Project Background

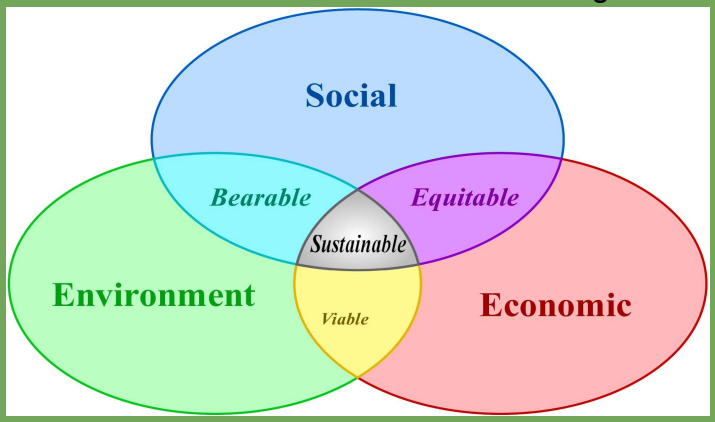
- By 2030, Portland's population will have increased from 575,000 to 725,000
- Investments that support healthy urban ecosystem structures and processes will be needed as the population expands

Source: City of Portland, Office of Transportation

Investment Scenario and Research Question

- The federal government has awarded Portland $20 million in economic stimulus funding to improve its environmental sustainability.
- The Portland Sustainable Development Department has commissioned a study to identify those areas of the city most in need of sustainability investments.
- Which neighborhoods in Portland currently have the least environmentally sustainable conditions?

Criterion and Indicators Framework for Assessing Sustainability



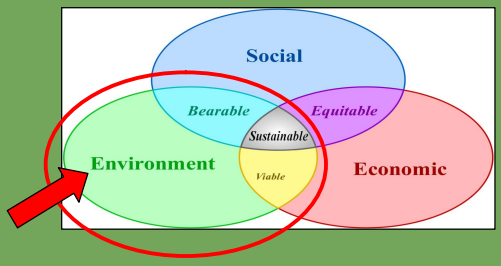
Working Definition of Sustainability:

"…using, developing and protecting resources at a rate and in a manner that enables people to meet their current needs and also provides that future generations can meet their own needs." (OSU Extension Sustainability Program)

Food and Agricultural Organization of the United Nations. 2008

Criterion and Indicators Framework

Environmental Sustainability Index



- ✓Transportation
- ✓Energy
- ✓Habitat
- ✓Waste
- ✓Water

1. Criteria - elements against which sustainability is assessed

2. Indicators – tools for monitoring the status and changes in the system

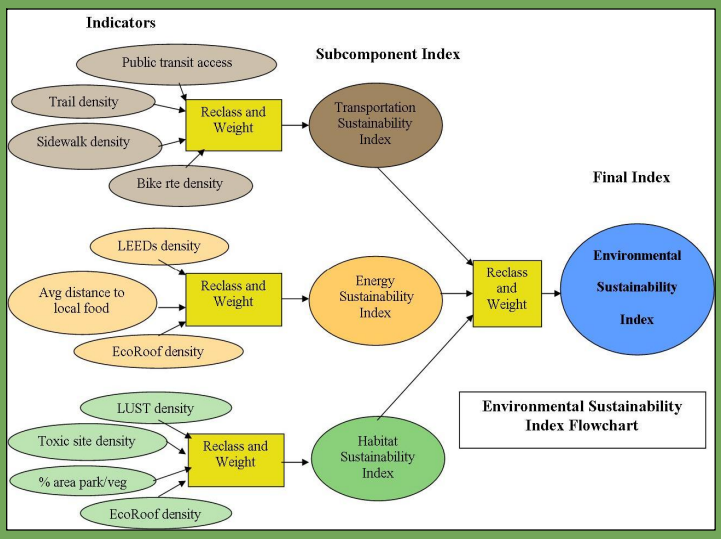
Hemphill, Lesley, Jim Berry, and Stanley McGreal. 2004

Creating an Environmental Sustainability Index (ESI)

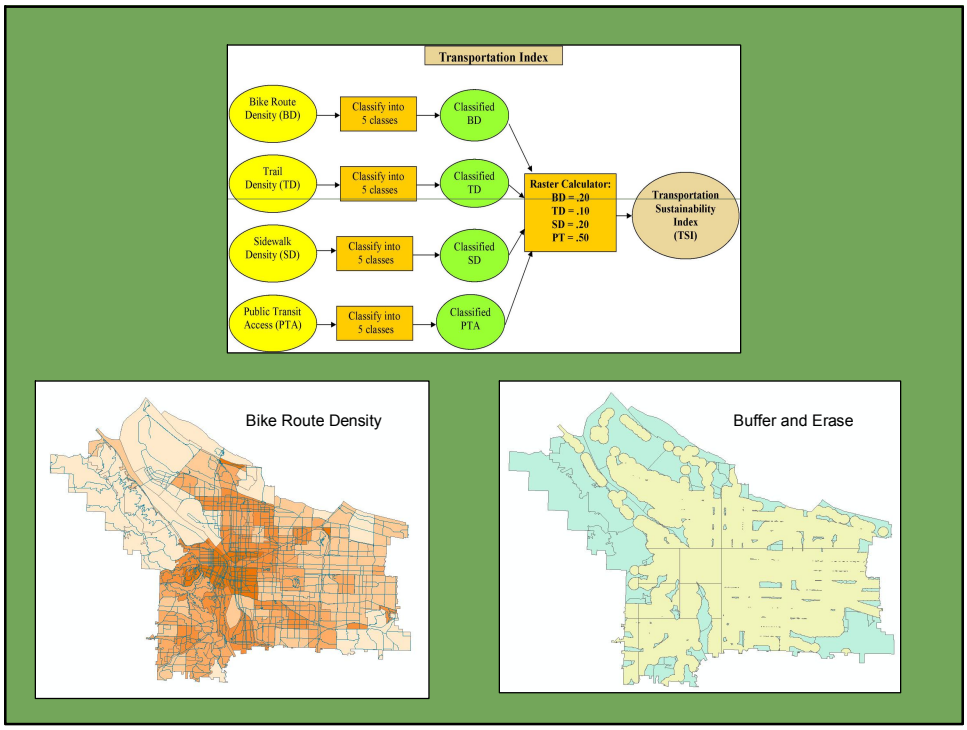
Steps

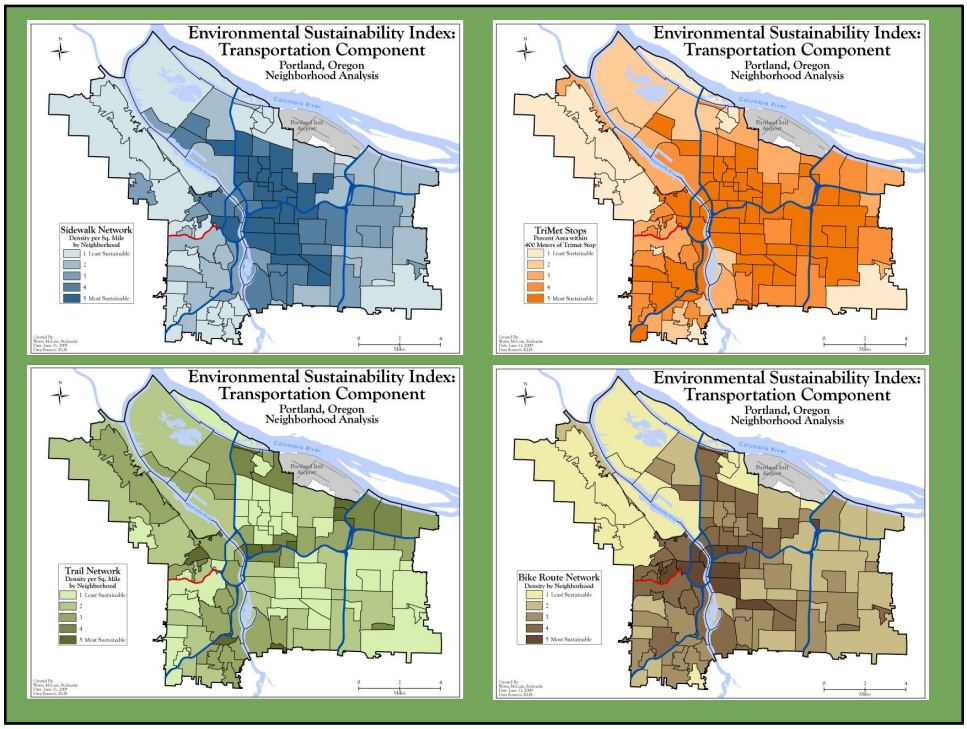
1. Identify criteria and indicators
2. Weight indicators within each component
3. Combine into subcomponent indices
4. Create alternative scenarios (Environmental Sustainability Index) by combining subcomponent indices using different weightings
5. Identify those neighborhoods with low ESI scores

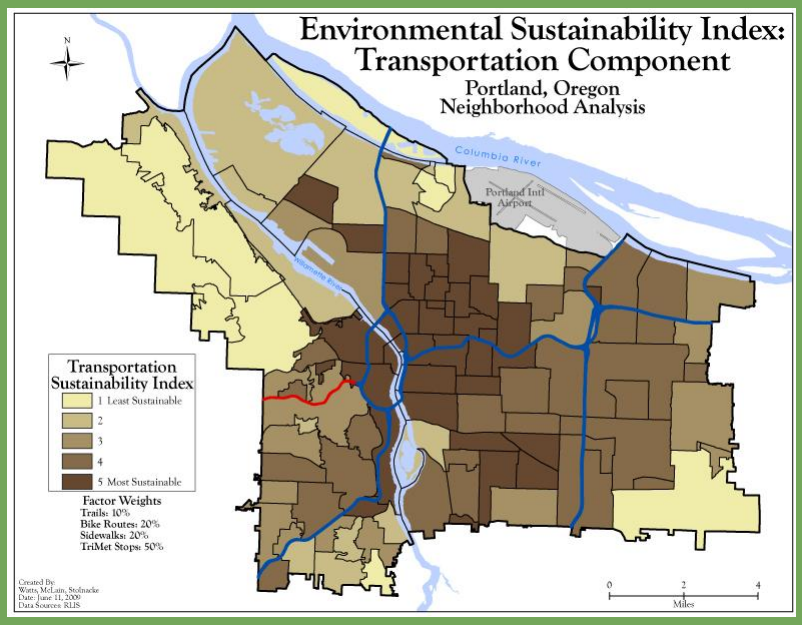
Structure Overview

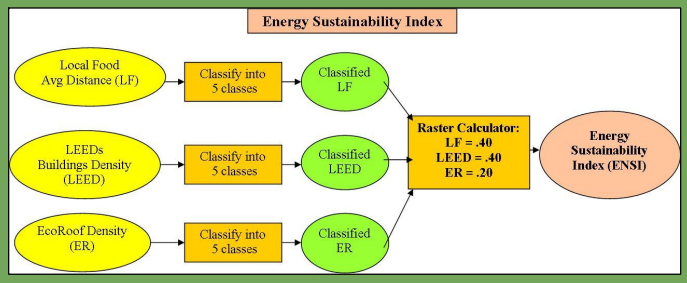


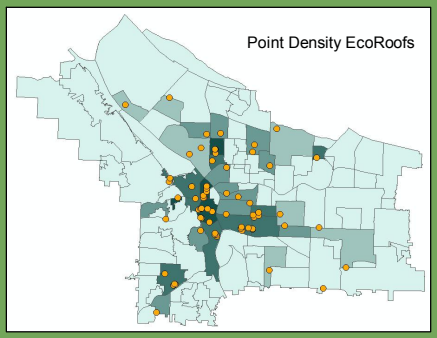
Study Area

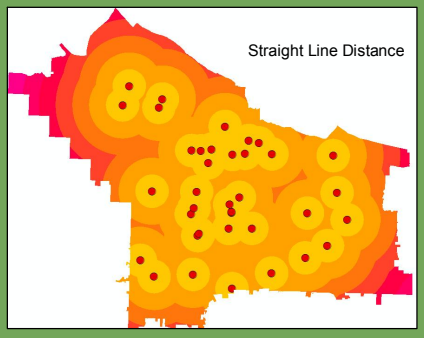

Transportation Index
Bike Route Density (BD)
Classify into 5 classes
Classified BD
Trail Density (TD)
Classify into 5 classes
Classified TD
Sidewalk Density (SD)
Classify into 5 classes
Classified SD
Public Transit Access (PTA)
Classify into 5 classes
Classified PTA
Raster Calculator:
BD = .20
TD = .10
SD = .20
PT = .50
Transportation Sustainability Index (TSI)
Bike Route Density
Buffer and Erase

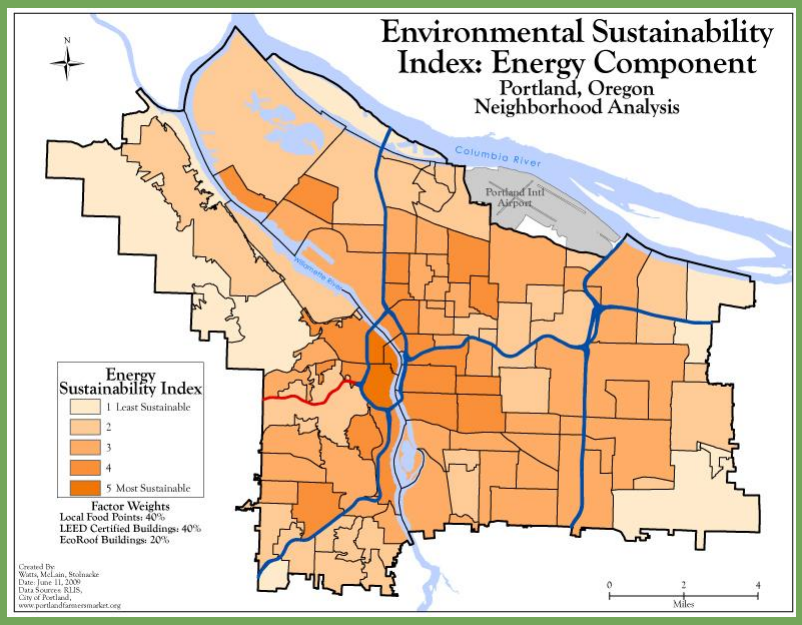

Environmental Sustainability Index:
Transportation Component
Portland, Oregon
Neighborhood Analysis
Sidewalk Network
Density per Sq. Mile by Neighborhood
1 Least Sustainable
5 Most Sustainable
TriMet Stops
Percent Area within 400 Meters of Transit Stop
Trail Network
Density per Sq. Mile by Neighborhood
Bike Route Network
Density by Neighborhood

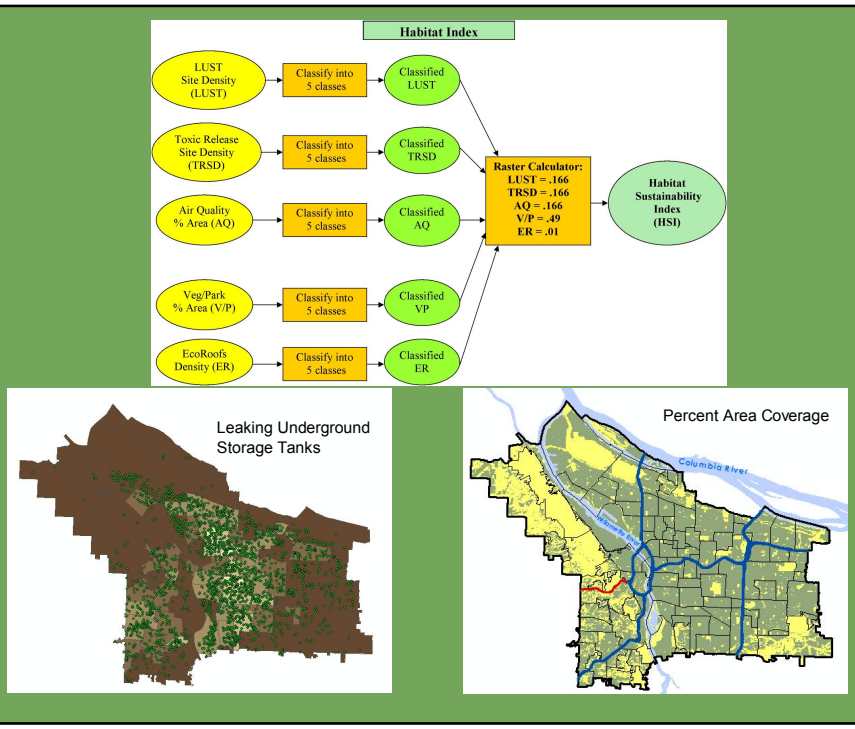

Environmental Sustainability Index:
Transportation Component
Portland, Oregon
Neighborhood Analysis
N
Columbia River
Portland Intl Airport
Transportation Sustainability Index
1 Least Sustainable
2
3
4
5 Most Sustainable
Factor Weights
Trails: 10%
Bike Routes: 20%
Sidewalks: 20%
TriMet Stops: 50%
Created By:
Watts, McLain, Stolnacke
Date: June 11, 2009
Data Sources: RLIS
0
2
4
Miles

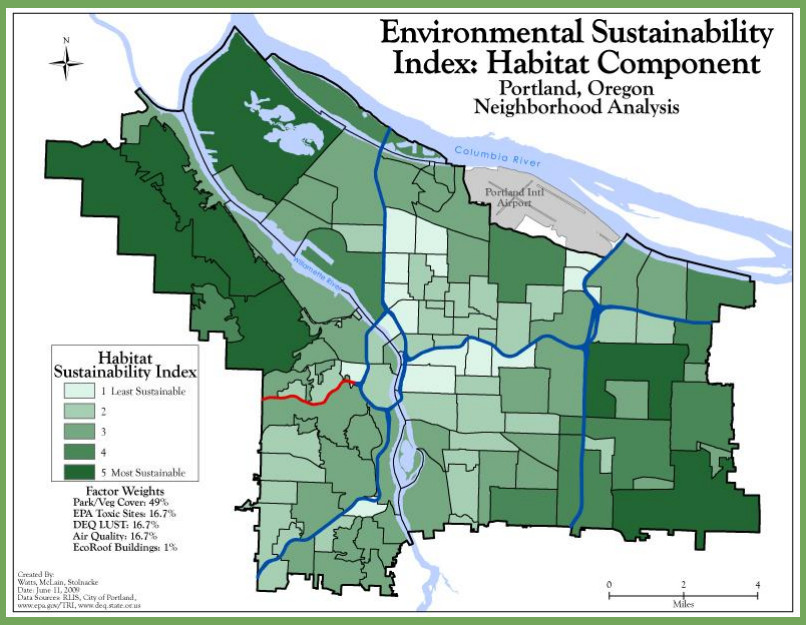

Energy Sustainability Index
Local Food Avg Distance (LF)
Classify into 5 classes
Classified LF
LEEDs Buildings Density (LEED)
Classify into 5 classes
Classified LEED
EcoRoof Density (ER)
Classify into 5 classes
Classified ER
Raster Calculator:
LF = .40
LEED = .40
ER = .20
Energy Sustainability Index (ENSI)


Point Density EcoRoofs

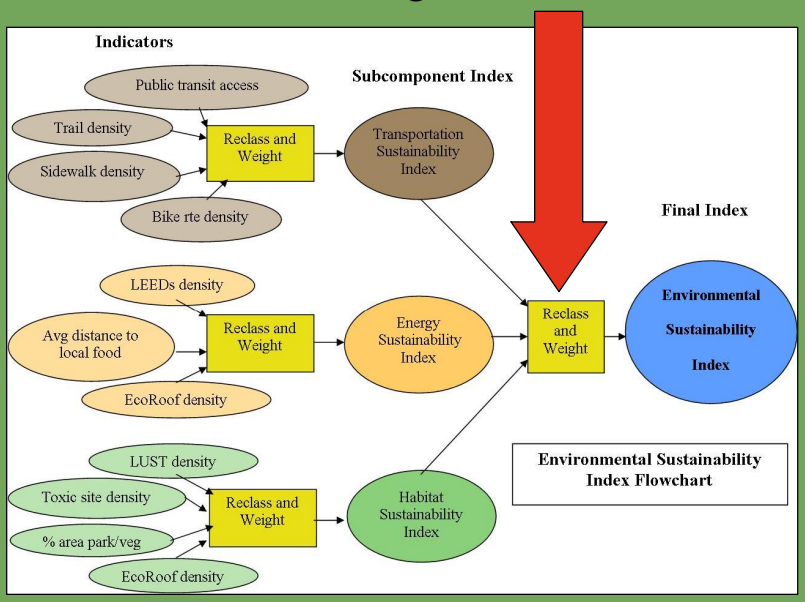

Straight Line Distance

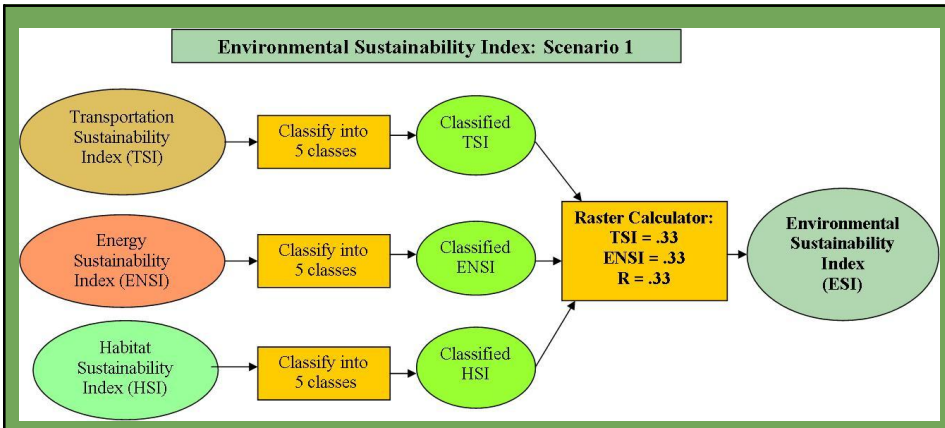

Environmental Sustainability Index: Energy Component
Portland, Oregon
Neighborhood Analysis
N
Columbia River
Portland Intl Airport
Energy Sustainability Index
1 Least Sustainable
2
3
4
5 Most Sustainable
Factor Weights
Local Food Points: 40%
LEED Certified Buildings: 40%
EcoRoof Buildings: 20%
Created By:
Watts, McLain, Stolnacke
Date: June 11, 2009
Data Sources: RLIS,
City of Portland,
www.portlandfarmersmarket.org
0
2
4
Miles


Habitat Index
LUST Site Density (LUST)
Classify into 5 classes
Classified LUST
Toxic Release Site Density (TRSD)
Classify into 5 classes
Classified TRSD
Air Quality % Area (AQ)
Classify into 5 classes
Classified AQ
Veg/Park % Area (V/P)
Classify into 5 classes
Classified VP
EcoRoofs Density (ER)
Classify into 5 classes
Classified ER
Raster Calculator:
LUST = .166
TRSD = .166
AQ = .166
V/P = .49
ER = .01
Habitat Sustainability Index (HSI)
Leaking Underground Storage Tanks
Percent Area Coverage
Columbia River

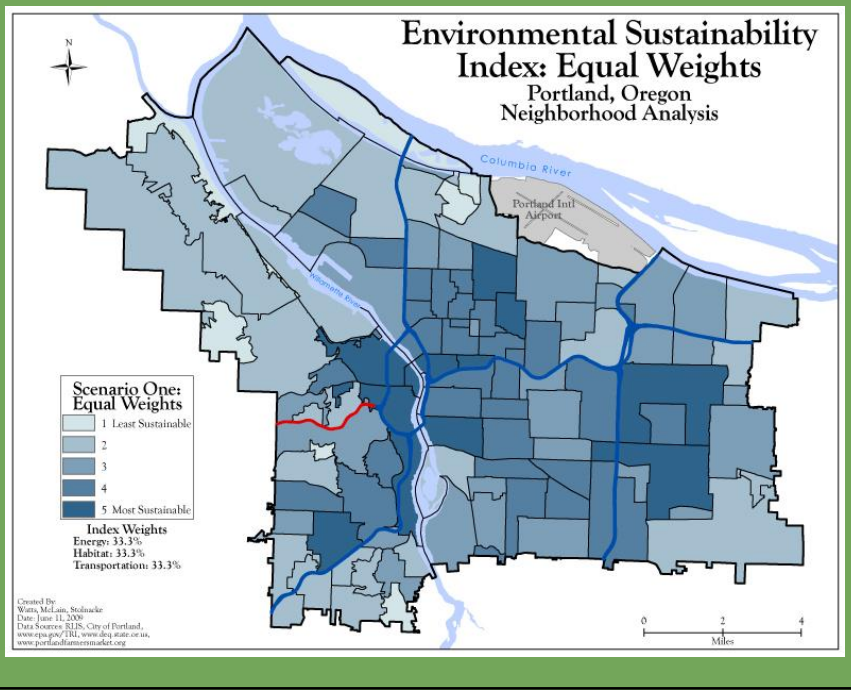


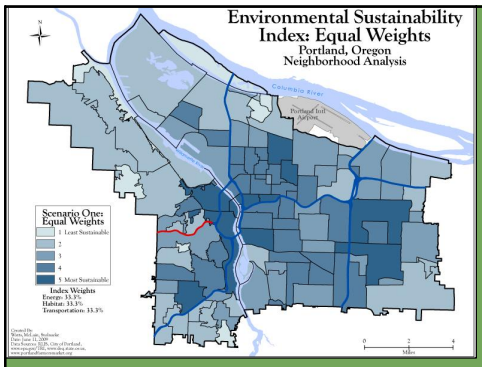
Constructing Scenarios

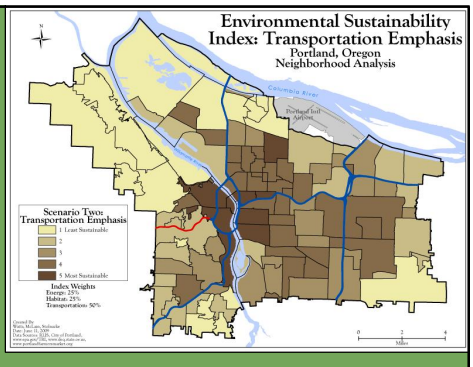


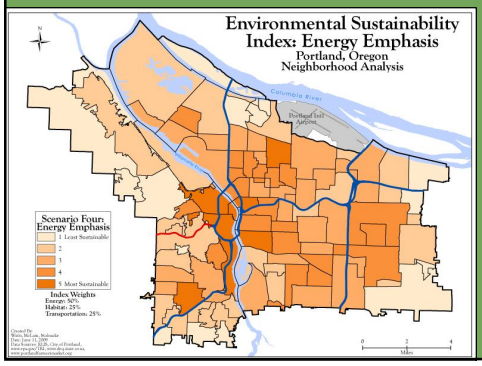


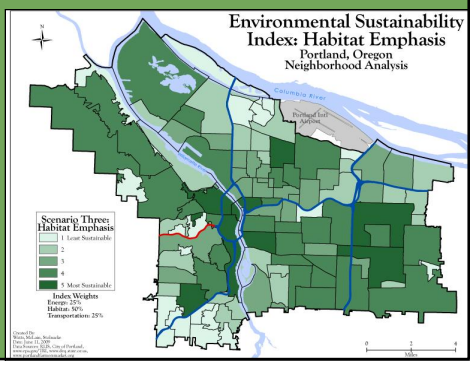
Sc. 1	Sc. 2	Sc. 3	Sc. 4
Transportation (.33)	Transportation (.50)	Transportation (.25)	Transportation (.25)
Energy (.33)	Energy (.25)	Energy (.50)	Energy (.25)
Habitat (.33)	Habitat (.25)	Habitat (.25)	Habitat (.50)



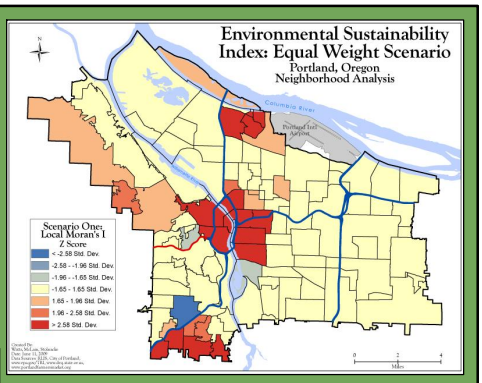


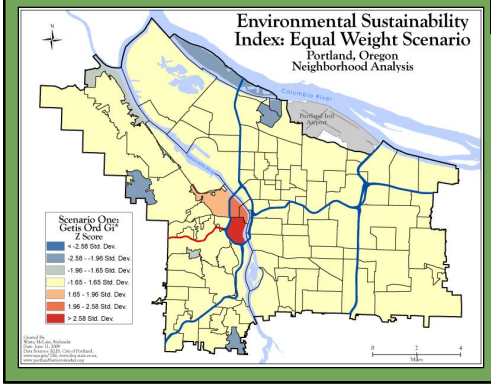






Cluster Analysis of ESI Scores



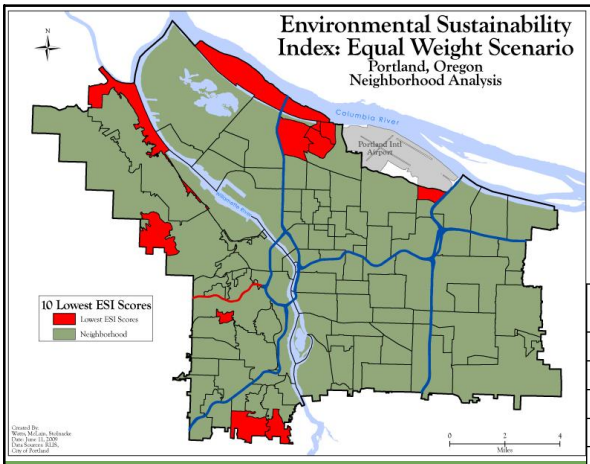


Global Moran's I: .48

Z = 11.25 p = .01

Getis-Ord General G: 0

Z = 5.64 p = .01



Neighborhoods with 10 Lowest ESI Scores

Rank	NAME	Equal Weight ESI Score
109	MC UNCLAIMED #2	1.87
108	MC UNCLAIMED #13	1.87
107	EAST COLUMBIA	1.93
106	HAYDEN ISLAND	1.94
105	NORTHWEST HEIGHTS	1.96
104	BRIDLEMILE-SOUTHWEST HILLS	2.08
103	LINNTON	2.10
102	ARNOLD CREEK	2.13
101	CULLY-SUMNER	2.23
100	MC UNCLAIMED #1	2.26

Conclusions

Research question

Which neighborhoods have the least sustainable environmental conditions?

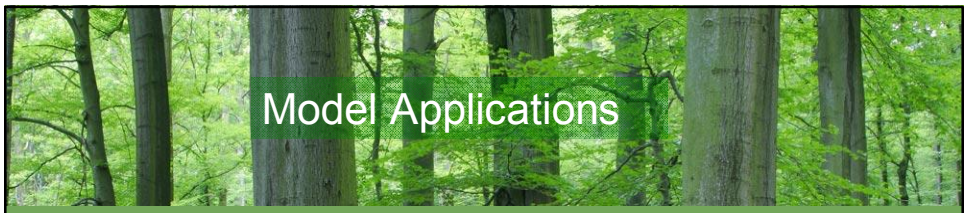
Answer:

It is too early to tell.

Further refinement of our model is needed to provide a meaningful answer.

Suggested Refinements

- Stratify neighborhoods by predominant land use categories
  - Identify desired conditions for each zone
  - Develop zone-specific criteria and indicators
- Refine and expand the number of indicators for each component
- Integrate dasymmetric mapping
- Refine weights through public participation or Delphi process
- Compare scenarios using contingency analysis



Model Applications

- It is **not** a tool for developing precise assessments of environmentally sustainable conditions
- It **is** useful as a platform for multi-stakeholder discussions focused on:
  - Identifying desired future conditions
  - Making assumptions and values explicit
- Once refined, our model provides a foundation for applying the criteria and indicators approach at the neighborhood scale.

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Thank you.
Any Questions?