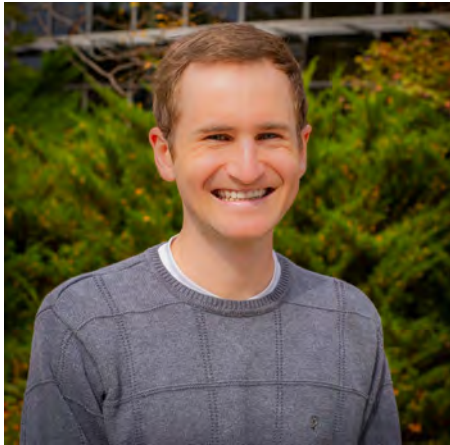SAVI Talks

# 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,
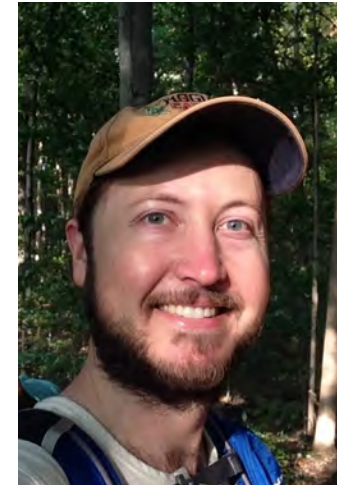WFYI/Side Effects Public Media

# 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

# 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
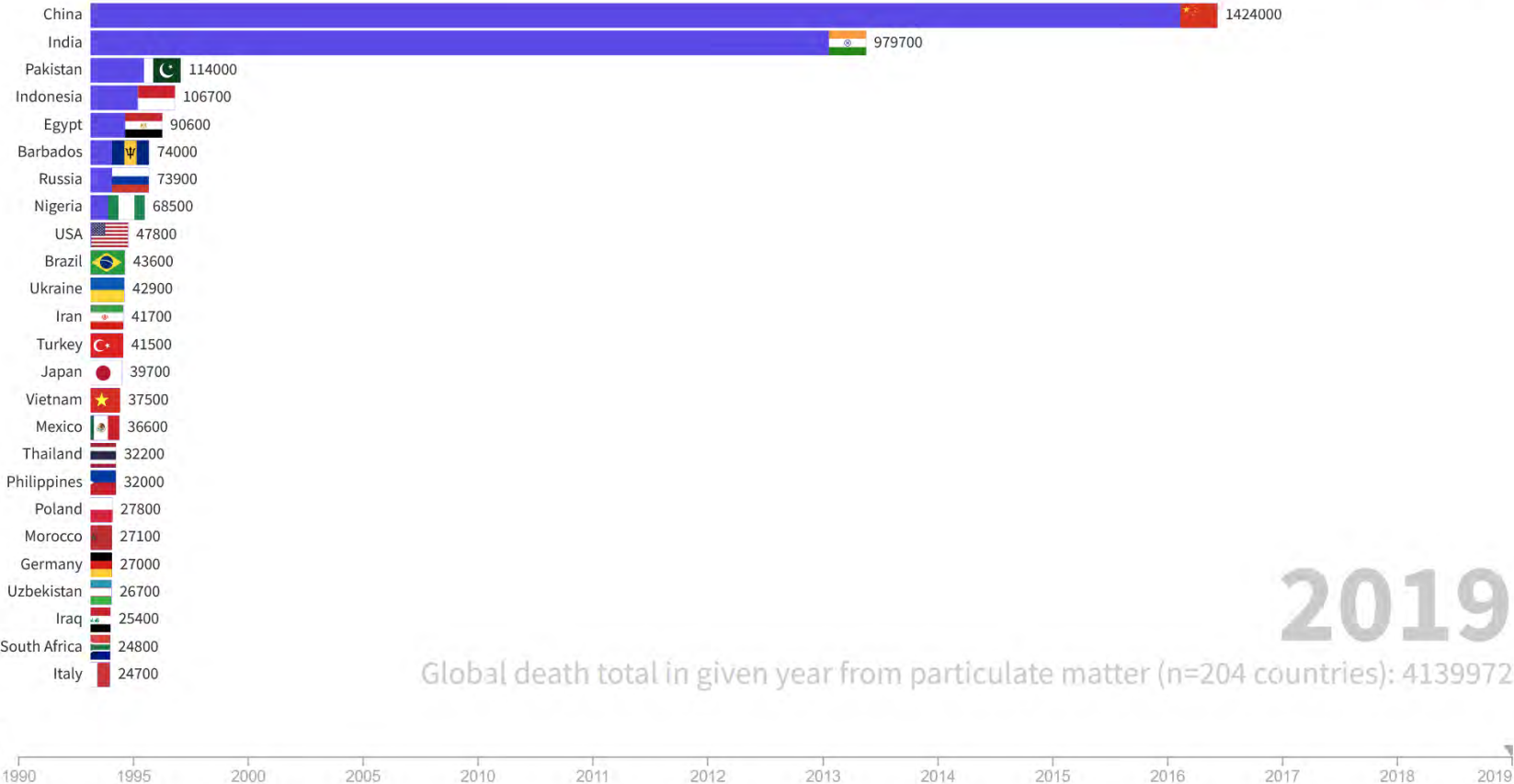
# Positive impacts on the environment

- Reduction in particulate matter pollution
- Lowers the urban heat island effect
- Helps mitigate surface water runoff

# Potentially help mitigate mortality from air pollution



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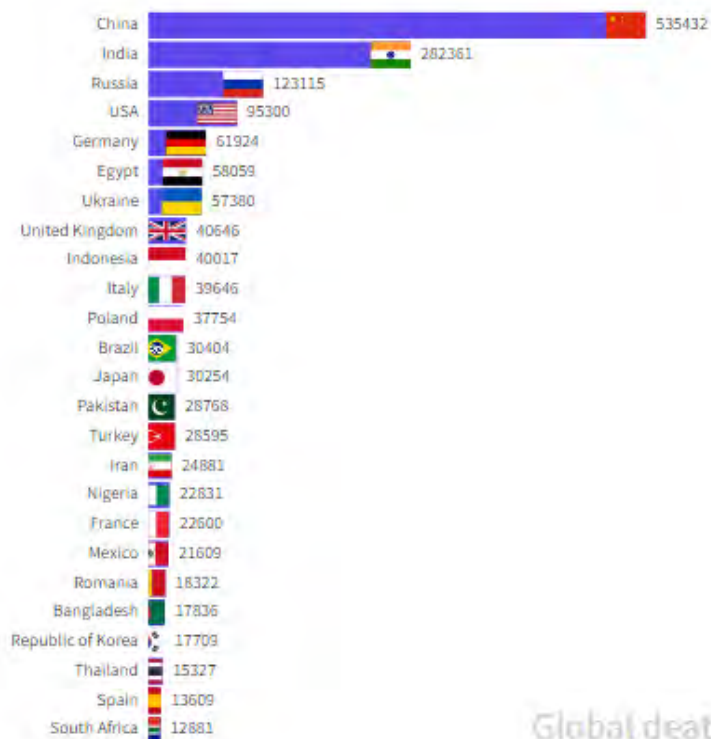Top 25 countries out of 204 countries

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| 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.

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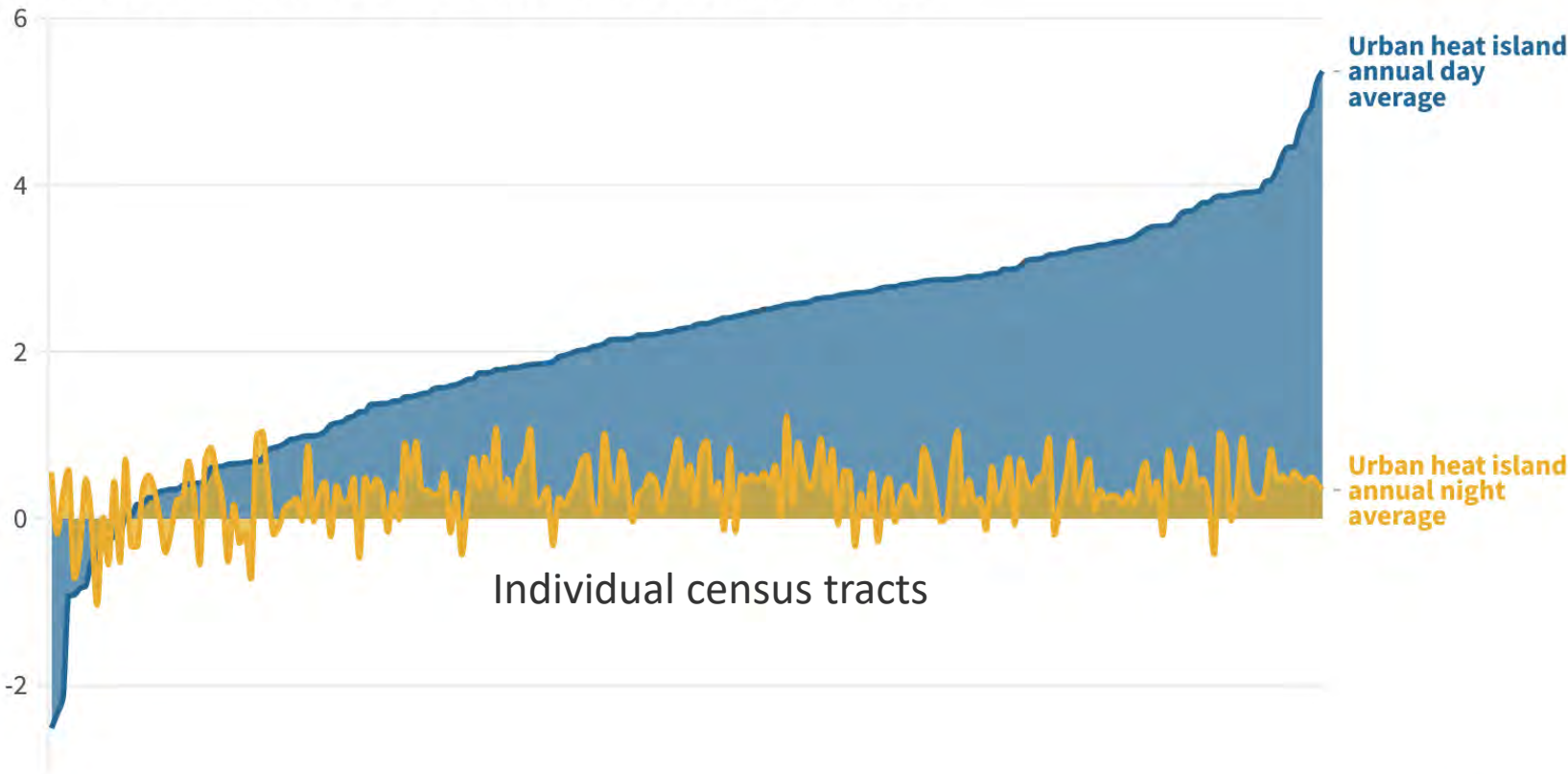
Source: Chakraborty, TC; Hsu, Angel; Sheriff, Glenn ; Manya, Diego (2020), "United States Surface Urban Heat Island database", Mendeley Data, V3, doi: 10.17632/x9mv4krnm2.3

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# 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
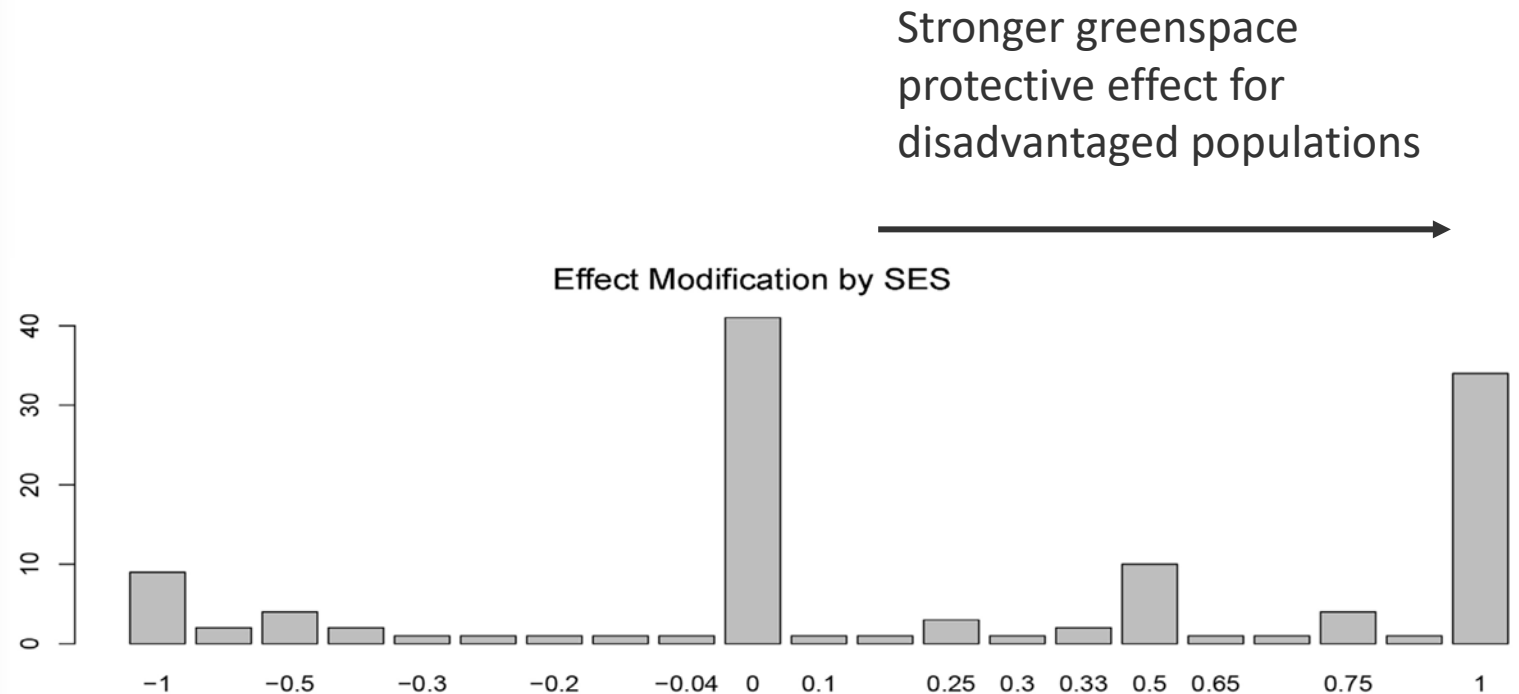


*(Rigolon et al., 2021)*

## 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)

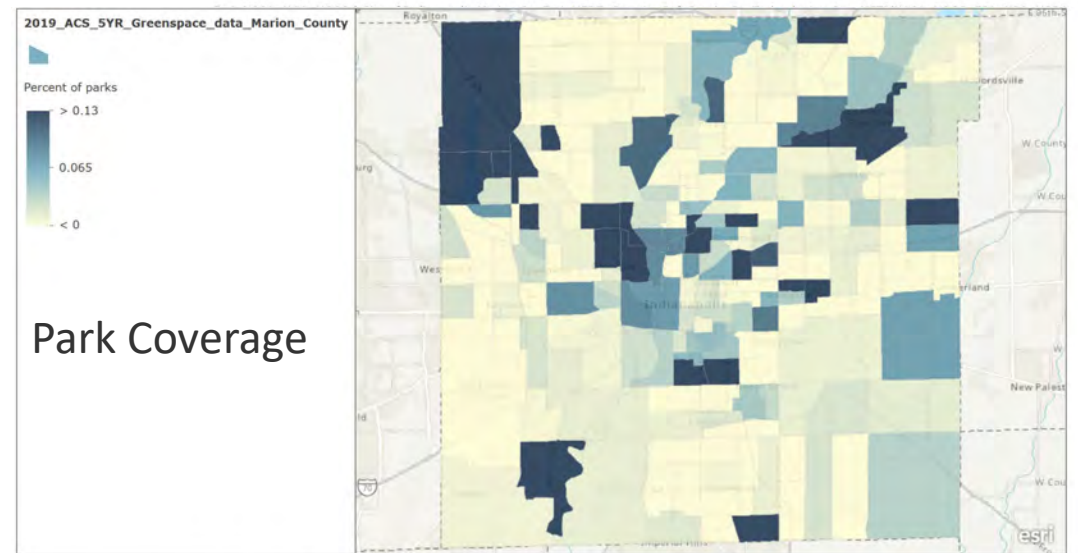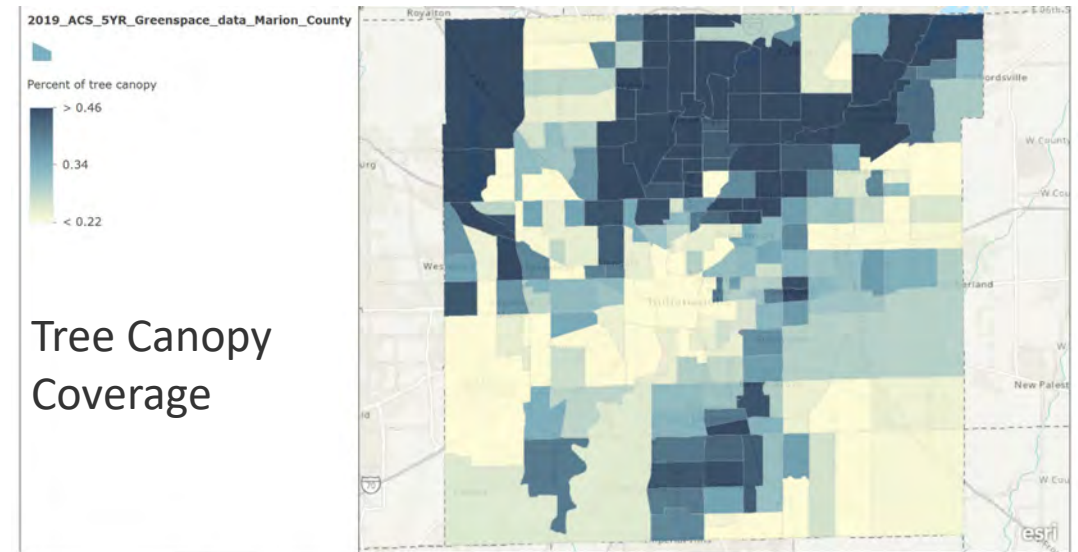| Variables | Weight in sub-index | Source |
|---|---|---|
| Share of land with no impervious or agricultural surface | | Climate Economic Justice Data |
| Census land area-current park area-current native plant area-current urban agricultural and garden area | | ACS + Polis Analysis |

# 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
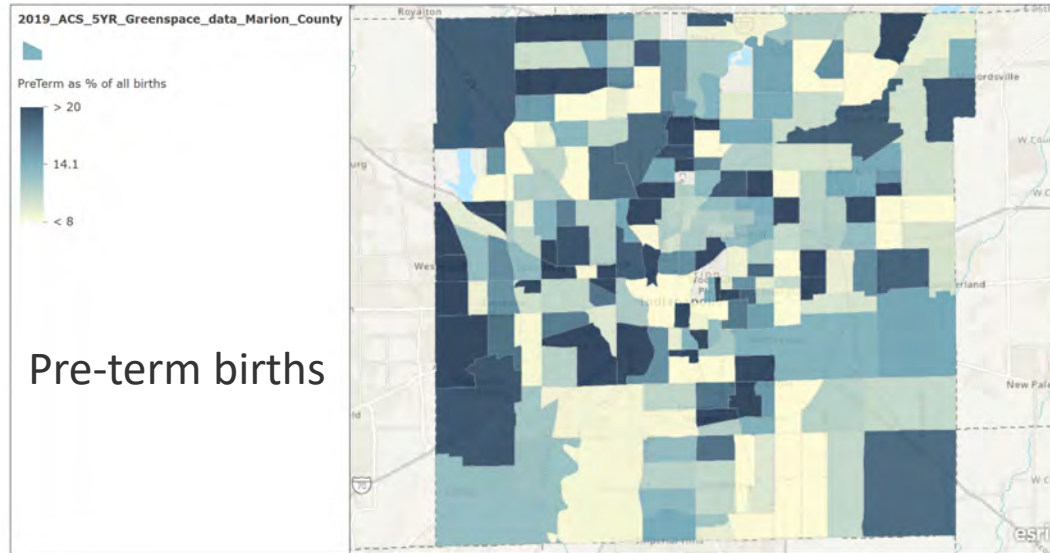  - **Tree canopy cover** *Weighted the most*
  - **Parks**



Tree Canopy Coverage

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
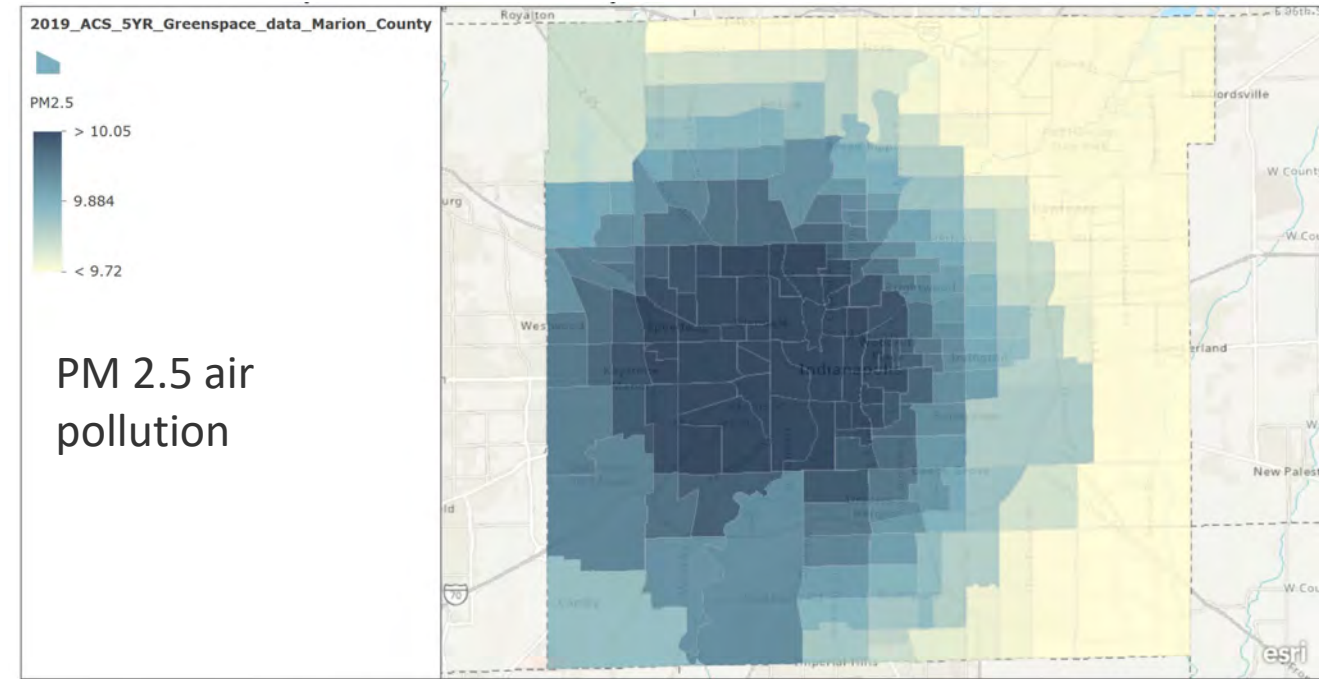


Greenspace needs in Marion County
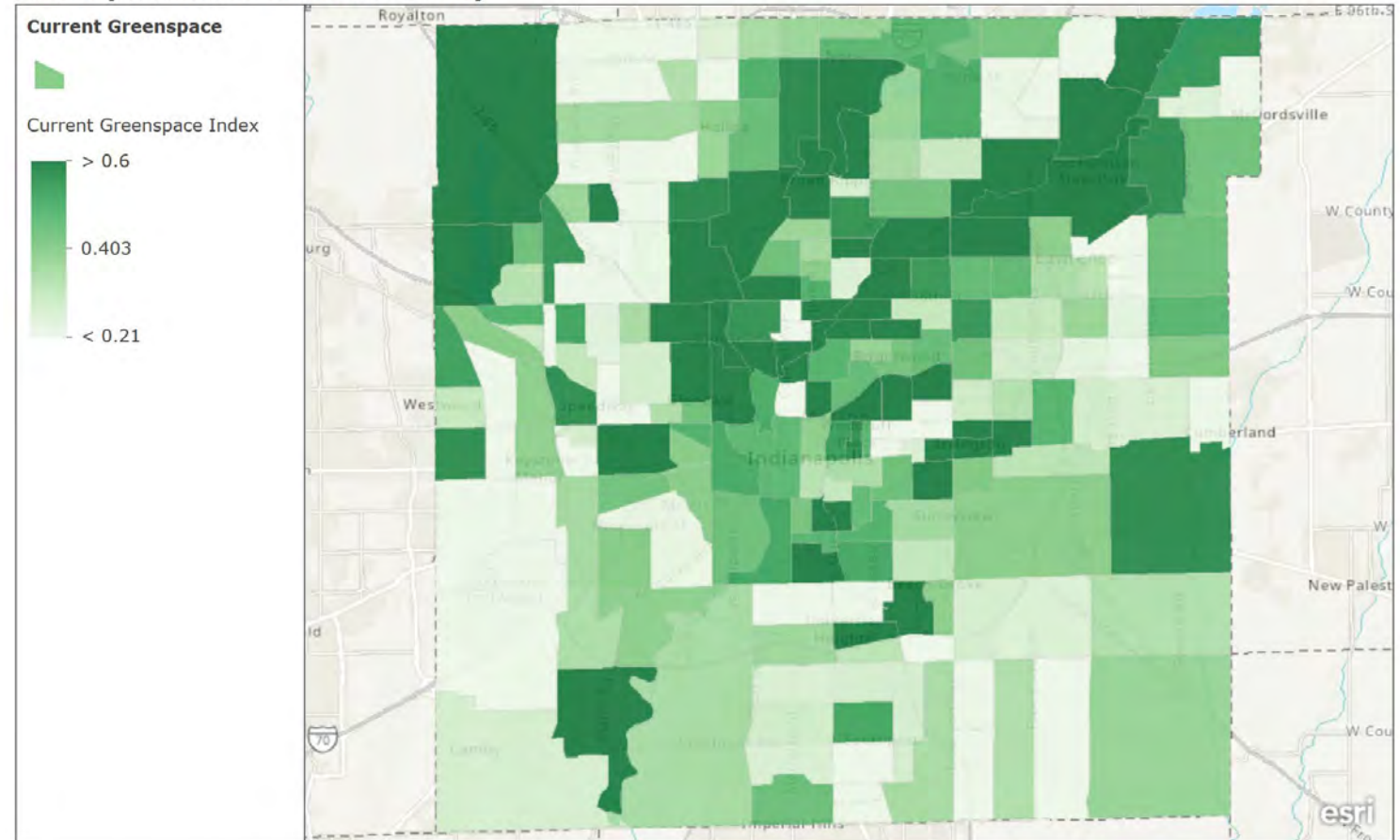
Current Greenspace

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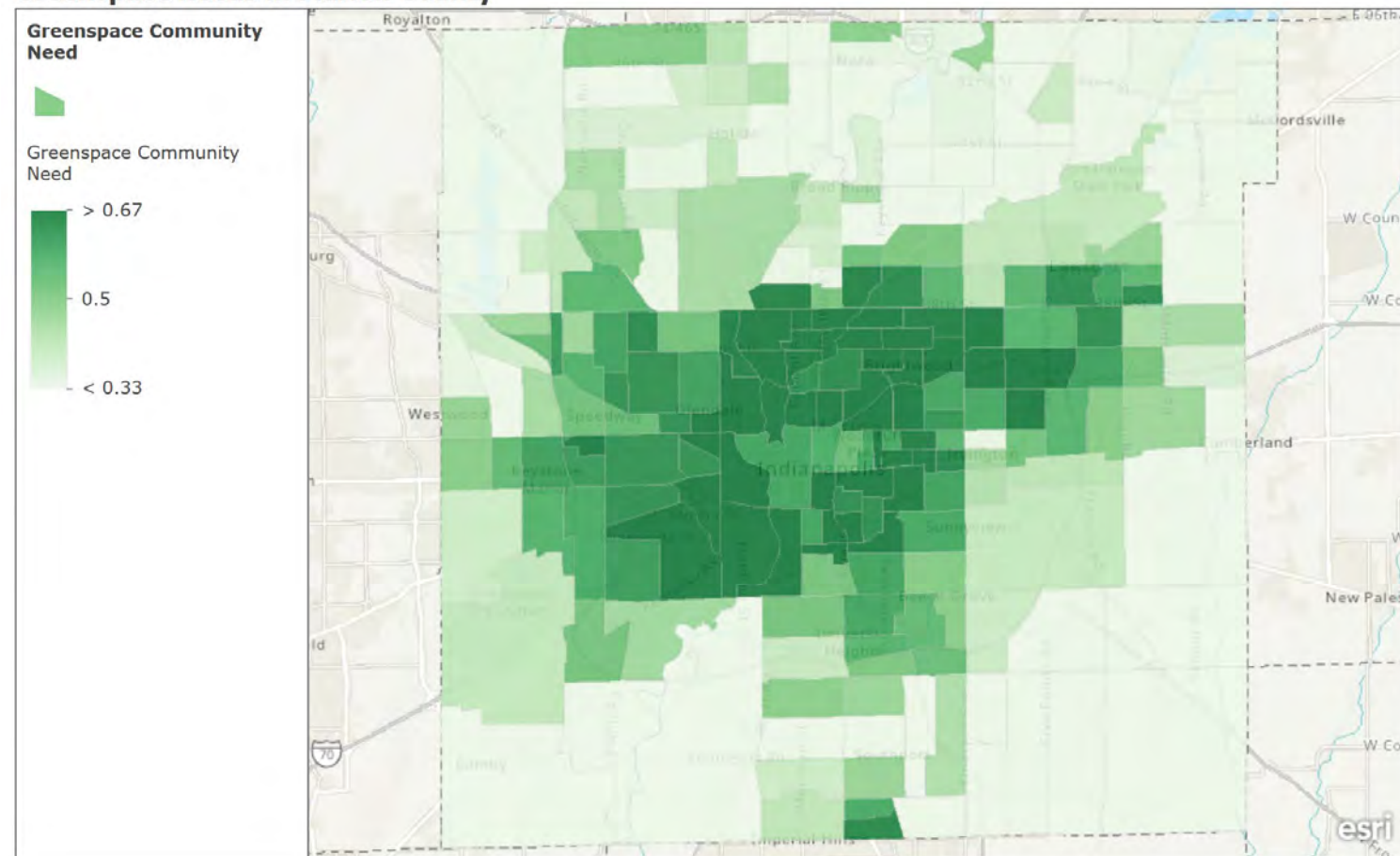
Variables
- Urban heat island daytime/nighttime
- PM2.5
- Life expectancy
- % w/no car
- Diabetes prevalence
- Traffic proximity volume
- Preterm birth

# 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
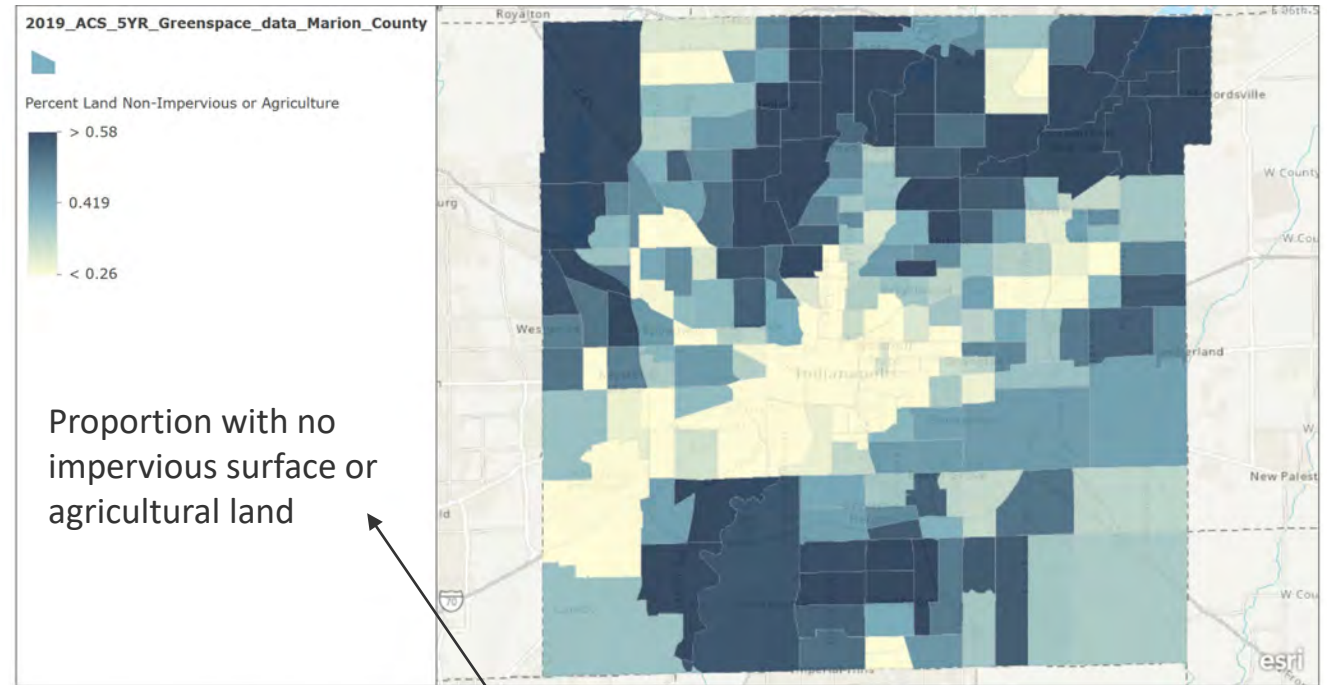


Greenspace needs in Marion County

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
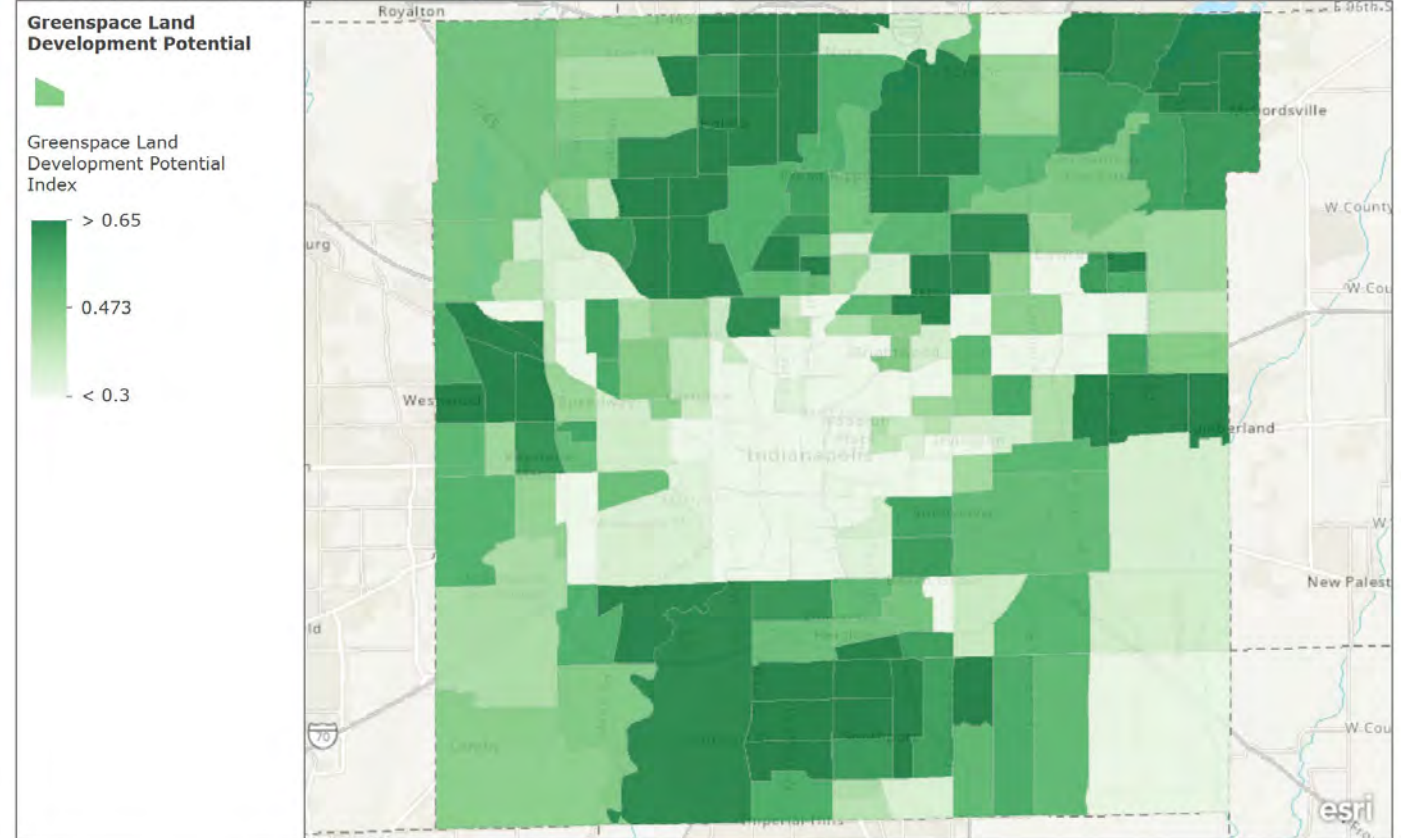
Greenspace Land Development Potential

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
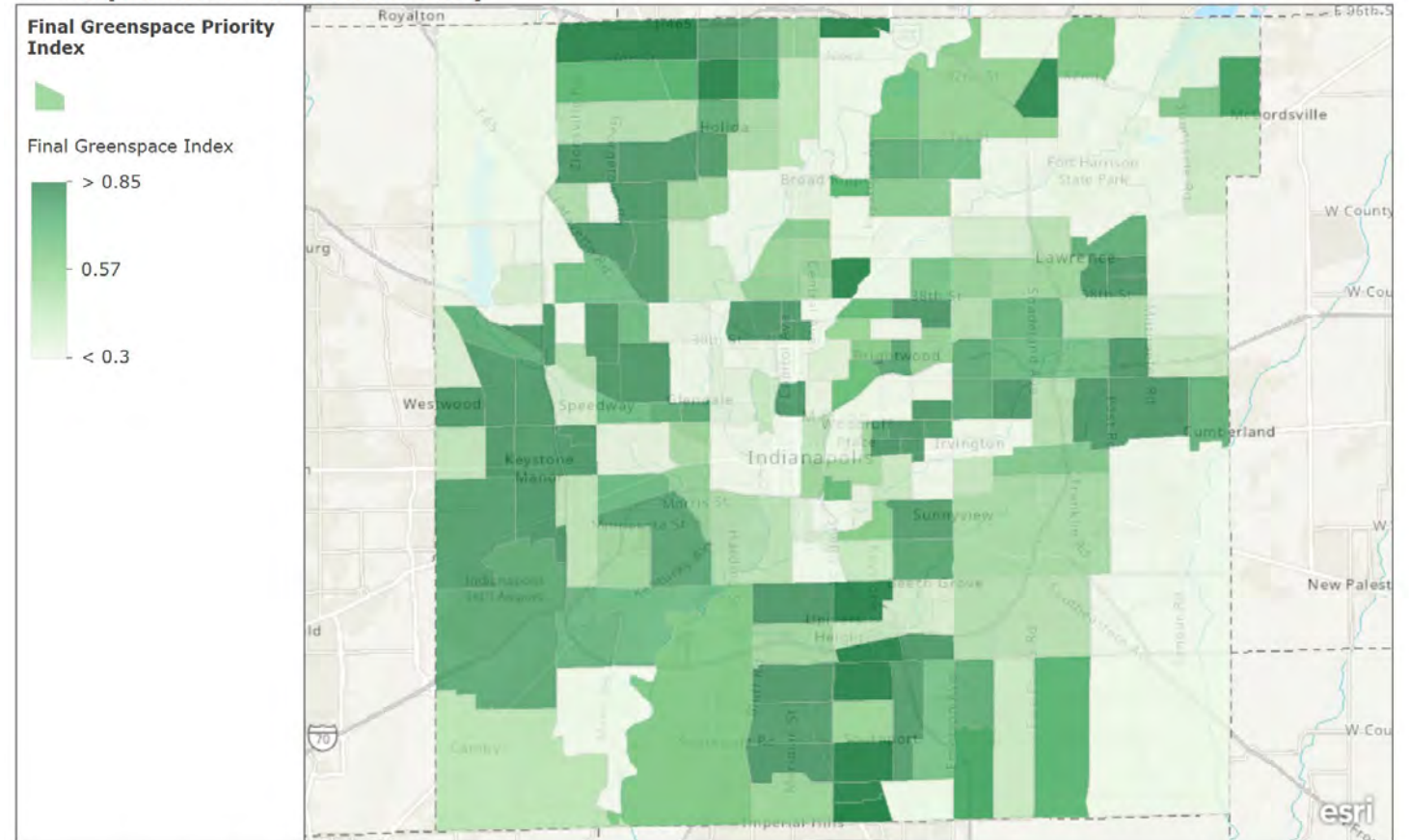
# Final Greenspace Priority Index

- 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]*
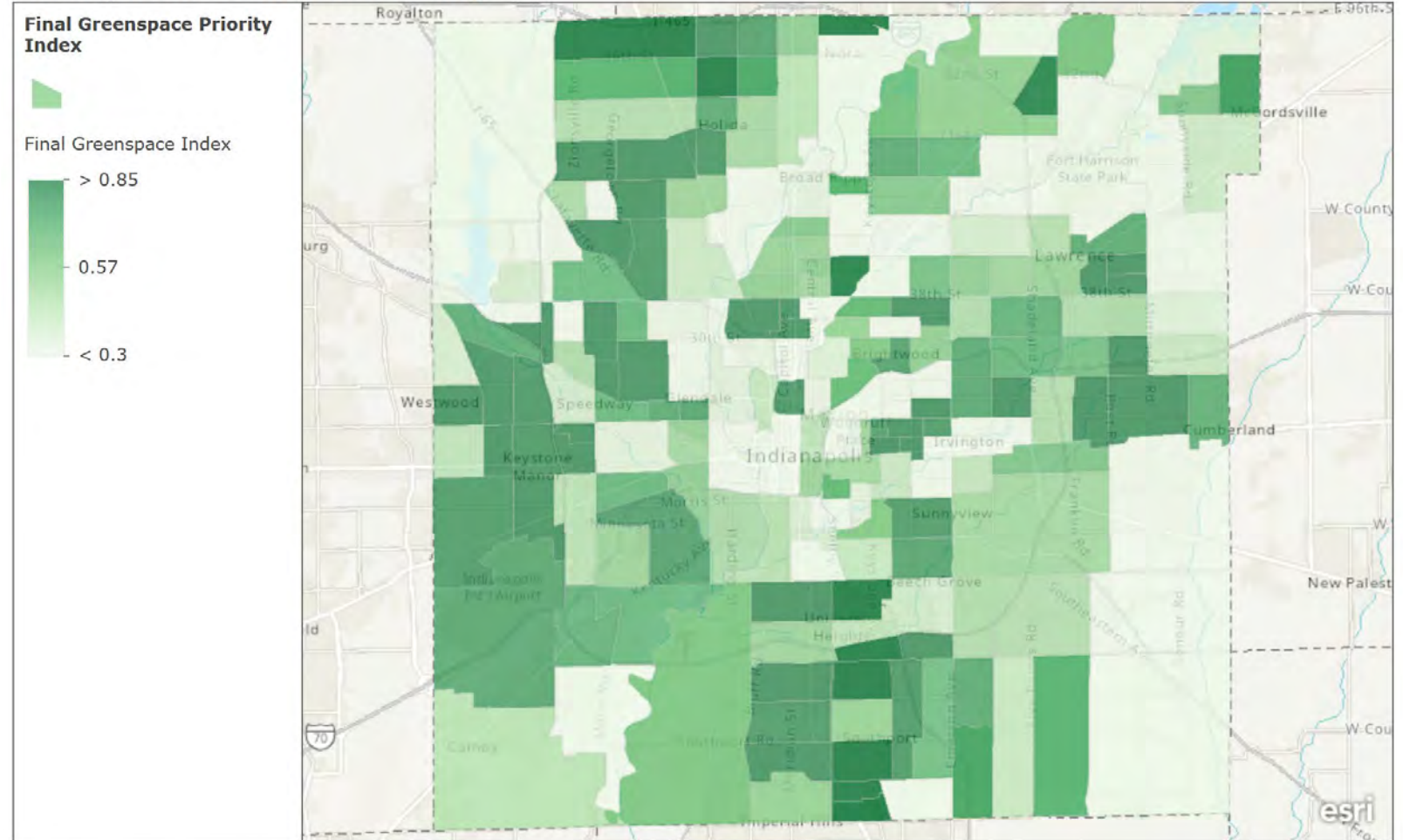
Online web map

https://arcg.is/0WDKfj0



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
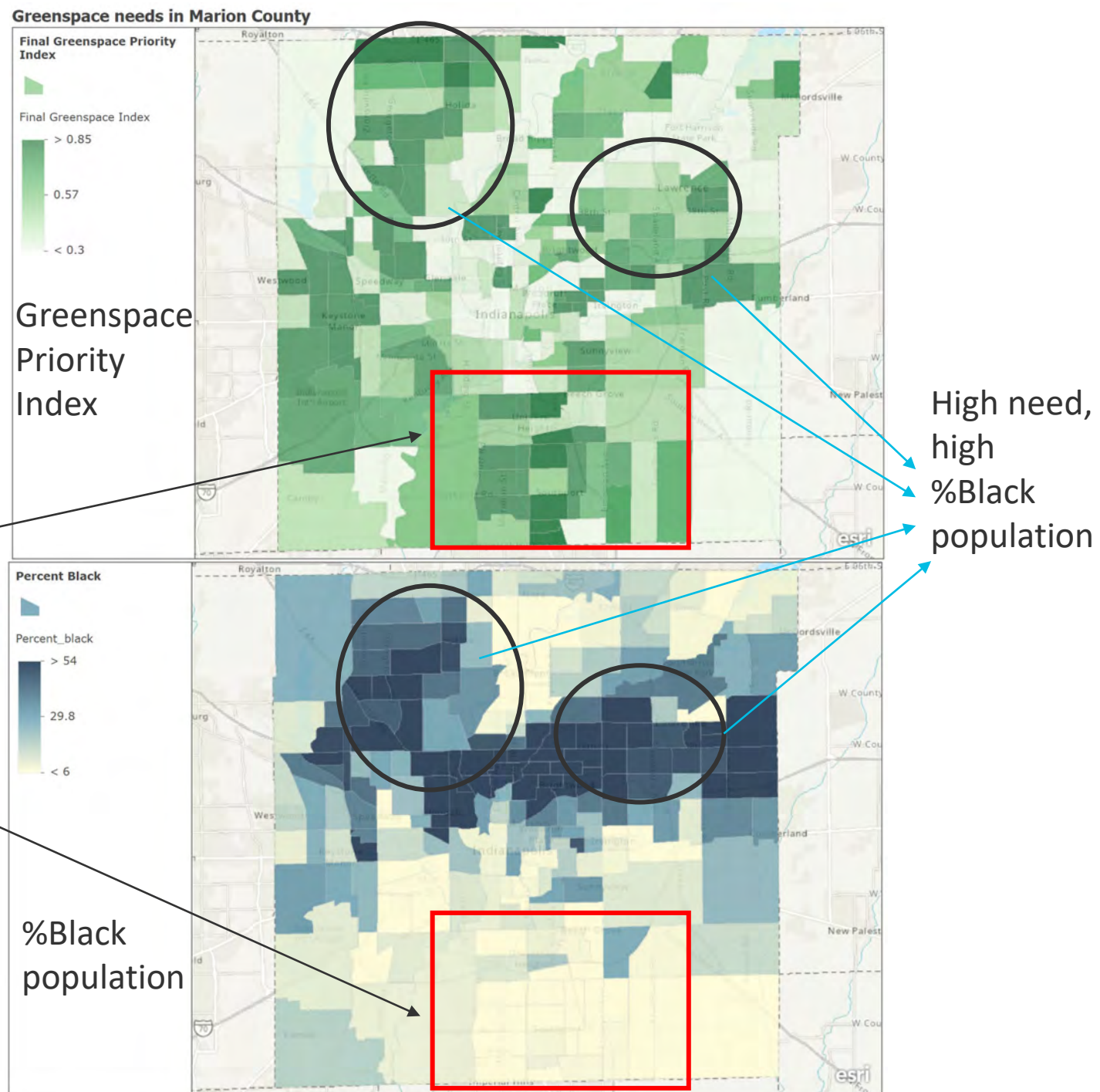
# Side-by-side percent Black population and greenspace need

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

**Final Greenspace Priority Index**

Final Greenspace Index

> 0.85

0.57

< 0.3

Greenspace Priority Index

High need, high %Black population

**Percent Black**

Percent_black

> 54

29.8

< 6

%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

Greenspace Priority Index

Median household income

High need, low income
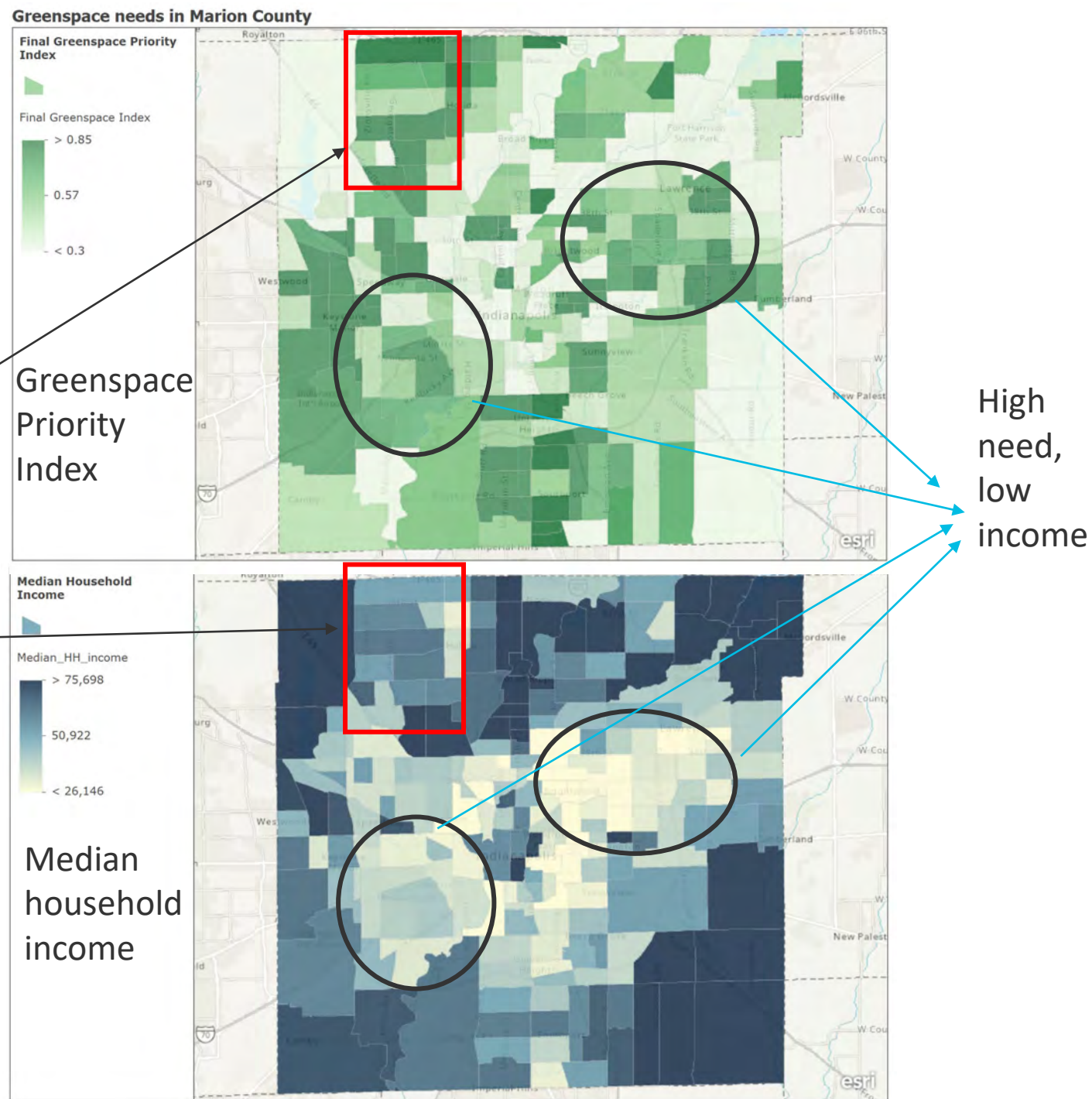
# What does this mean for how to further prioritize greenspace?

- 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...
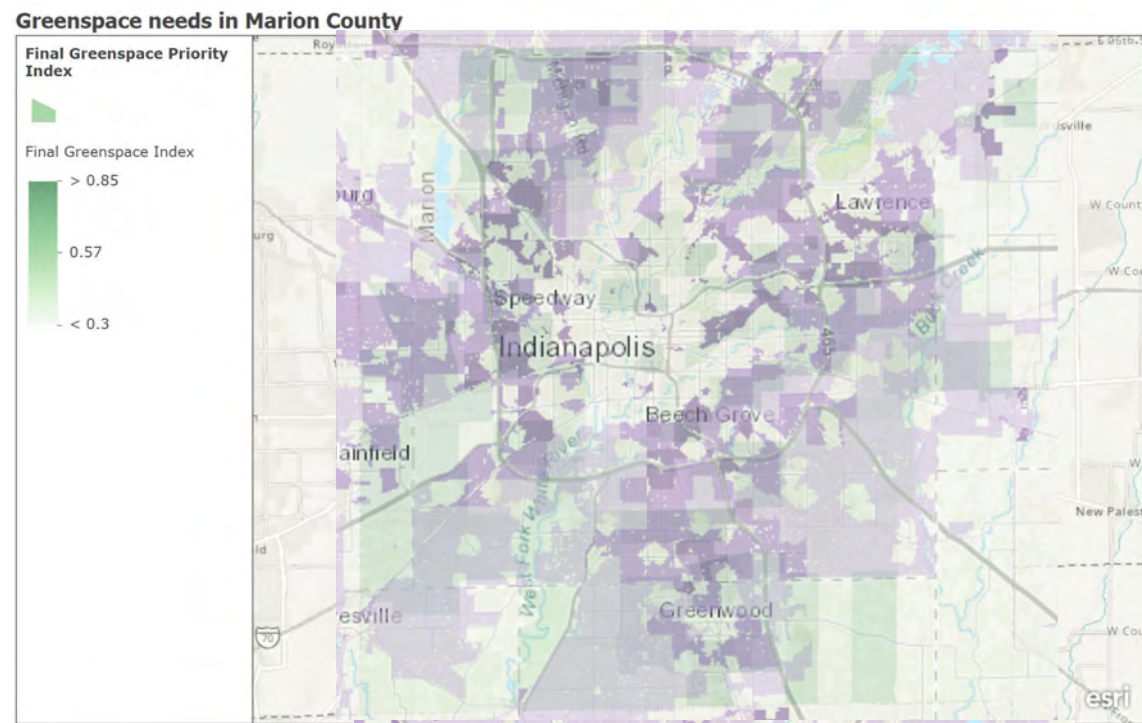  - Hopefully can expand beyond Marion County

Savi.org
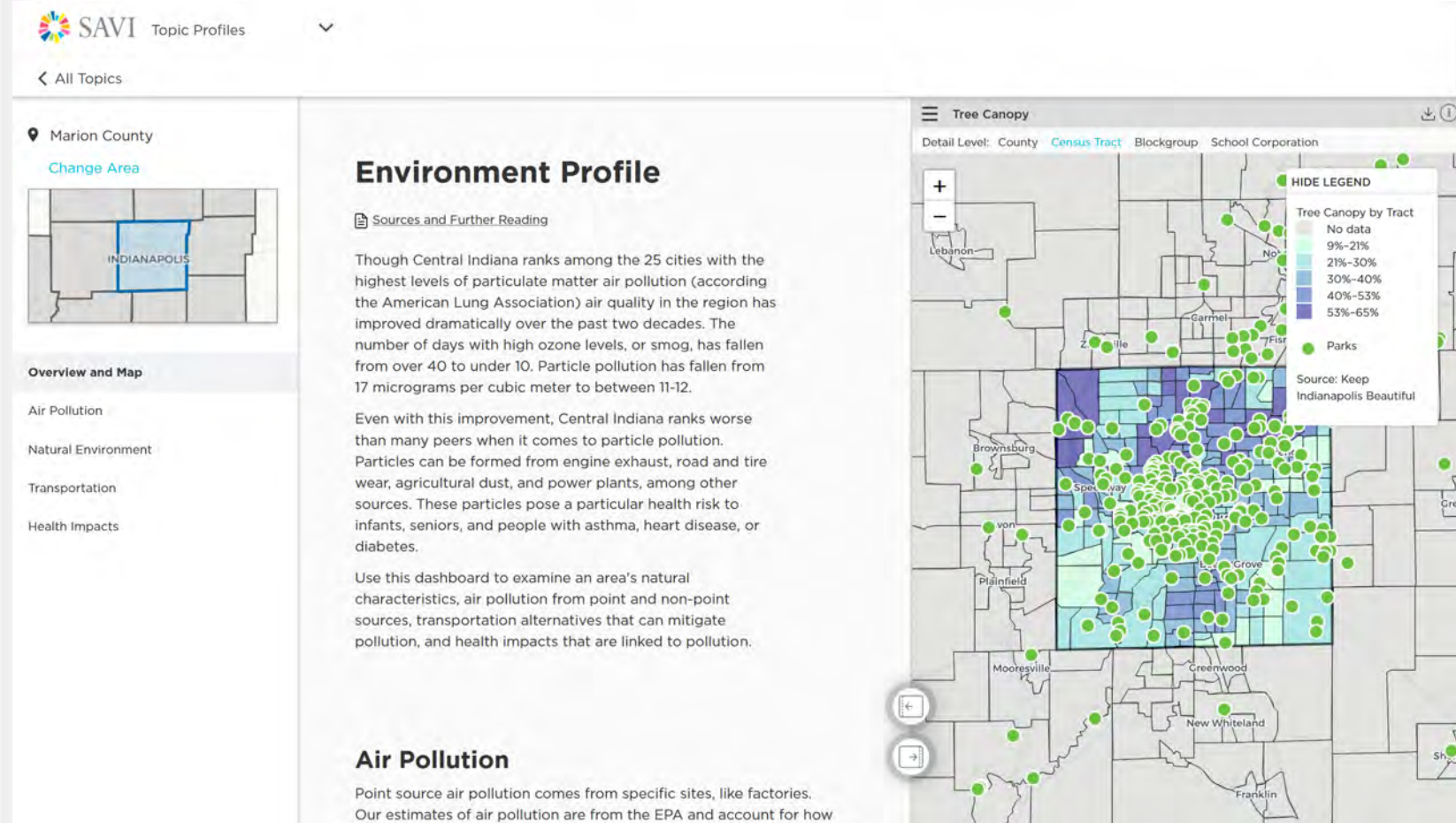
# Our index vs ParkServe Park Priorities
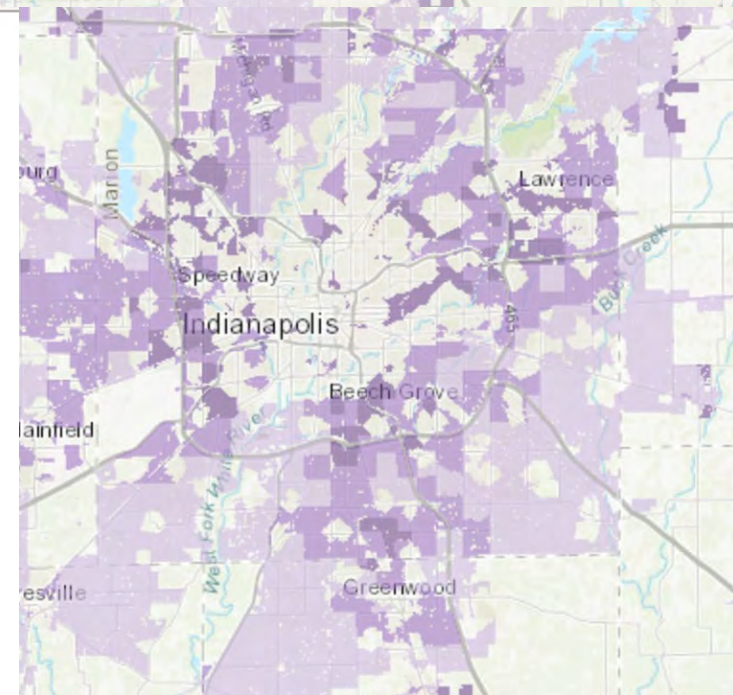
Key Differences:

- 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
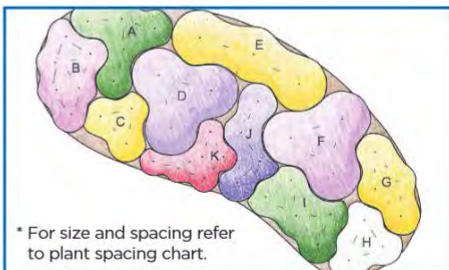




June 2020

## 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!

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Any questions?