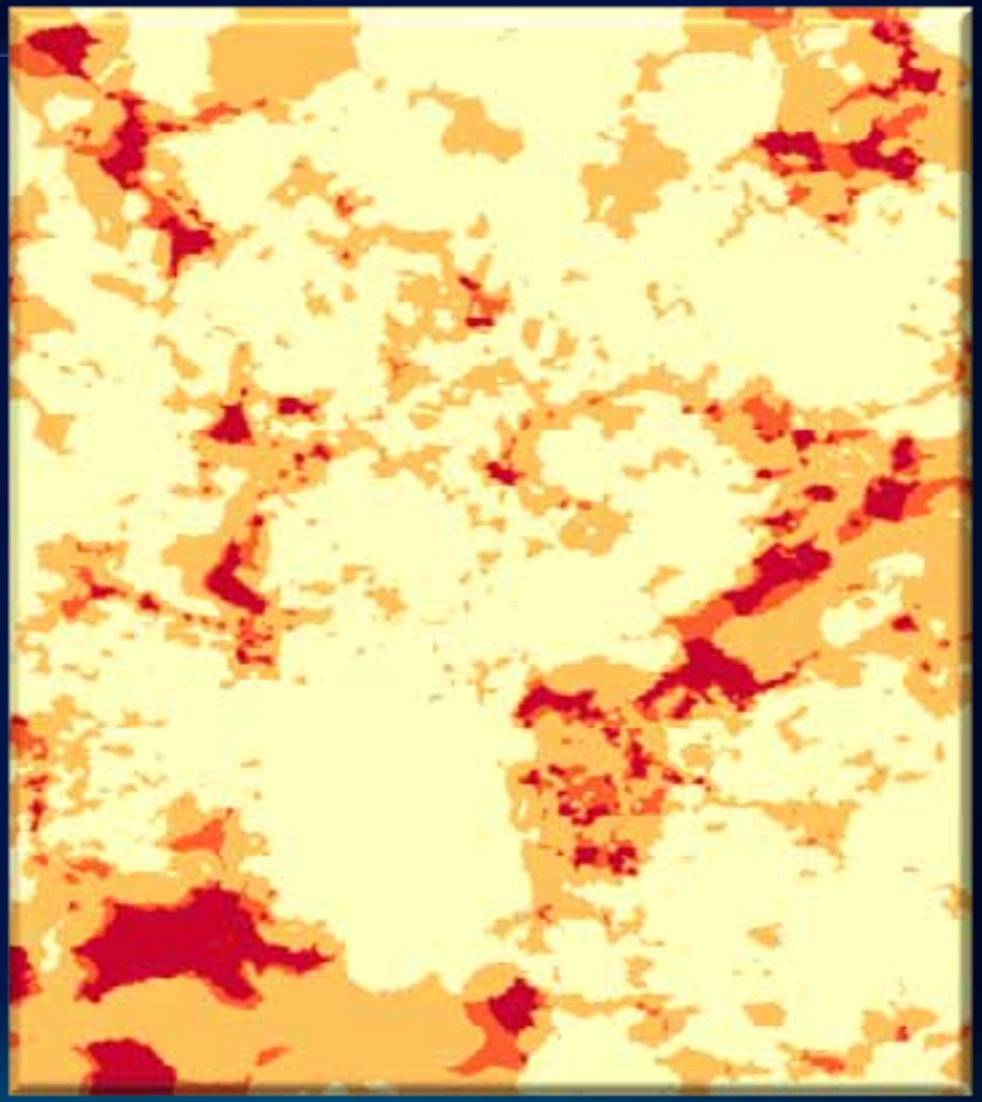
Hillshade before and after FocalMin





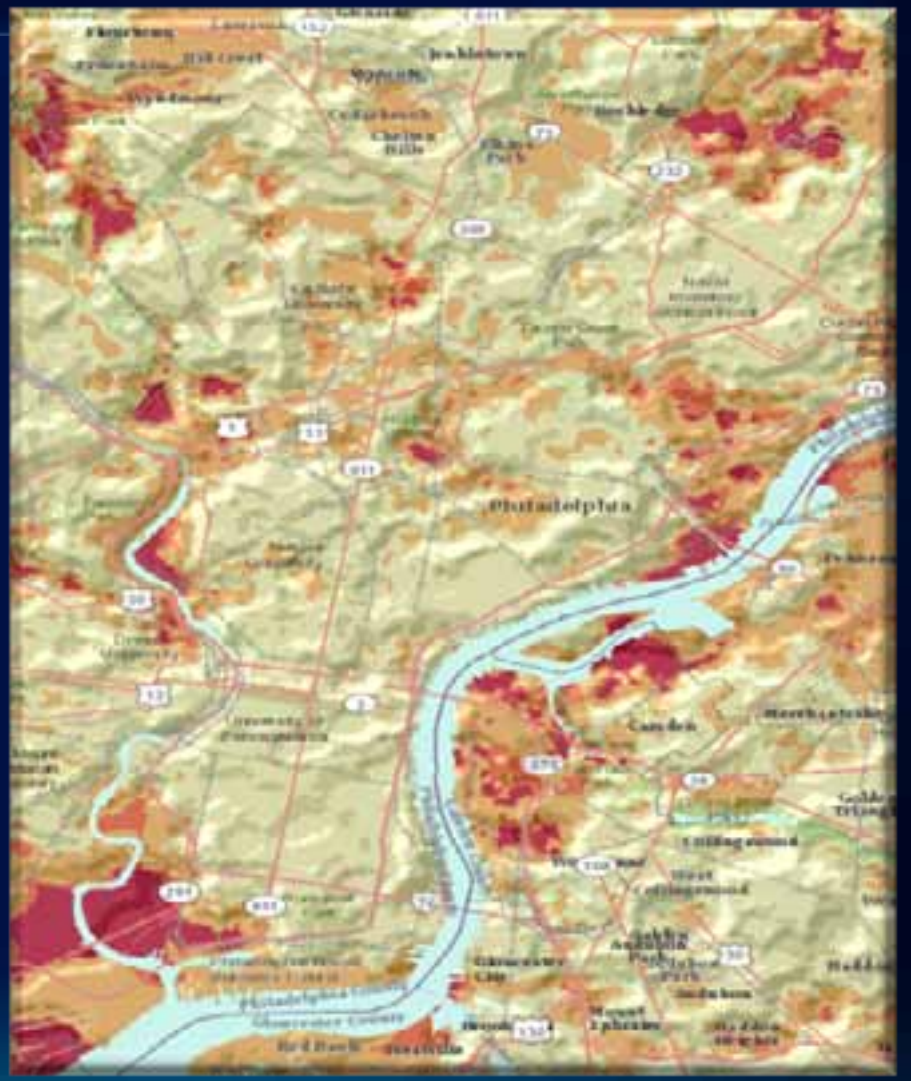
Final Colors

- Red indicates areas with a lower food environment score
- Color breaks based on cell score:
  - >16 is not a problem (squash)
  - <16 and >13 is questionable (cheddar cheese)
  - <13 is a problem (ketchup)



Final Result

- 60% transparency on the hillshade
- Color and hillshade show a pattern
- Neighborhoods with lower access and lower mobility have a lower score (red)
- Hillshade puts the reds in a trough for greater visual effect



Thank you!

QUESTIONS?

Please fill out your evaluations: it helps us improve every year

Special thanks to
Claire Steiner: Intern Extraordinaire!