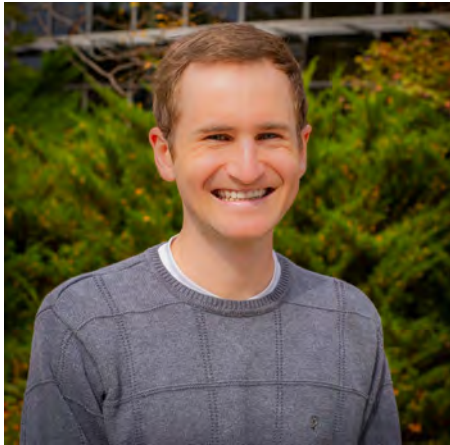SAVI Talks
Greenspace Assessment for Marion County

April 20, 2023
Matthew Dietrich, Danielle Lafever, Asger Ali,
Aaron Olson

SAVI 2023

Presenters

Dr. Matthew Dietrich

Senior Research Data Analyst,
The Polis Center

Brittani Howell, Moderator

Community Engagement Specialist,
WFYI/Side Effects Public Media

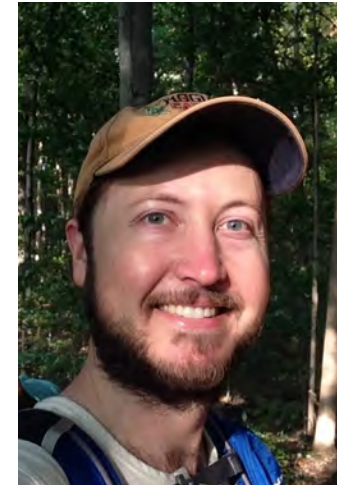# Panelists

Dr. Sarah Mincey

Clinical Associate Professor, O'Neill School of
Public and Environmental Affairs
Managing Director, Environmental Resilience
Institute
Indiana University

Jeremy Kranowitz

President & CEO,
Keep Indianapolis Beautiful

Jacob Brinkman

Ecologist,
Indianapolis Office of Land
Stewardship

Greenspace

1. What is it?

2. Why is it important?

3. How did we measure and prioritize greenspace needs?

4. What did we learn from our analyses?

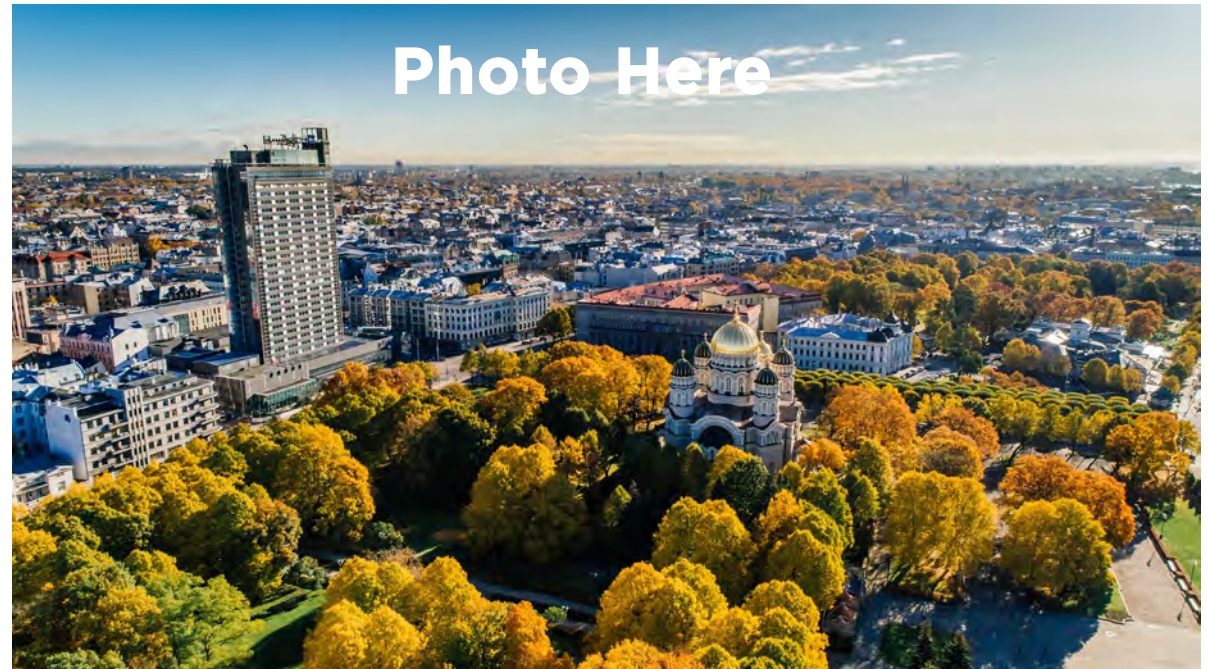5. What can be done to improve greenspace access?

What is greenspace?

Lots of different definitions and ways to categorize it...

- Parks
- Gardens
- Provides an ecosystem service
- Vegetated areas
- Recreational areas
- Undeveloped land

Photo Here

Gets tricky sometimes...

For example, are curbside bioswales, traffic medians, detention basins, and green roofs considered greenspace?

Why is greenspace important?

Greenspace is significantly associated with a variety of positive health outcomes in the peer-reviewed literature

- Reduction in disease incidence of:
    - All-cause mortality
    - Type II diabetes
    - Preterm birth
    - Cardiovascular mortality

- Rise in good self-reported health

(Twohig-Bennett and Jones, 2018)

Twohig-Bennett, C., & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. *Environmental research*, *166*, 628-637. https://doi.org/10.1016/j.envres.2018.06.030

Positive impacts on the environment

- Reduction in particulate matter pollution

- Lowers the urban heat island effect

- Helps mitigate surface water runoff

Photo Here

Potentially help mitigate mortality from air pollution

Annual deaths from ambient particulate matter pollution
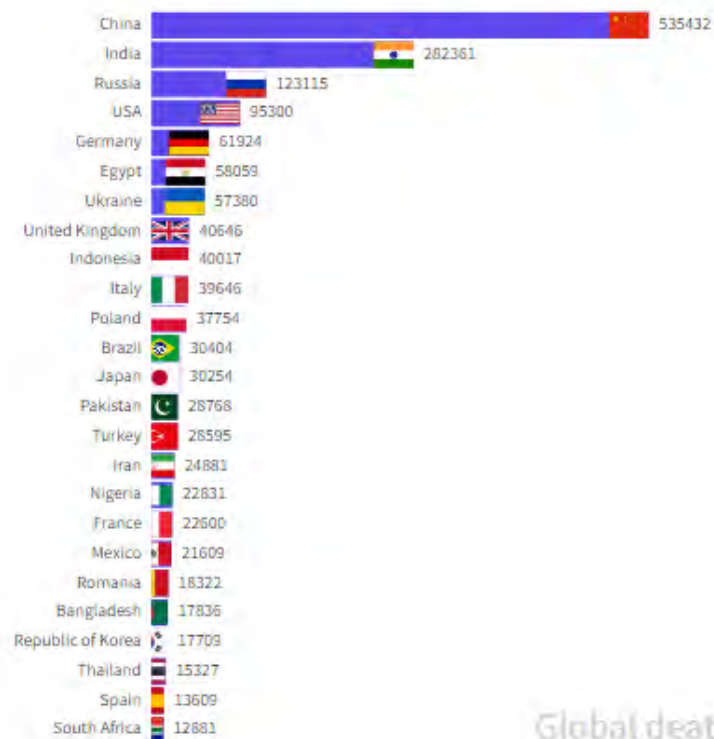Top 25 countries out of 204 countries

SAVI

The Polis Center

Country	Deaths
China	1424000
India	979700
Pakistan	114000
Indonesia	106700
Egypt	90600
Barbados	74000
Russia	73900
Nigeria	68500
USA	47800
Brazil	43600
Ukraine	42900
Iran	41700
Turkey	41500
Japan	39700
Vietnam	37500
Mexico	36600
Thailand	32200
Philippines	32000
Poland	27800
Morocco	27100
Germany	27000
Uzbekistan	26700
Iraq	25400
South Africa	24800
Italy	24700

2019

Global death total in given year from particulate matter (n=204 countries): 4139972

1990   1995   2000   2005   2010   2011   2012   2013   2014   2015   2016   2017   2018   2019

Source: Health Effects Institute. 2020. State of Global Air 2020. , Data source: Global Burden of Disease Study 2019.

Annual deaths from ambient particulate matter pollution
Top 25 countries out of 204 countries

Country	Deaths
China	535432
India	282361
Russia	123115
USA	95300
Germany	61924
Egypt	58059
Ukraine	57380
United Kingdom	40646
Indonesia	40017
Italy	39646
Poland	37754
Brazil	30404
Japan	30254
Pakistan	28768
Turkey	28595
Iran	24881
Nigeria	22831
France	22600
Mexico	21609
Romania	18322
Bangladesh	17836
Republic of Korea	17709
Thailand	15327
Spain	13609
South Africa	12881

1990

Global death total in given year from particulate matter (n=204 countries): 2081169

1990 1995 2000 2005 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

Source: Health Effects Institute. 2020. State of Global Air 2020. , Data source: Global Burden of Disease Study 2019.

Source: https://public.flourish.studio/visualisation/13334609/

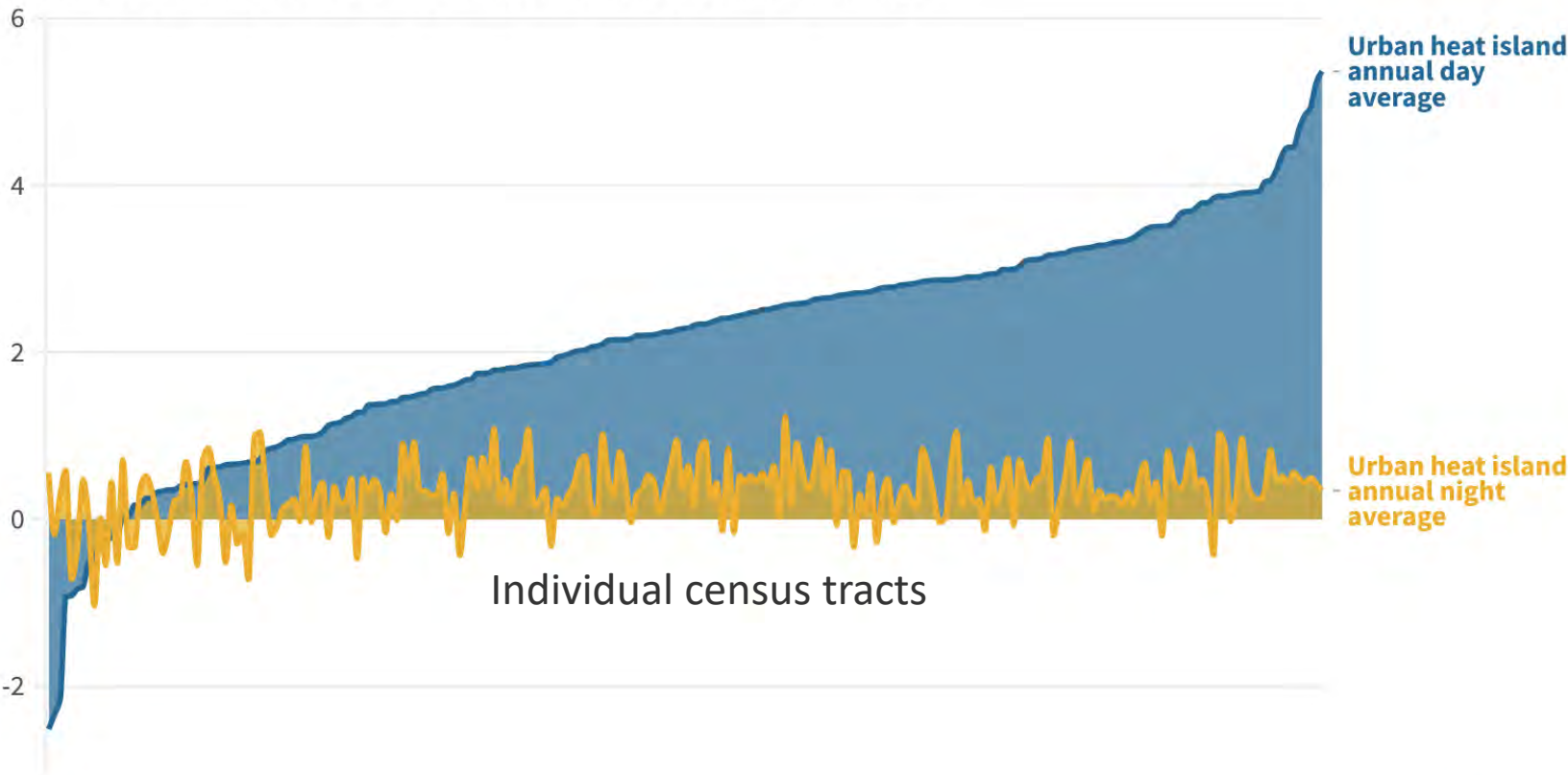Web Viewer Terms | Privacy & Cookies   Edit

Much of Indianapolis experiences significant urban heat island effects

■ Urban heat island annual day average ■ Urban heat island annual night average

Urban heat island effect (°C) for each census tract in Marion County

Urban heat island annual day average

Urban heat island annual night average

Individual census tracts

Source: Chakraborty, TC; Hsu, Angel; Sheriff, Glenn ; Manya, Diego (2020), "United States Surface Urban Heat Island database", Mendeley Data, V3, doi: 10.17632/x9mv4krnm2.3

SAVI

The Polis Center

Needs for prioritizing greenspace

Some areas may have more vulnerable subpopulations that could most directly benefit from greenspace.

Greenspace found to have stronger protective effects for lower socioeconomic status (SES) individuals compared to higher SES individuals.

- Stronger effect in Europe than the U.S.

- Parks generally more important than green land cover

- Protective effects not apparent based on race/ethnicity alone though

(Rigolon et al., 2021)

Rigolon, A., Browning, M. H., McAnirlin, O., & Yoon, H. (2021). Green space and health equity: a systematic review on the potential of green space to reduce health disparities. *International journal of environmental research and public health*, *18*(5), 2563. https://doi.org/10.3390/ijerph18052563

Stronger greenspace protective effect for disadvantaged populations
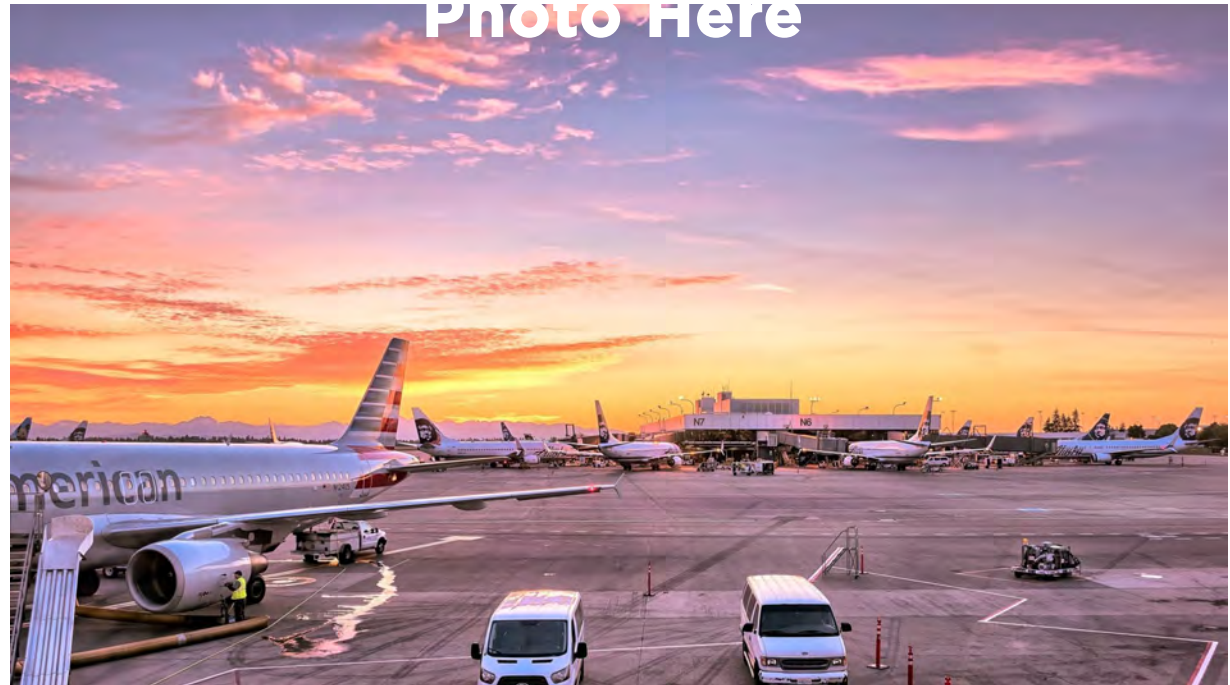

Effect Modification by SES
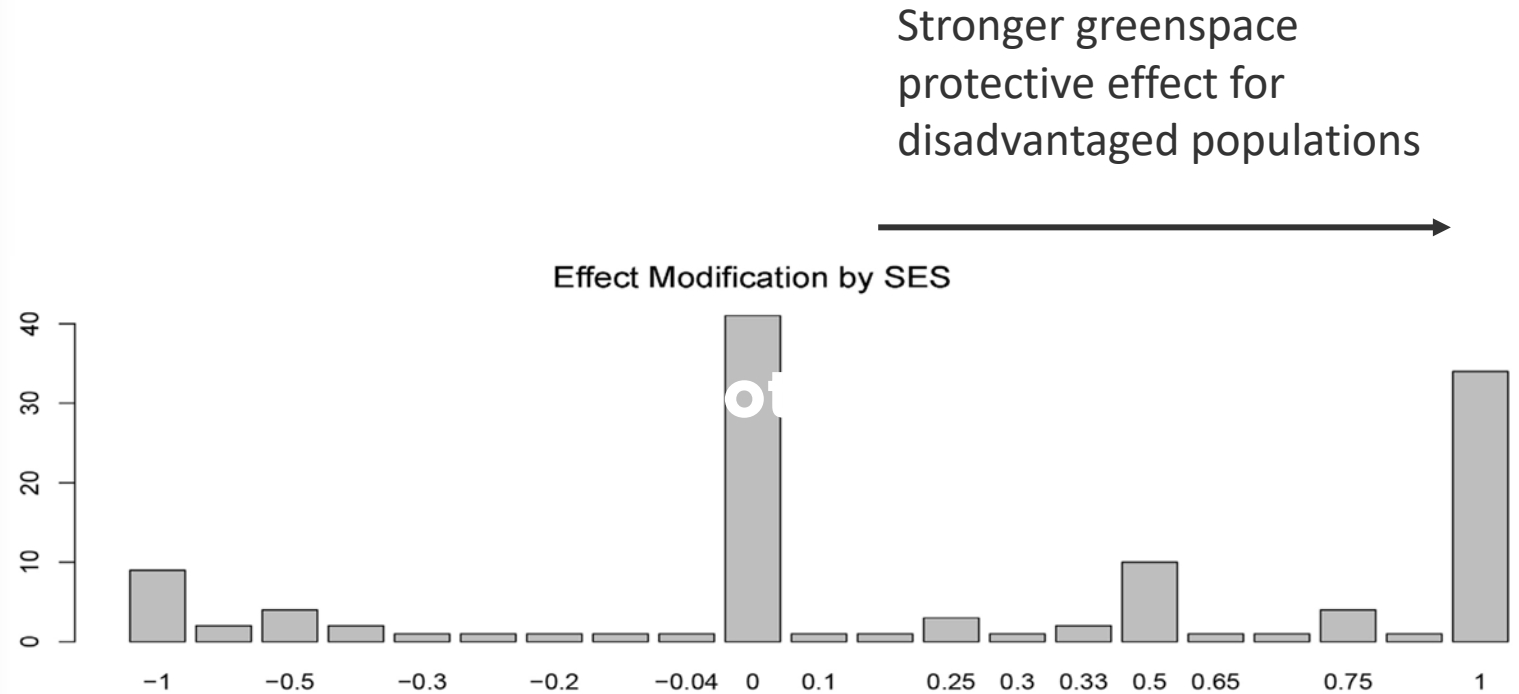
(Rigolon et al., 2021)

Other considerations for prioritizing greenspace

- Can you feasibly add greenspace in a safe and legal manner?

- Does an area have a lot of land that can still be developed into greenspace?

So, how did we measure greenspace and estimate where it should be prioritized?

How did we measure greenspace?

In short, taking into account a lot of factors…

- Leveraging sources from the [Indiana Green City Mapper](#) from ERI
- Utilizing measures of tree canopy, and native planting spaces from KIB
- Using other external datasets

Current greenspace (CG)

Variables	Weight in sub-index	Source
Urban agriculture and garden location	▪	Indiana Green City Mapper
Tree canopy cover	▪▪▪	Indiana Green City Mapper/KIB
Trails and greenways	▪	Indiana Green City Mapper
Native planting areas	▪	KIB
Parks	▪▪	Indiana Green City Mapper

Greenspace community need (GCN)

Variables	Weight in sub-index	Source
Urban heat island daytime/nighttime	▪▪	Chakraborty, TC; Hsu, Angel; Sheriff, Glenn ; Manya, Diego (2020), "United States Surface Urban Heat Island database", Mendeley Data, V3, doi: 10.17632/x9mv4krnm2.3
PM2.5	▪	Climate Economic Justice Data
Life expectancy	▪	Climate Economic Justice Data
% w/no car	▪	Justice40
Diabetes prevalence	▪	Climate Economic Justice Data
Traffic proximity volume	▪	Climate Economic Justice Data
Preterm birth	▪	American Community Survey (2021 5YR)

Greenspace land development potential (GLDP)

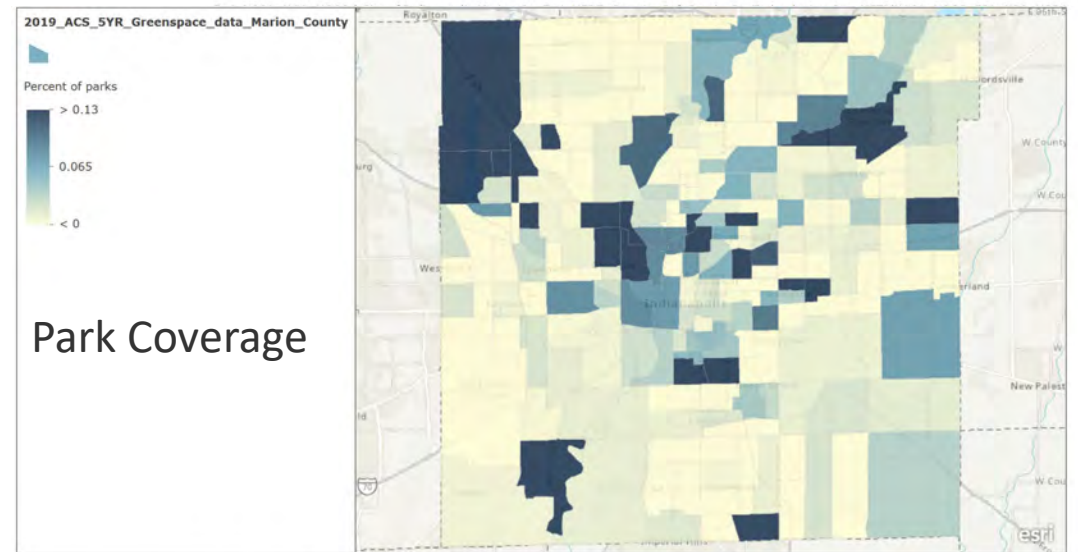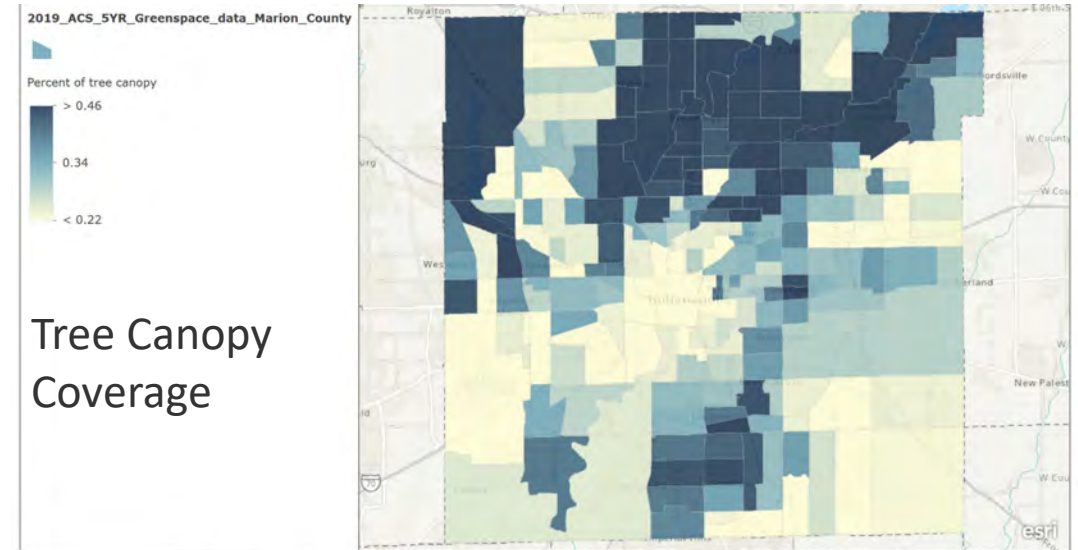| Variables	Weight in sub-index	Source
Share of land with no impervious or agricultural surface	▪	Climate Economic Justice Data
Census land area-current park area-current native plant area-current urban agricultural and garden area	▪	ACS + Polis Analysis

Three main domains, or sub-indices

- Current Greenspace
- Greenspace Community Need
- Greenspace Land Development Potential

Current Greenspace

- Utilized KIB data and ERI's Indiana Green City Mapper

- Measured % land coverage:
  - Urban agriculture and garden location
  - Trails and greenways
  - Native planting areas
  - **Tree canopy cover** *Weighted the most*
  - **Parks**

About Indiana Green City Mapper

2019_ACS_5YR_Greenspace_data_Marion_County

Percent of tree canopy
- > 0.46
- 0.34
- < 0.22

Tree Canopy Coverage

2019_ACS_5YR_Greenspace_data_Marion_County

Percent of parks
- > 0.13
- 0.065
- < 0

Park Coverage

Esri, NASA, NGA, USGS | City of Indianapolis Marion Co, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA
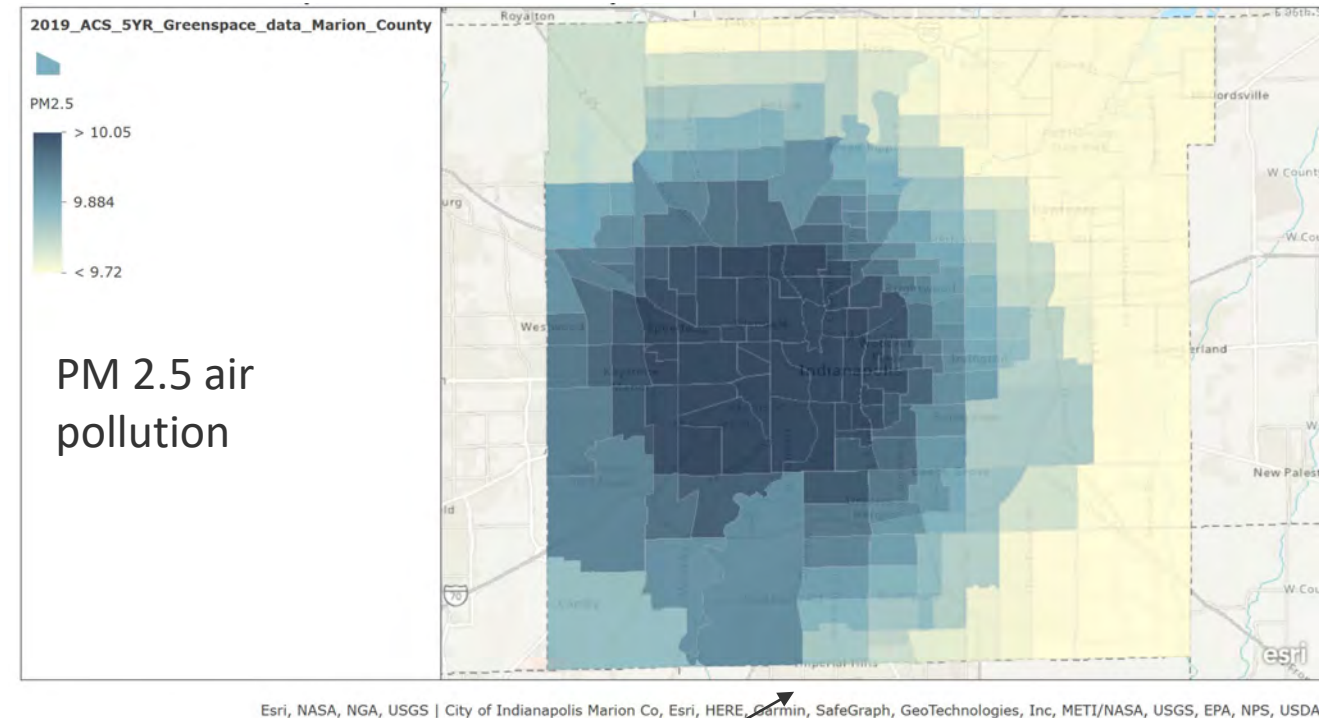
Current Greenspace

- Ranked each metric from low to high within Marion County
- Composite score to represent the approximate amount of current greenspace within a tract

Greenspace needs in Marion County
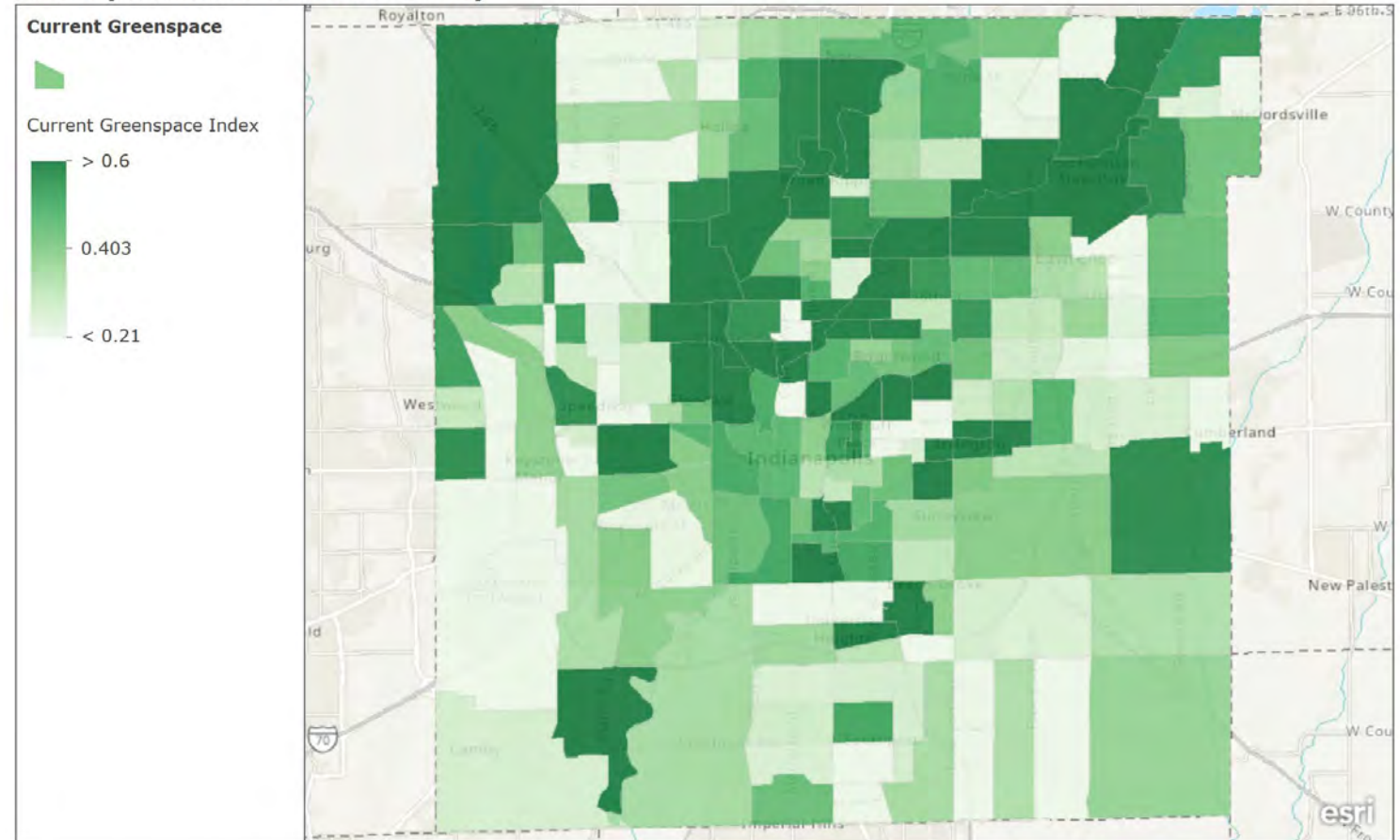
Current Greenspace

Current Greenspace Index

> 0.6

0.403

< 0.21

Esri, NASA, NGA, USGS | City of Indianapolis Marion Co, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

Greenspace Community

Pre-term births

PM 2.5 air pollution
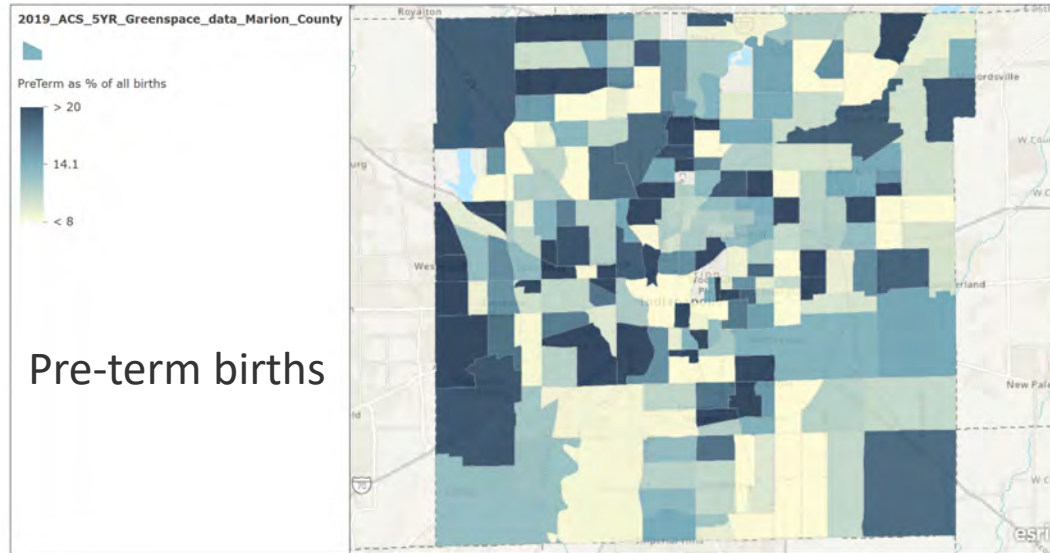
- Looked at important health/community variables associated with greenspace

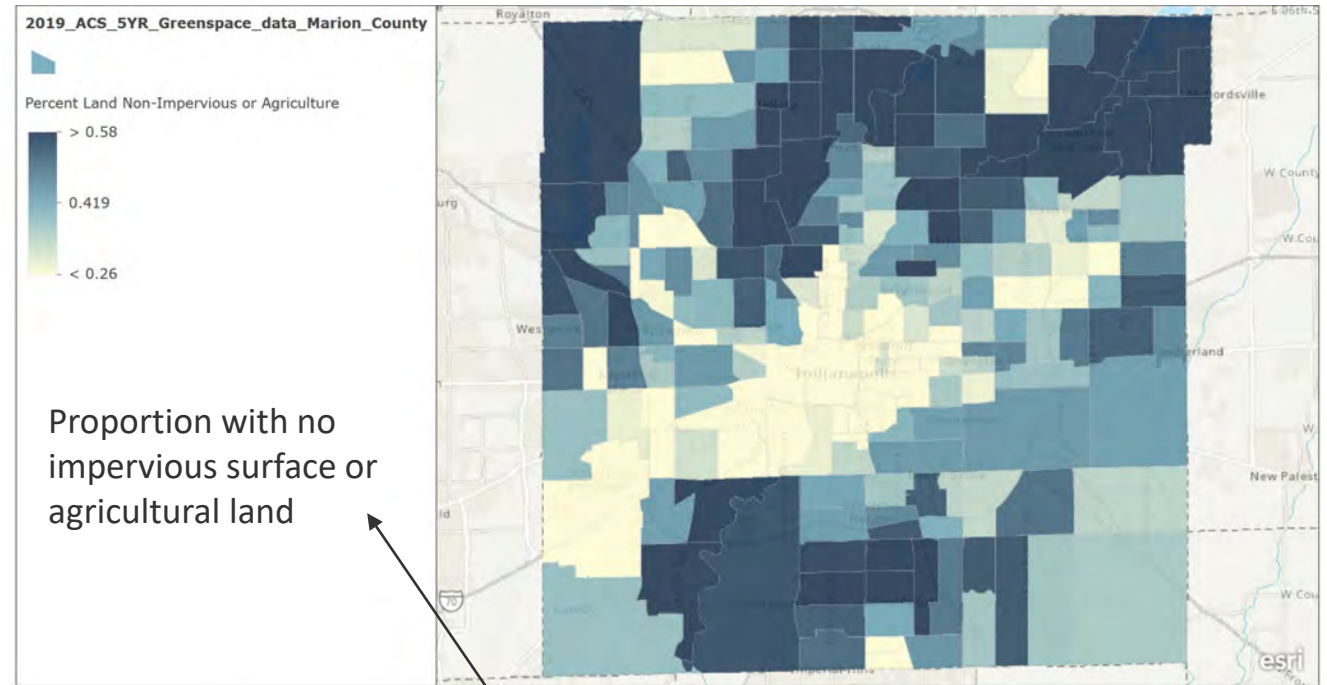- Tried to avoid adding too many obvious co-related variables

Variables
- Urban heat island daytime/nighttime
- PM2.5
- Life expectancy
- % w/no car
- Diabetes prevalence
- Traffic proximity volume
- Preterm birth

Greenspace Community Need

- Ranked each metric from low to high within Marion County

- Composite score to represent the approximate amount of greenspace community need within a tract

Greenspace needs in Marion County
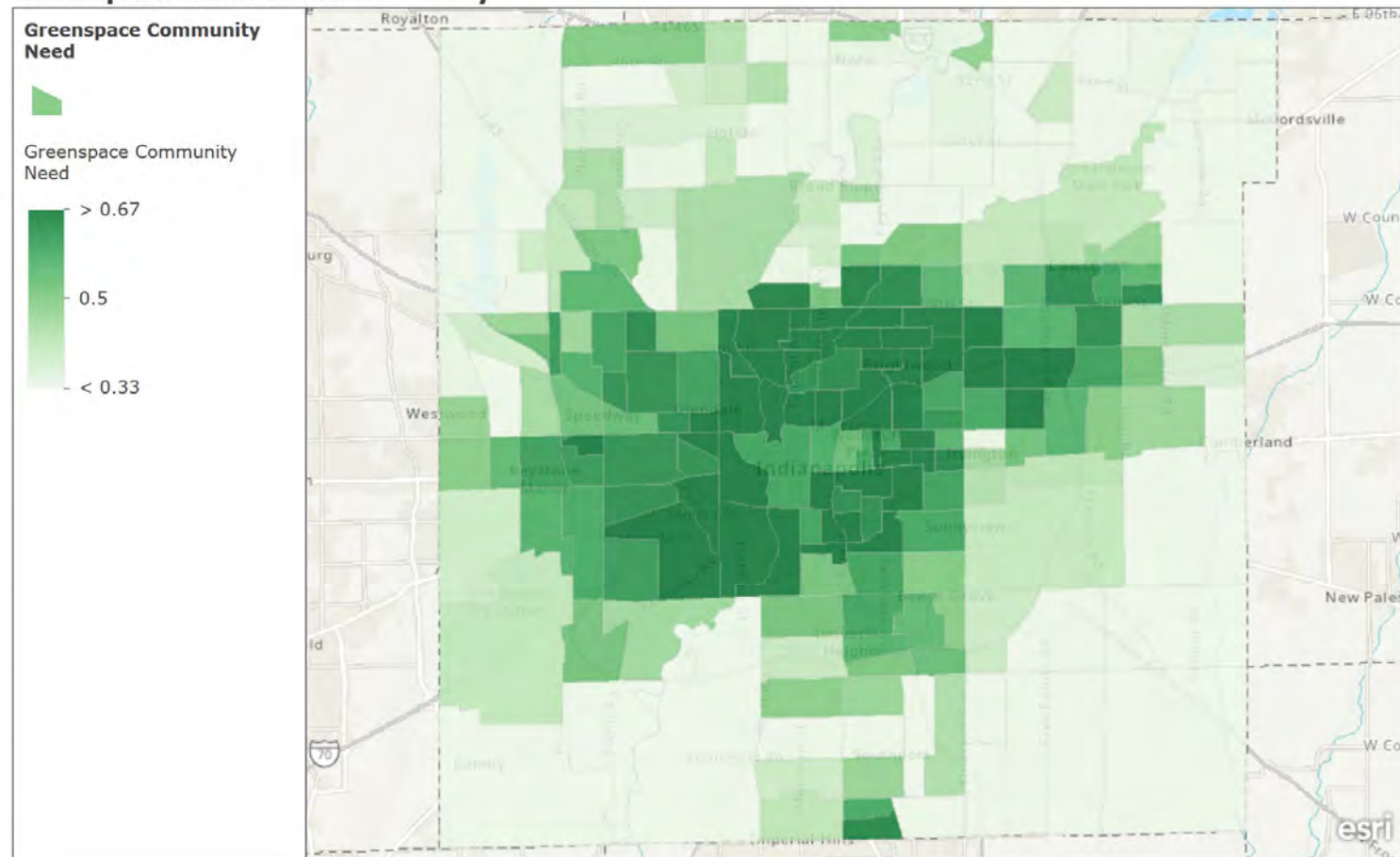
Greenspace Community Need

Greenspace Community Need

> 0.67

0.5

< 0.33

Esri, NASA, NGA, USGS | City of Indianapolis Marion Co, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

Greenspace Land Development Potential

- Approximate where greenspace can still be developed

- Which census tracts have the greatest percentage of land available to develop into greenspace?

- Hardest sub-index to approximate

2019_ACS_5YR_Greenspace_data_Marion_County

Percent Land Non-Impervious or Agriculture

> 0.58

0.419

< 0.26

Proportion with no impervious surface or agricultural land

Esri, NASA, NGA, USGS | City of Indianapolis Marion Co, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

Variables
- Share of land with no impervious or agricultural surface
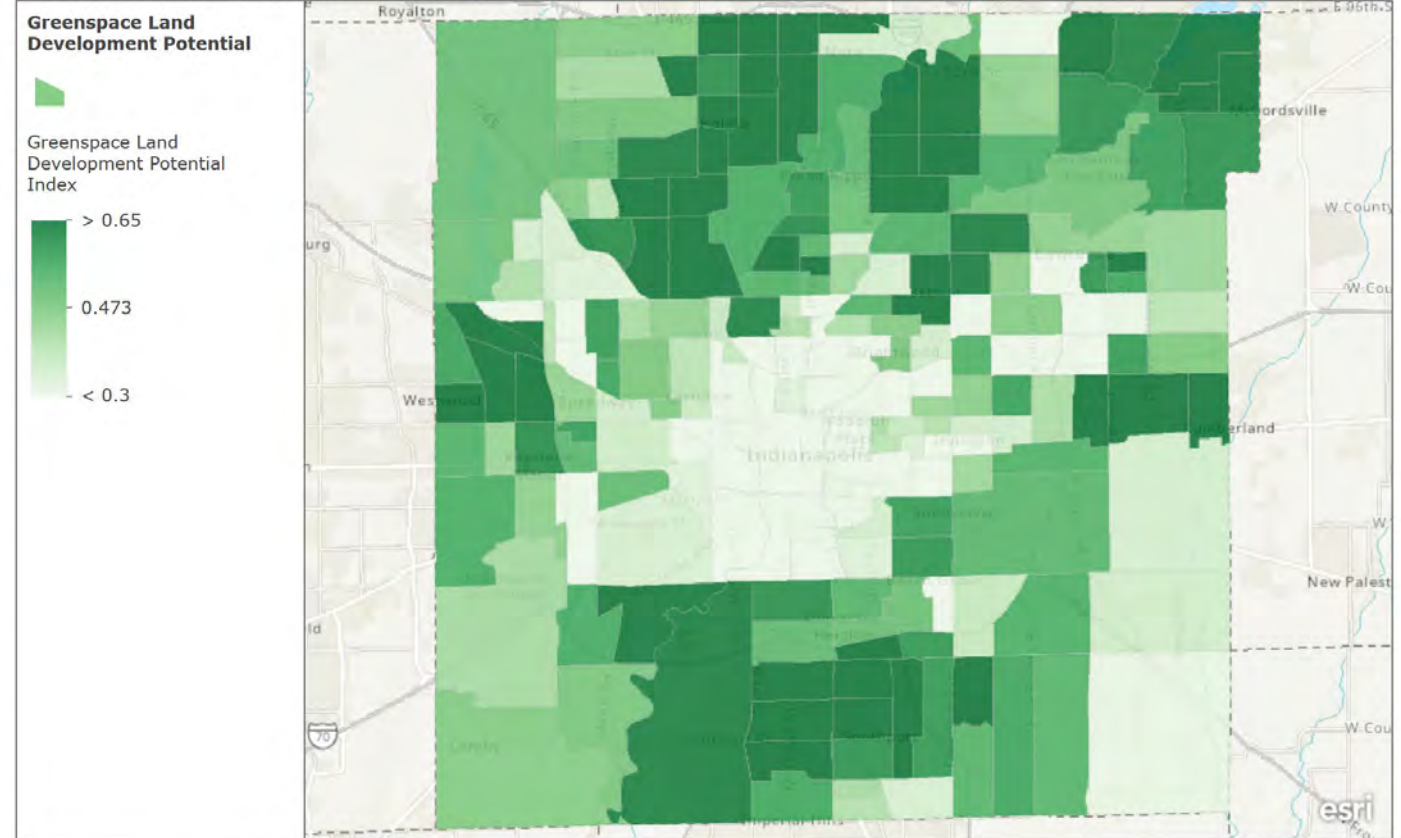- Census land area that isn't current park, native plant, or urban garden area

Greenspace Land Development Potential

- Ranked each metric from low to high within Marion County

- Composite score to represent the approximate amount of greenspace land development potential within a tract

Greenspace needs in Marion County

Greenspace Land Development Potential

Greenspace Land Development Potential Index

> 0.65

0.473

< 0.3

Esri, NASA, NGA, USGS | City of Indianapolis Marion Co, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA
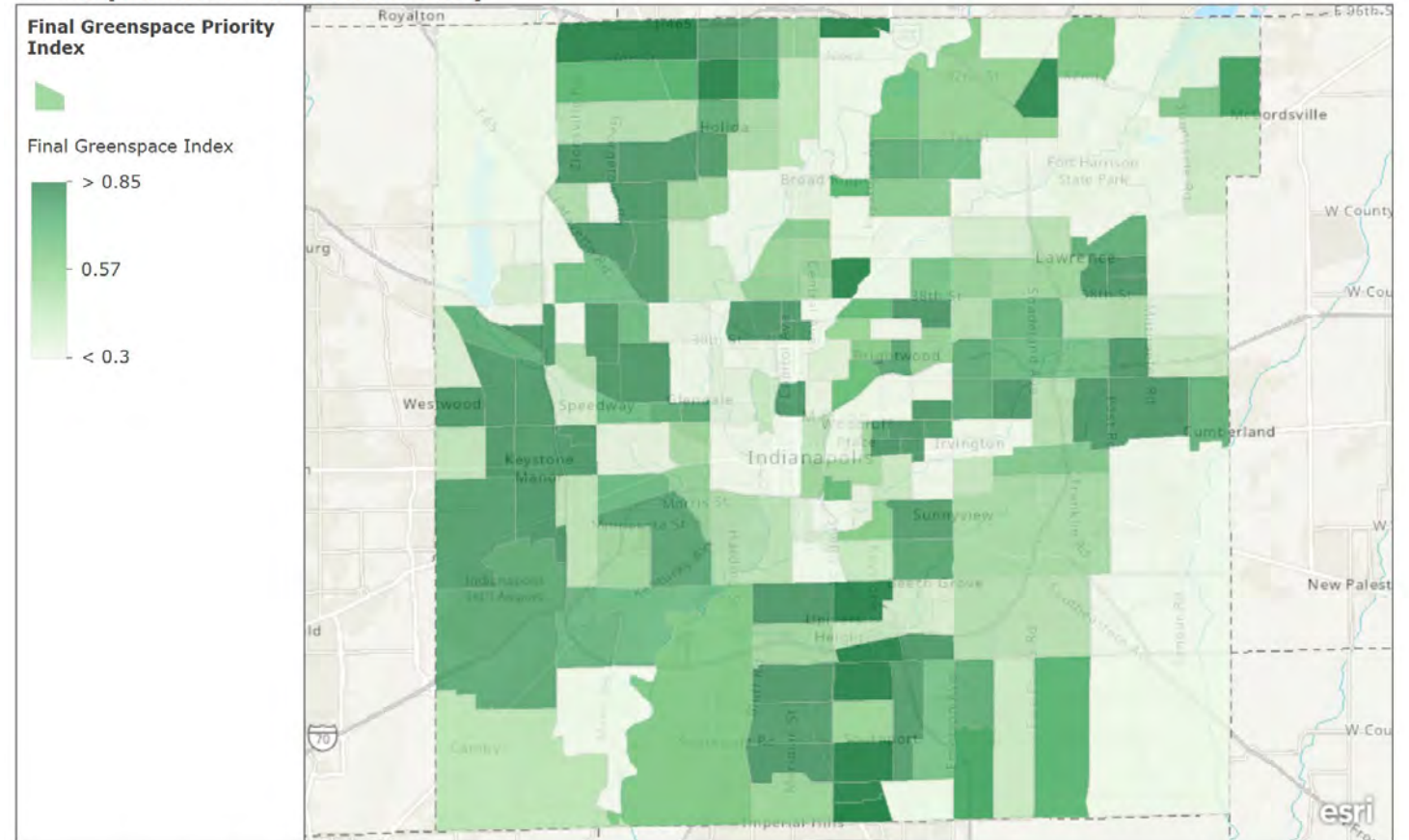
Final Greenspace Priority Index

- Final index (GI) was a combination of the previous three sub-indices

- Added Greenspace Community Need (GCN) and Greenspace Land Development Potential (GLDP) together, then subtracted Current Greenspace (CG)
  - ***GI = [GCN+GLDP-CG]***

Online web map

https://arcg.is/0WDKfj0

Greenspace needs in Marion County

Final Greenspace Priority Index

Final Greenspace Index
- > 0.85
- 0.57
- < 0.3

Esri, NASA, NGA, USGS | City of Indianapolis Marion Co, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

What did we find?

- Our index displays varying, nuanced degrees of greenspace priority throughout Marion County

- Most trends based on race and income are weak when looking at the whole county, but strong in several geographic pockets

Greenspace needs in Marion County
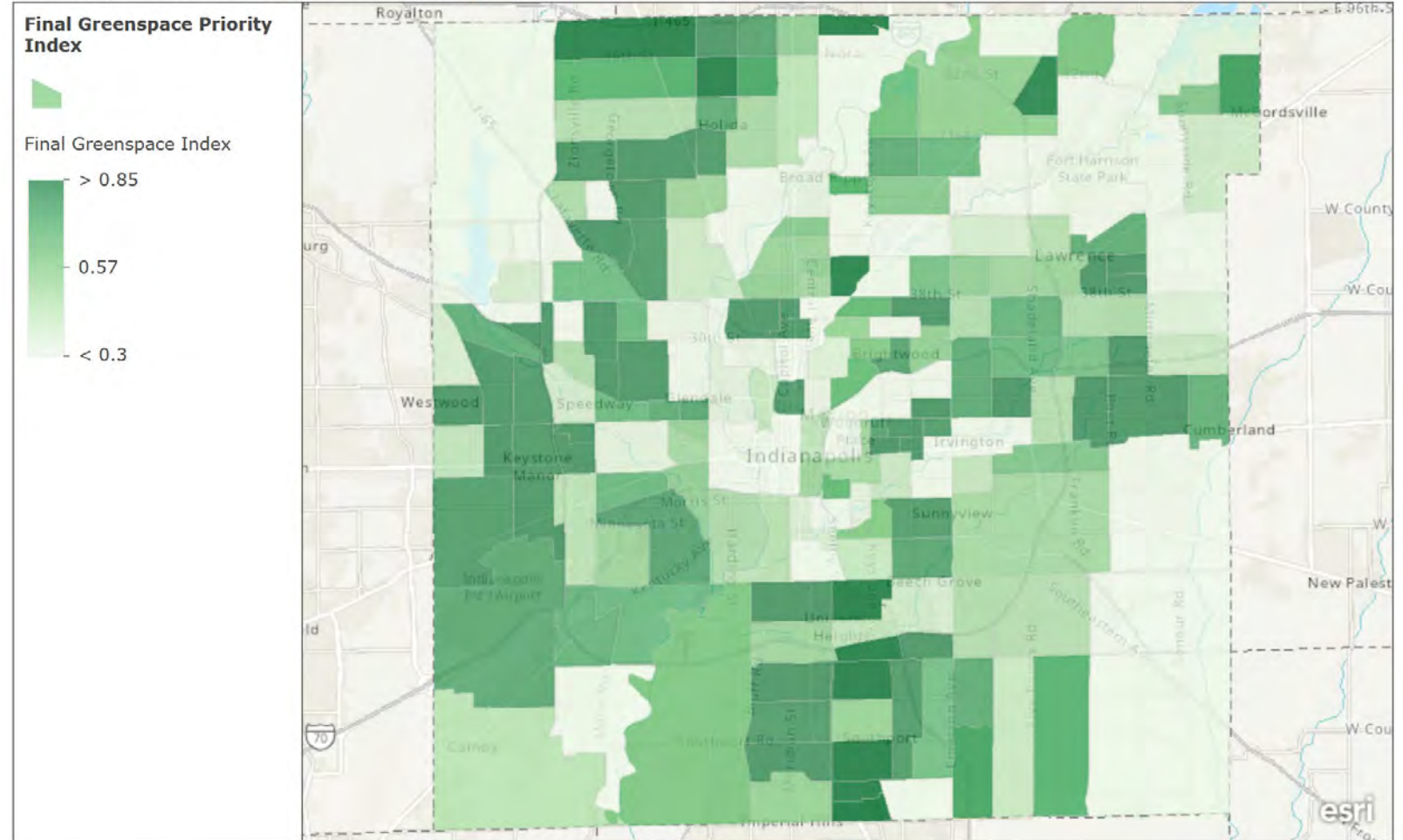
Final Greenspace Priority Index

Final Greenspace Index
- > 0.85
- 0.57
- < 0.3

Esri, NASA, NGA, USGS | City of Indianapolis Marion Co, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA
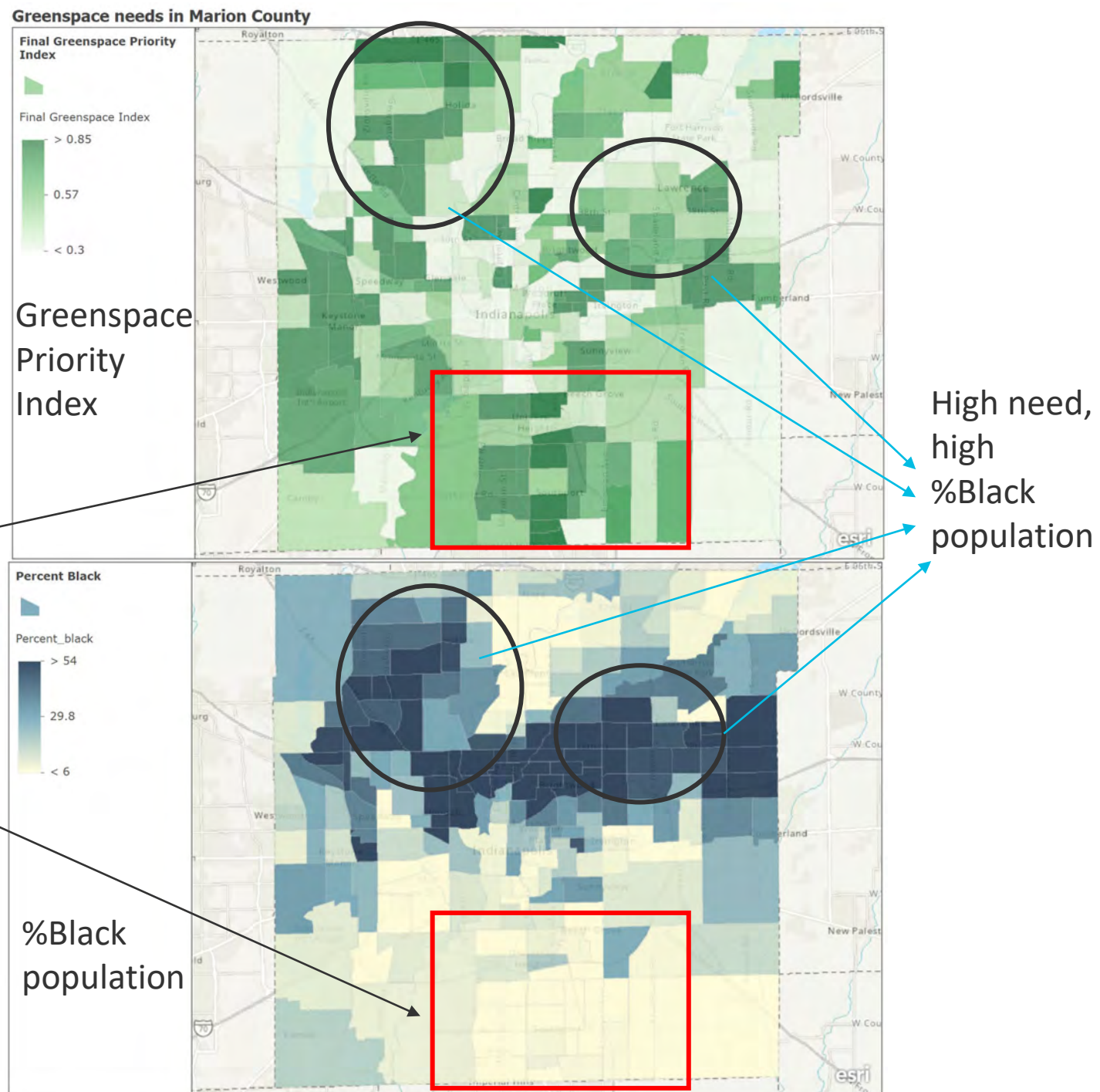
Side-by-side percent Black population and greenspace need

Relationships vary throughout the county.

Overall correlation statistics are weaker because of high greenspace need on the southside, but a higher %White population there.
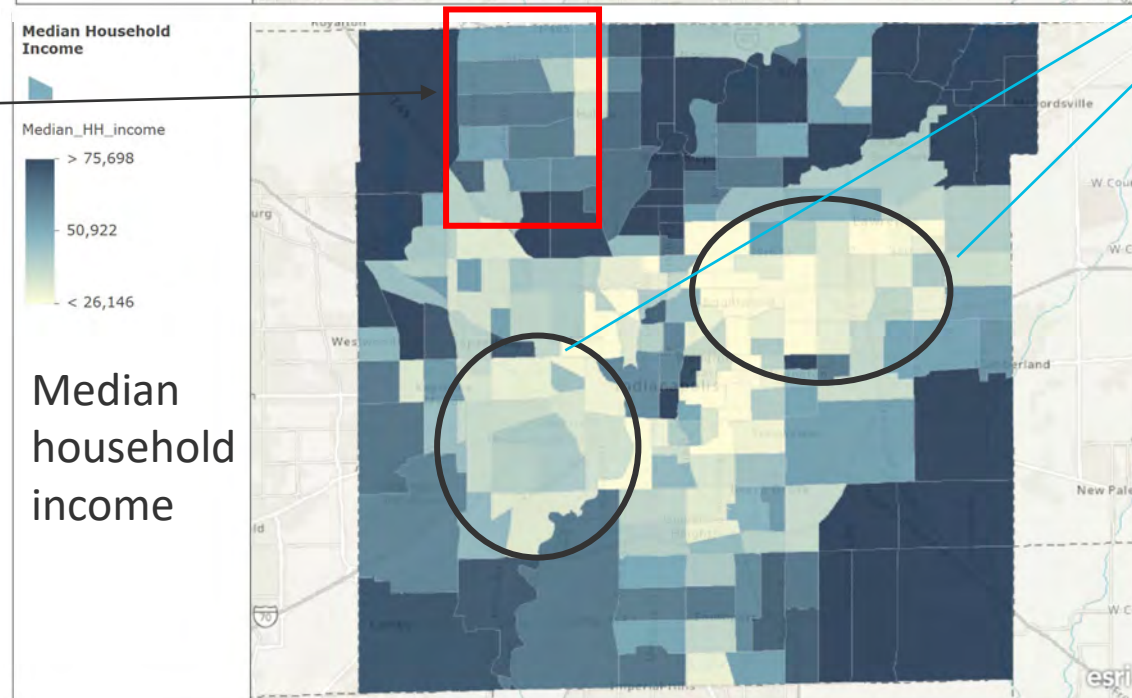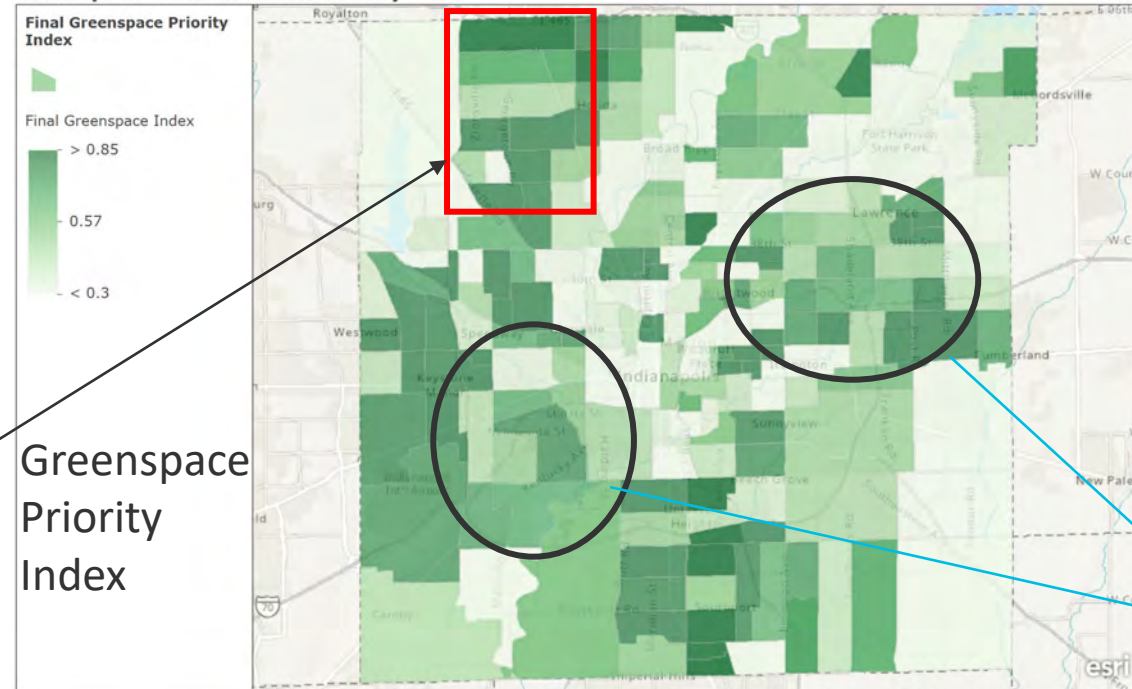

Greenspace needs in Marion County

Greenspace Priority Index

%Black population

High need, high %Black population

Side-by-side median household income and greenspace need

East-Indy and Southwest-Indy particularly have strong relationships between income and greenspace need.

But again, depending on where you look, trends may vary, such as parts of NW Indy.

Greenspace needs in Marion County

Final Greenspace Priority Index

Final Greenspace Index
- > 0.85
- 0.57
- < 0.3

Greenspace Priority Index

Median Household Income

Median_HH_income
- > 75,698
- 50,922
- < 26,146

Median household income

High need, low income

What does this mean for how to further prioritize greenspace?

- Our greenspace priority index does not include race and income

- But… race and income should be an important additional part of the discussion when looking holistically at which areas to focus on for greenspace development
  - Because of past inequities continuing to this day, such as [redlining practices](#) that affected development
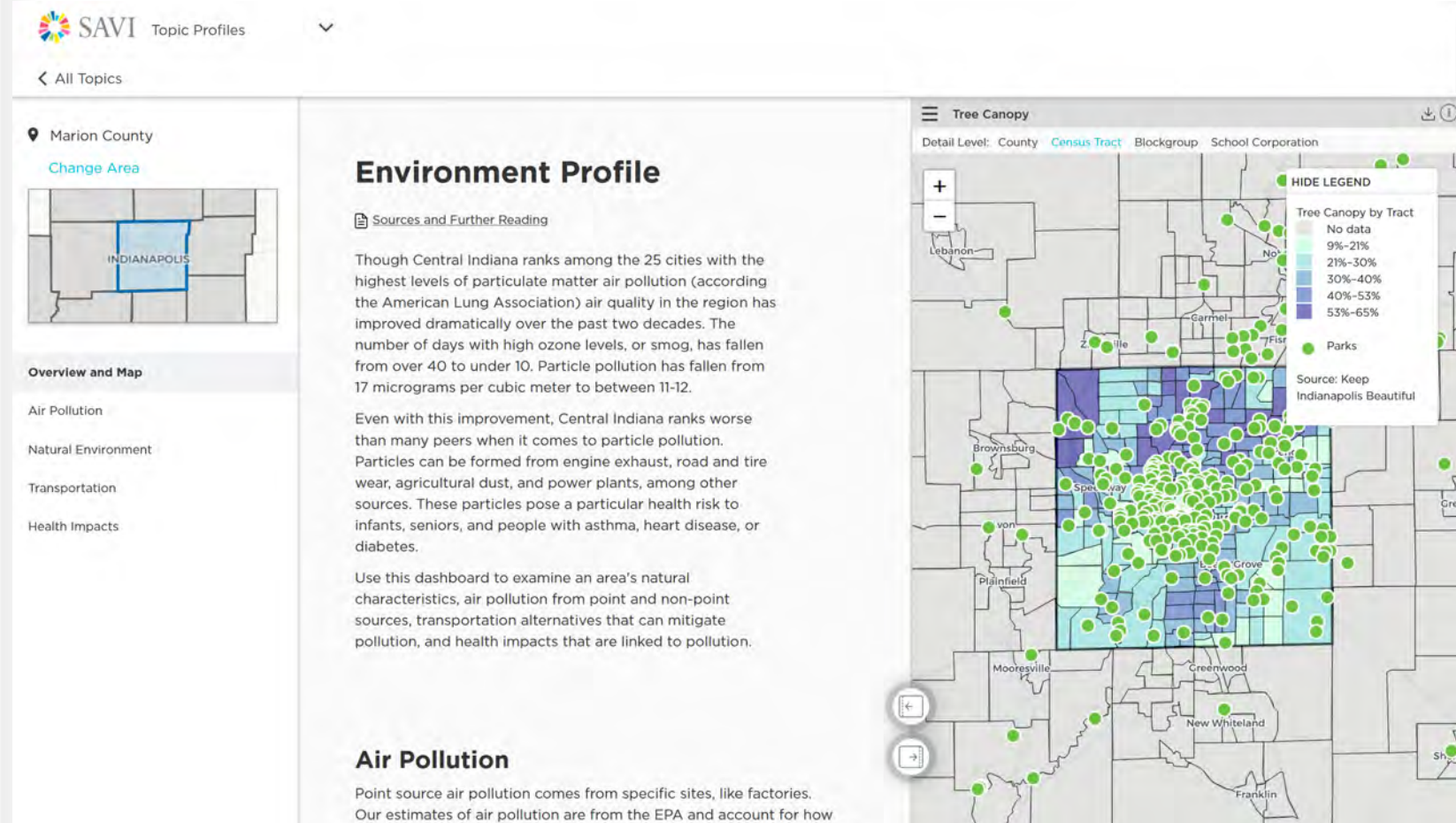
Plan to incorporate into SAVI website

- Update every 2-3 years based on new greenspace data and demographic/health data

- Note: Greenspace data is hard to come by...
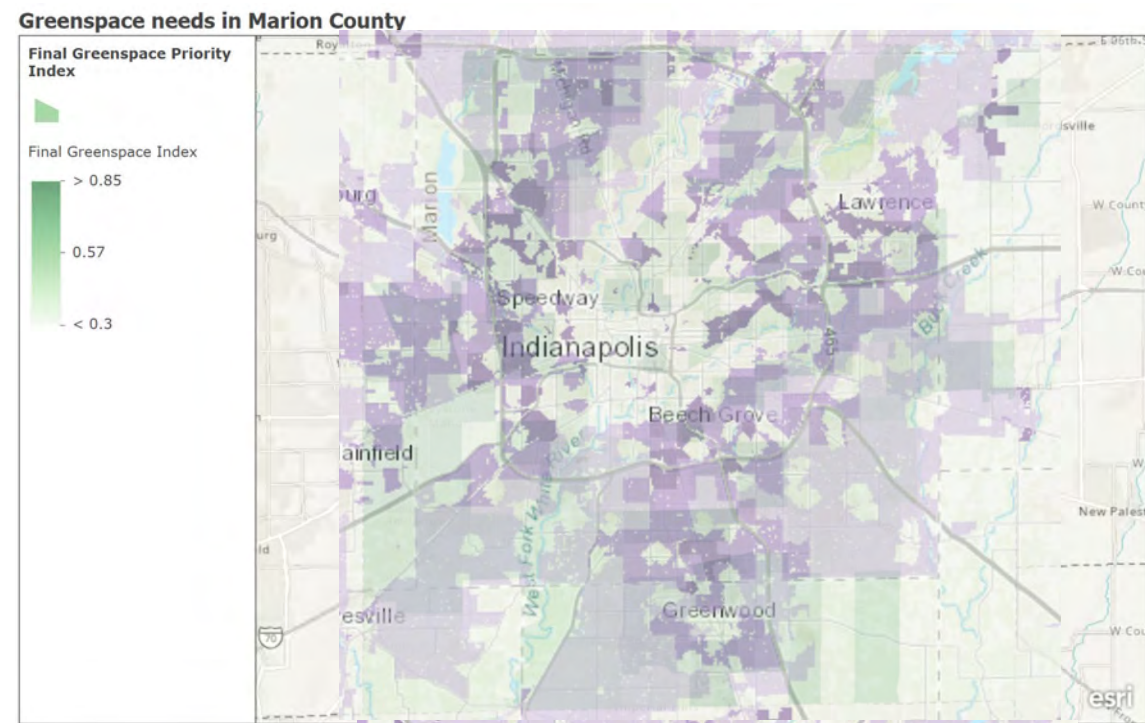 - Hopefully can expand beyond Marion County

Savi.org

Our index vs ParkServe Park Priorities
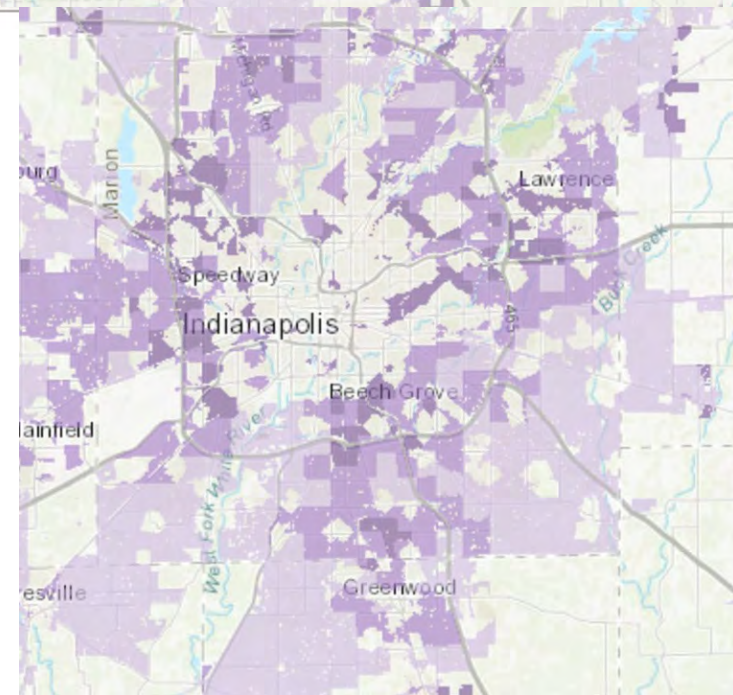
Key Differences:

- Inclusion of parks, tree canopy, native planting sites, and urban agriculture data

- Don't use race and household income in our greenspace index calculations

- Using raw health variables within our index calculation instead of using a previously calculated health index (CDC PLACES Index used by ParkServe)

- More holistic view of greenspace

ParkServe mapping app:
https://parkserve.tpl.org/mapping/

Greenspace needs in Marion County

Final Greenspace Priority Index

Final Greenspace Index

> 0.85

0.57

< 0.3

ParkServe Park Priorities Map

Darker color=higher park priority

So, we have an index that prioritizes where to put greenspace, but what are the next steps?

Local engagement before implementation

- Localized insight and community engagement in target areas
  - Helps to understand priorities we can't measure and where the community believes greenspace would actually be useful, if at all

- Particularly important to give community voice in historically underserved areas
  - Equity focus

https://www.kibi.org/AES-Indiana-project-greenspace

AES INDIANA PROJECT GREENSPACE

Examples of greenspace

- Native planting areas
- Tree planting
- Urban gardens/agriculture
- Park space
- Etc.

Indianapolis office of Land Stewardship

https://www.kibi.org/AES-Indiana-project-greenspace

https://sustainability.iupui.edu/operations/food/20180702_urban_garden_lk373.jpg
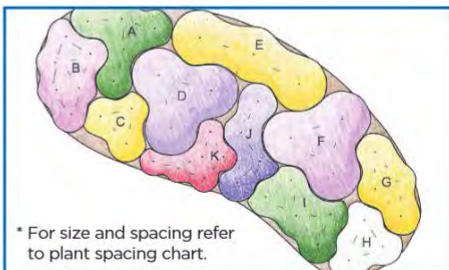

June 2020

NATIVE PLANTING AREA - BIRD & BUTTERFLY ATTRACTION

This native planting area plan was designed by a local landscape architect to attract birds and butterflies to the area in your yard where it is planted. For more information on the City of Indianapolis' Native Planting Area Resources visit: indy.gov/LandStewardship

	Scientific Name	Common Name	Quantity	Color	Spacing	Height
A	Schizachyrium scoparium	Little Bluestem	5	Green	18" oc	2–3'
B	Monarda fistulosa	Bergamot	6	Purple	18" oc	2–4'
C	Zizia aurea	Golden Alexanders	3	Yellow	12" oc	2–3'
D	Asclepias tuberosa	Butterflyweed	3	Orange	18" oc	1–2'
E	Ratibida pinnata	Yellow Coneflower	3	Yellow	18" oc	3–5'
F	Echinacea purpurea	Purple Coneflower	3	Purple	18" oc	3–4'
G	Solidago riddellii	Riddell's Goldenrod	4	Yellow	12" oc	2–4'
H	Pycnanthemum virginianum	Mountain Mint	3	White	12" oc	1–2'
I	Carex bicknellii	Prairie Oval Sedge	5	Green	12" oc	1–2'
J	Baptisia australis	Blue False Indigo	5	Purple	12" oc	2–4'
k	Liatris aspera	Rough Blazing Star	6	Purple	12" oc	1–3'

* For size and spacing refer to plant spacing chart.

Conclusion

- Greenspace in general has a lot of positive impacts on community and environmental health

- There are many areas throughout Marion County that could use greater greenspace development

- Some areas of focus include low-income and high minority population areas

- Prioritizing greenspace implementation requires more than just an index
  - Community engagement

Thank you!

Any questions?