

Shade Tree Prioritization Map: Planning Analysis



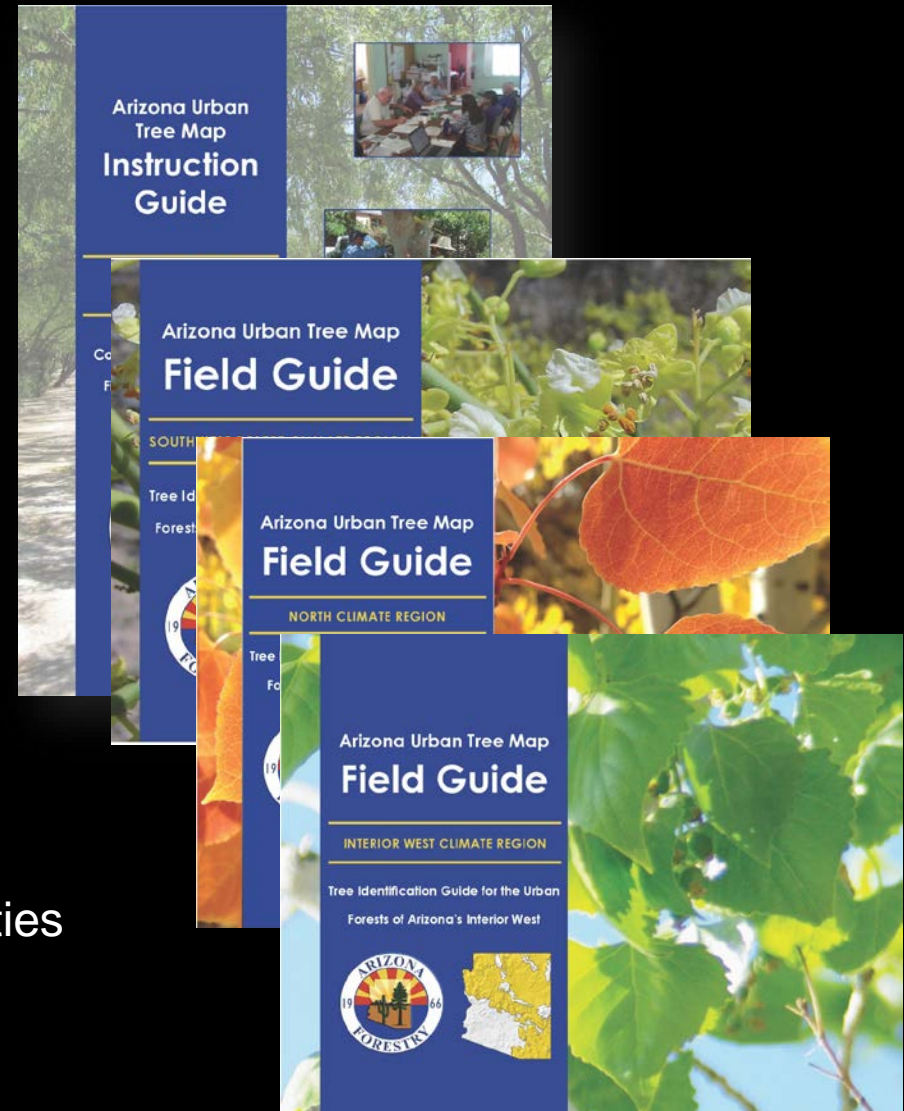
Setting the Stage

Setting the Stage



Urban Forest Resource Inventory

- 2012 Western Comp. Grant
- Partners
 - UA – ART Lab, SNRE, Campus Arboretum
 - 6 Pilot Communities
- Project Goals
 - Develop statewide database of existing urban forest inventories
 - Develop products to help communities conduct urban tree inventories
 - Train communities/volunteers





Setting the Stage

Products and Tools

Upload Web Application

- Analyzes data and produces a report based on data uploaded
- Report provides summary analysis based on information collected (tree cover, density, structure, insect and disease presence, etc.)
- Modified i-Tree Streets analysis, based on custom species lists (improved accuracy)

AZUTM: dffm.az.gov/azutm

[AZUTM MAPS](#) ■ [ABOUT](#) ■ [RESOURCES](#) ■ [UPLOAD](#) ■

COMMUNITY INVENTORIES

ARIZONA TREE GUIDES

Urban tree field guides tailored for volunteers and citizen scientists in Arizona. The guides are split into three of i-Tree Streets climate zones but feel free to mix and match the guides for your community.

i-Tree Streets' economic and environmental tree value analysis are based on reference cities within STRATUM Climate Zones developed by USDA-FS. Not until you upload your data to AZUTM to run the analysis, do you have to decide on a climate zone.



 Southwest Desert

 North

 Interior West



 **AZUTM Field Guide - Southwest Desert** 04/28/2015

Tree identification guide for select horticultural tree species found in Arizona and listed in i-Tree Streets' Southwest Desert climate zone.



 **AZUTM Field Guide - Interior West** 04/28/2015

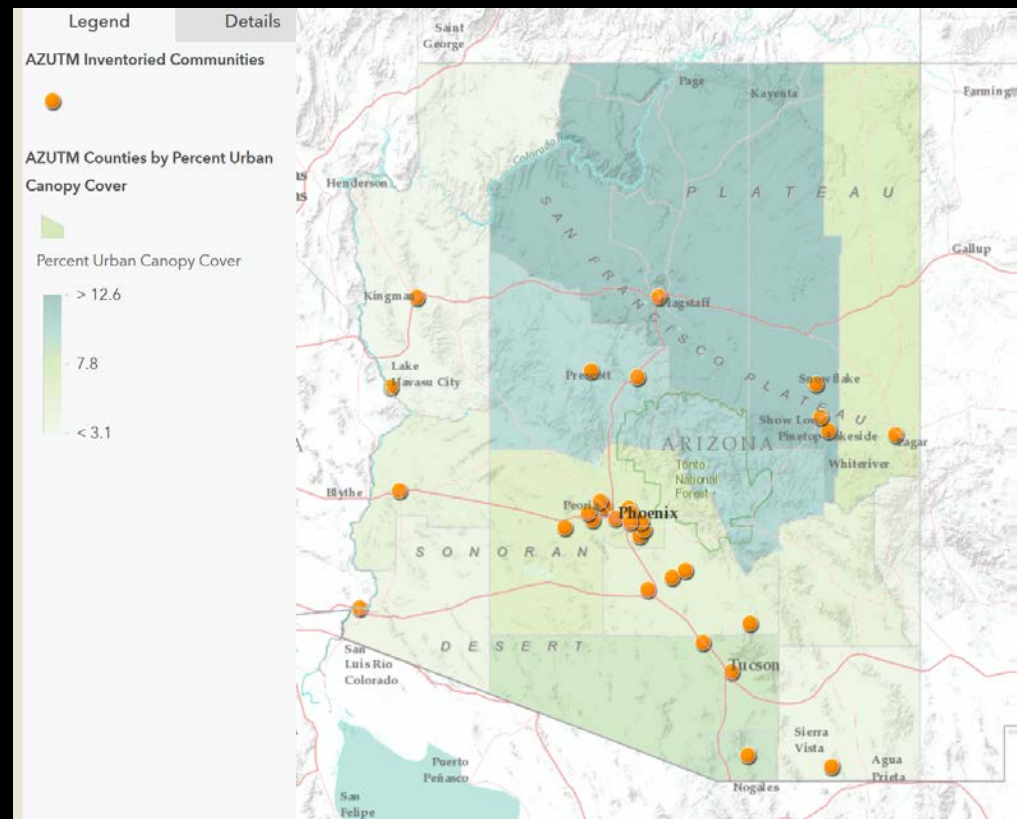
Tree identification guide for select horticultural tree species found in Arizona and listed in i-Tree Streets' Interior West climate zone.

Setting the Stage



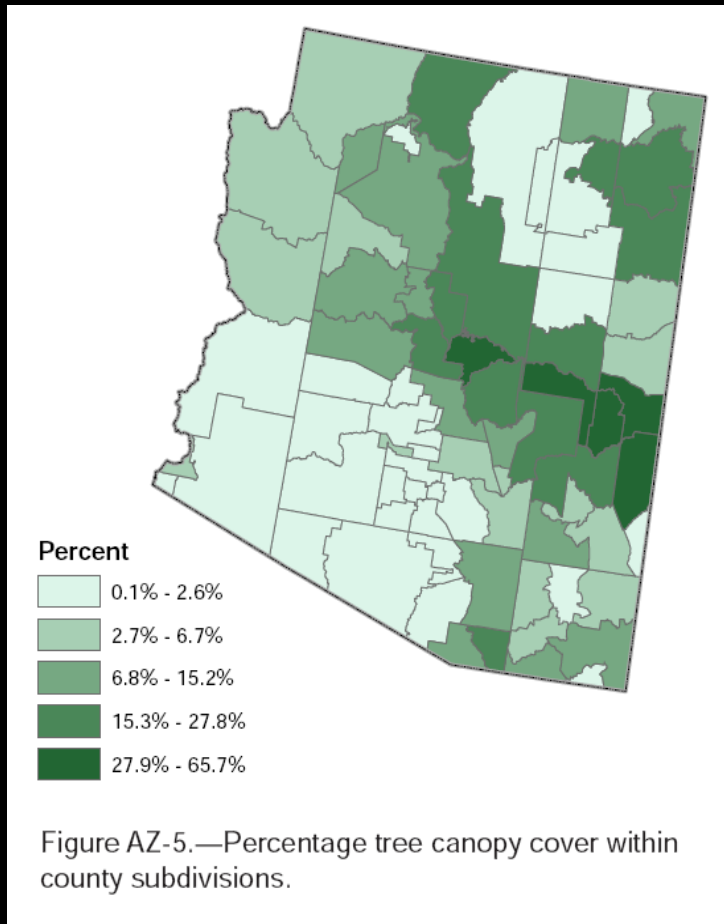
Statewide Urban Canopy Assessment

- Information Summarized
 - Submitted inventories
 - Tree Cities (29)
 - All incorporated communities (94)
- Results Generated
 - Estimated urban canopies
 - 28.8% - Pinetop/Lakeside
 - 18.5% - Flagstaff
 - 1.0% - Huachuca City and Tombstone

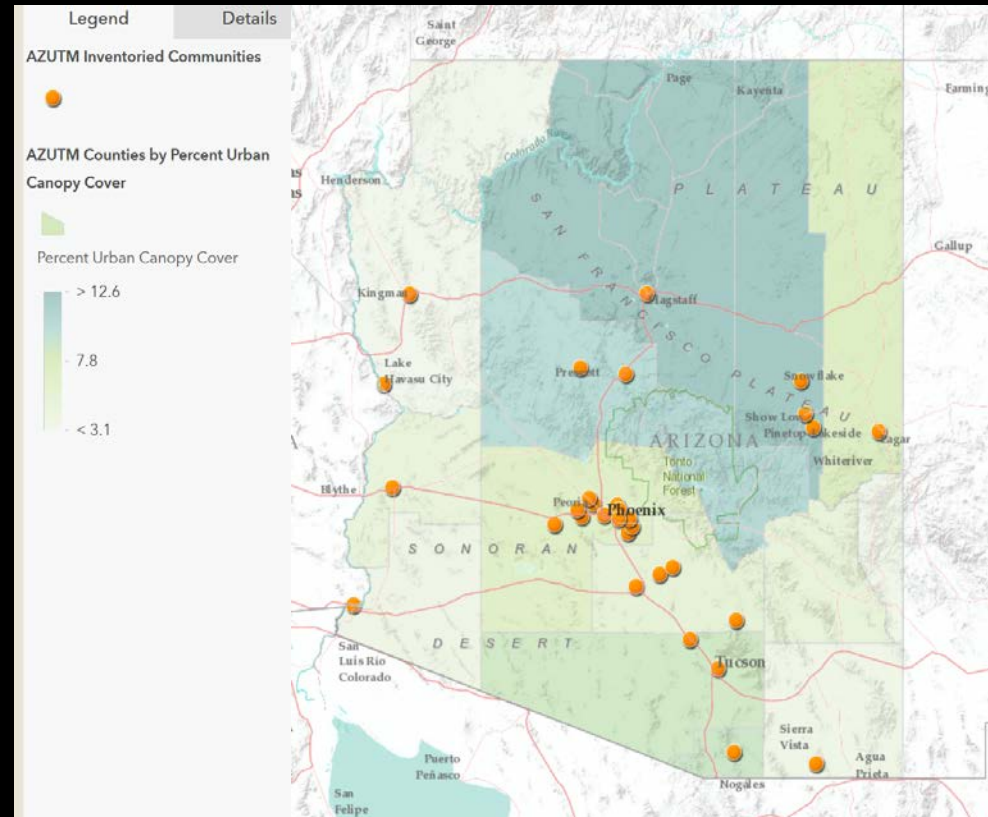


Setting the Stage

How'd we do?



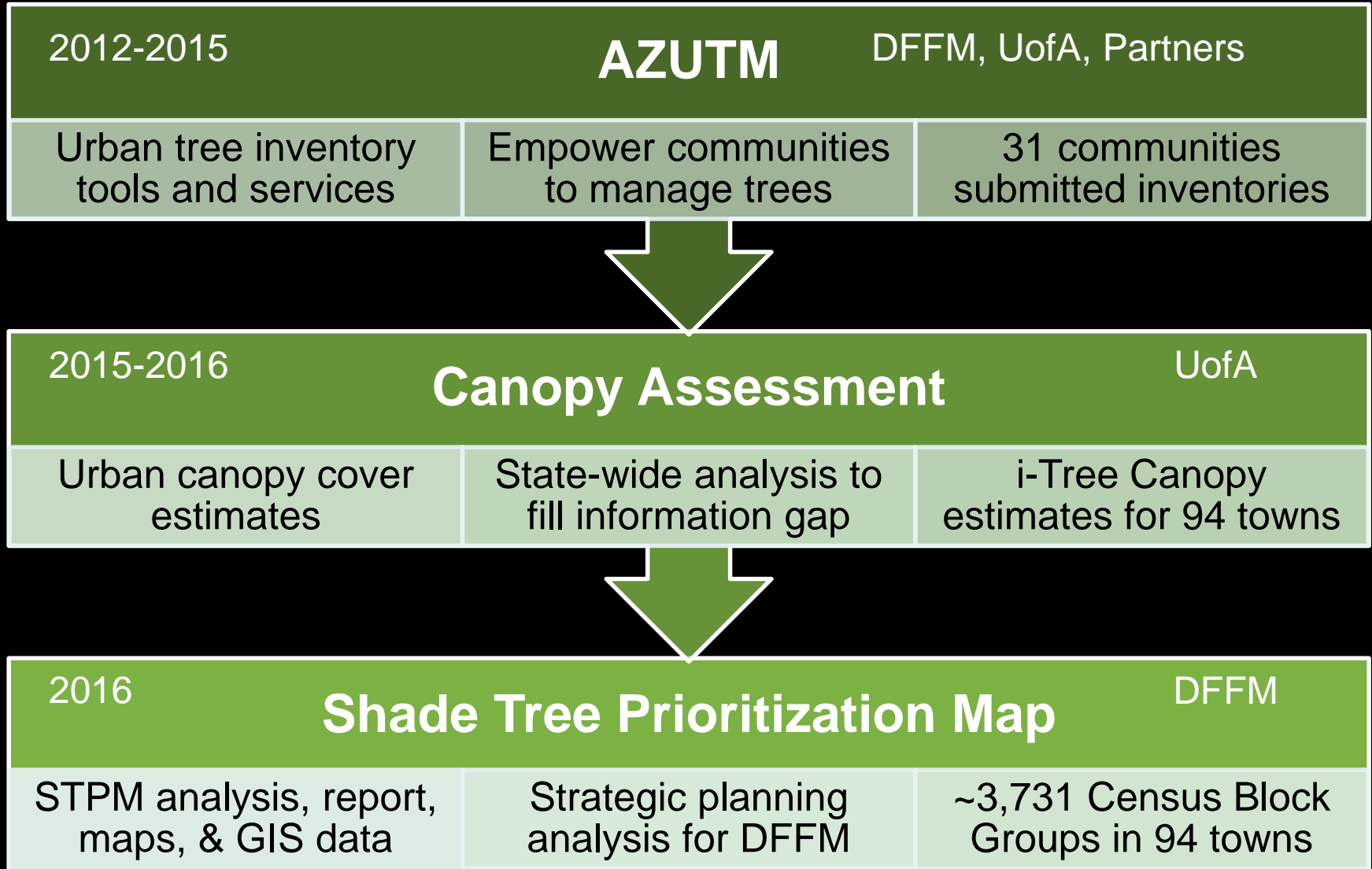
Nowak and Greenfield (GTR NRS-63, 2010)



UCF Program, DFFM, 2016



Setting the Stage

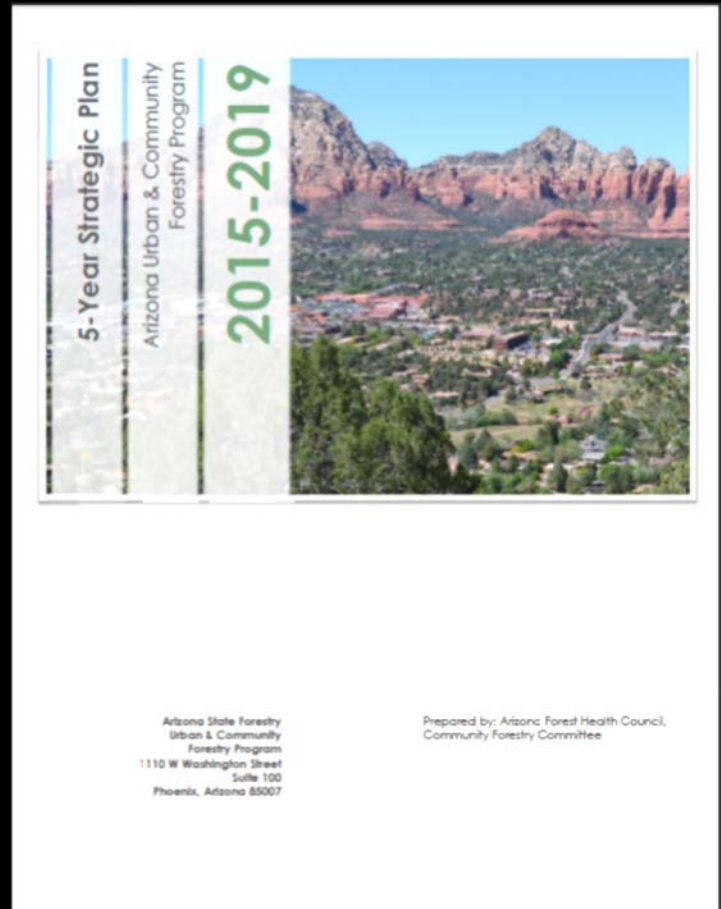




Setting the Stage

Shade Tree Prioritization Map

- UCF Programmatic Plan →
 - UCF Strategy to address DFFM – FAP Climate Change Goal #1
 - *“Develop a statewide priority map for shade tree planning programs in communities to identify “below average” tree canopy areas at risk to adverse effects from predicted climate change scenarios.”*



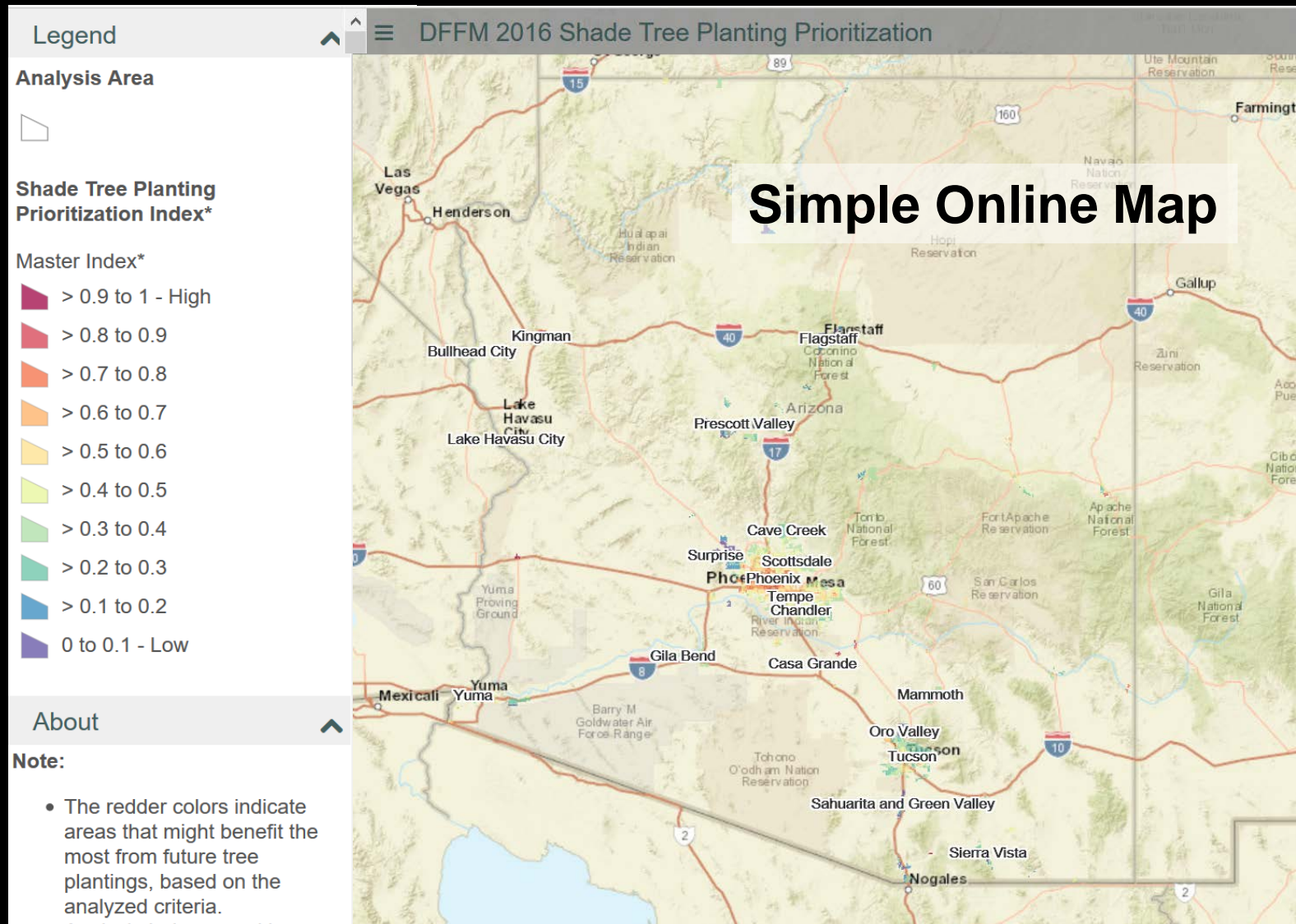


Setting the Stage

Shade Tree Prioritization Map

- Intent
 - Statewide
 - Tool that is easy-to-use // easy to understand
 - High-level view of urban canopy and planting needs
 - Useful for any community's planning efforts
 - Can inform granting decisions
- Determination of Analysis Parameters
 - CFC recommendations
 - UCF planning needs
 - Available data

Setting the Stage *(teaser)*



Methodology



Analysis Intent

- **Rapidly** and strategically **assess** Arizona's urban forest communities to inform Urban and Community Forestry planning
- **Identify** Arizona's **underserved cities and communities** based on state-wide, best available, and relevant socio-economic and environmental data
- **Account for** a city's **commitment to** their **urban forest** (sustainability) as it applies to UCF partnerships and projects
- **Keep** spatial and quantitative analysis **simple and transparent**
- Generate summaries and geospatial **products for internal and public dissemination**
- The analysis and products will **inform future DFFM priorities** for program delivery and may be **used** directly **by communities** for their management needs.



Parameters

1. Population
 - 2010 Census population density per Block Group
2. Urban Canopy Cover
 - i-Tree Canopy estimates per city [[DFFM's UFRI Canopy Analysis](#)]
3. Poverty
 - EPA Low-Income Index per Block Group
4. Traffic
 - EPA Traffic Proximity Index per Block Group
5. Sustainability
 - Tree City USA membership per city [[DFFM's 2015 Records](#)]
6. Air Quality
 - EPA's Ozone and PM 2.5 product per Block Group
7. Heat Island
 - DFFM's night time surface temperature and imperviousness per Block Group
8. ~~Food Security~~ – not included
 - No appropriate data found



Parameters

Index	Description	Data Source	Calculation
A Population Density	2010 Census population density per Census Block Group (pop / square mile)	EPA EJSCREEN ; Census Bureau	<i>Index</i> = normalized <i>population density</i>
B Lack of Canopy Cover	2015/2016 i-Tree Canopy urban canopy cover estimate per incorporated or major community (%)	UCF	<i>Index</i> = normalized <i>% urban tree cover</i>
C Low-Income	2010 Census population at below two times the poverty level per Census Block Group (%)	EPA EJSCREEN ; Census Bureau	<i>Index</i> = normalized <i>% Low-Income</i>
D Traffic Proximity	EPA traffic proximity index per Census Block Group	EPA EJSCREEN	<i>Index</i> = normalized <i>traffic proximity index</i>
E Sustainability	2016 Tree City USA status per incorporated community (1, 0)	Tree City USA	<i>Index</i> = normalized <i>Tree City USA status</i>
F Air Quality	Combination of EPA Ozone and PM 2.5 concentration scores per Census Block Group	EPA EJSCREEN	<i>Score</i> = normalized <i>Ozone concentration</i> + normalized <i>PM 2.5 concentration</i> <i>Index</i> = normalized <i>Score</i>
G Heat and Developed Imperviousness	Product of Nightly MODIS Land Surface Temperature (LST, 1 km resolution) averages (June 2013, 2014, 2015; in Fahrenheit) and NLCD 2011 Percent Developed Imperviousness (%; 30 m)	MODIS ; NLCD	<i>Score</i> = normalized <i>average MODIS LST</i> x normalized <i>NLCD Imperviousness</i> <i>Index</i> = normalized <i>Score</i>
Shade Tree Planting Prioritization Index	<p>The Master Score is the average of all sub-indices per analysis polygon. The Master Index is based on normalizing the Master Score per analysis polygon among towns with similar population sizes (2015 ASLD):</p> <ul style="list-style-type: none"> 1 to 1,000 6 communities 1,001 to 5,000 28 communities 5,001 to 10,000 16 communities 10,001 to 50,000 27 communities 50,001 to 100,000 7 communities 100,001 and larger 10 communities 	ASLD (2015 city population); Census Bureau	$Score = \frac{(A + B + C + D + E + F + G)}{7}$ <i>Index</i> = normalized <i>Scores</i> grouped by Population Class

Contributors




























- Arizona Community Forestry Committee
 - Parameter suggestions and discussion
- Advanced Resource Technology Lab, University of Arizona
 - Urban canopy cover analysis
- Arizona Department of Economic Security
 - Food security data discussion
- Arizona Remote Sensing Center, University of Arizona
 - MODIS Nightly Land Surface Temperature satellite images for June 2013-2015
- Association of Arizona Food Banks
 - Food security data discussion
- Climate Science Extension, University of Arizona
 - Urban Heat Island substitution and tree-climate interaction modeling (water use) discussion
- Cooperative Extension, University of Arizona
 - Help search for public tree care/planting NGOs in Arizona
- EJSCREEN, EPA and US Census
 - Geospatial environmental justice data (socio-economic and environmental factors)
- School of Geographical Sciences and Urban Planning, Arizona State University
 - Urban Heat Island substitute discussion
- USDA FS
 - Developed Imperviousness data (and Urban Heat Island data in 2017?)

Results and Products

STPM Ranking

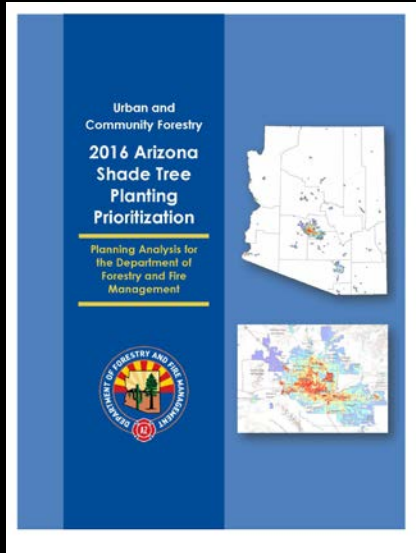


Table 3. 2016 Arizona Shade Tree Planting Prioritization Ranking. The Arbor Day Foundation logo  denotes 2016 Tree City USA communities.

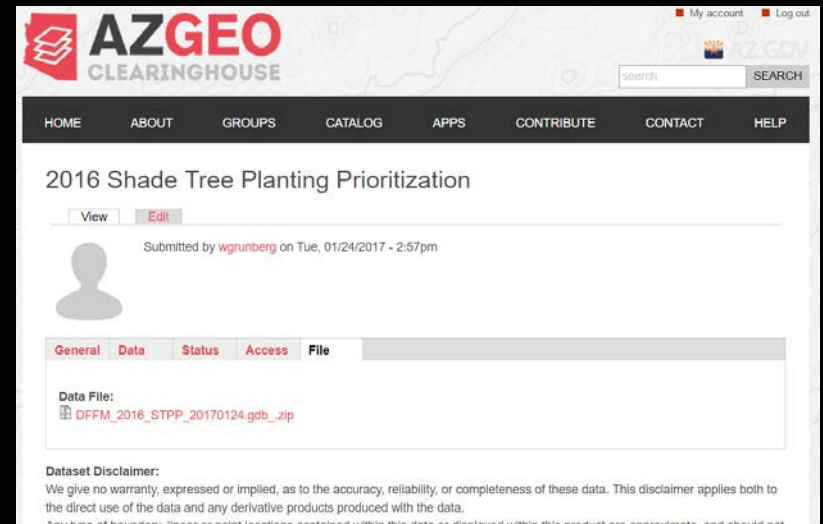
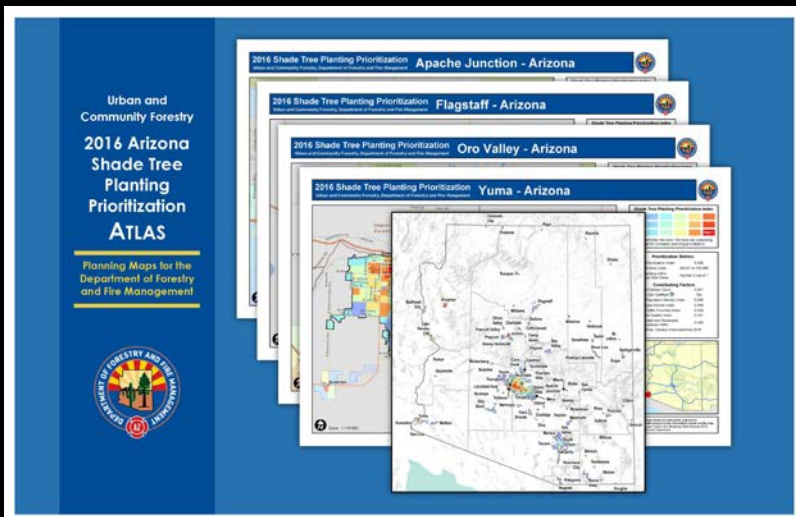
Population 1 to 1,000	1,001 to 5,000	5,001 to 10,000	10,001 to 50,000	50,001 to 100,000	100,001 and higher
<ol style="list-style-type: none"> 1. Patagonia  2. Duncan 3. Hayden 4. Winkelman 5. Jerome 6. Tusayan 	<ol style="list-style-type: none"> 1. Quartzsite  2. Eagar  3. Miami 4. Superior 5. Parker 6. Willcox 7. San Carlos 8. Chinle 9. Colorado City 10. Pima 11. Carefree 12. Mammoth 13. Fredonia 14. Benson 15. Tombstone 16. Clifton 17. St. Johns 18. Clarkdale 19. Springerville 20. Gila Bend 21. Kearny 22. Williams 23. Pinetop - Lakeside  24. Huachuca City 25. Taylor 26. Star Valley 27. Dewey Humboldt 28. Wellton 	<ol style="list-style-type: none"> 1. Guadalupe 2. Litchfield Park  3. South Tucson 4. Tolleson 5. Youngtown 6. Snowflake  7. Winslow 8. Globe 9. Holbrook 10. Thatcher 11. Kayenta 12. Safford 13. Cave Creek 14. Page 15. Wickenburg 16. Bisbee 	<ol style="list-style-type: none"> 1. Coolidge  2. Paradise Valley  3. Florence  4. Kingman  5. Prescott Valley  6. Marana  7. El Mirage 8. Camp Verde  9. San Luis 10. Apache Junction 11. Bullhead City 12. Somerton 13. Show Low  14. Fountain Hills 15. Maricopa 16. Eloy 17. Douglas 18. Queen Creek 19. Sierra Vista 20. Cottonwood 21. Nogales 22. Chino Valley 23. Payson 24. Oro Valley 25. Prescott 26. Sedona 27. Sahuarita & Green-Valley 	<ol style="list-style-type: none"> 1. Avondale  2. Yuma  3. Lake Havasu City  4. Casa Grande  5. Buckeye  6. Flagstaff  7. Goodyear 	<ol style="list-style-type: none"> 1. Tempe  2. Phoenix  3. Glendale  4. Mesa  5. Peoria  6. Chandler  7. Scottsdale  8. Gilbert  9. Tucson  10. Surprise



STPM Online Products



- Report
- Atlas (PDF)
- Simple and Advanced Interactive Maps
- GIS Data Download





Arizona



Advanced Interactive Map



Layer List

Operational Layers

- ☒ Analysis Area
- ☒ Shade Tree Planting Prioritization Index*

Master Index*

- > 0.9 to 1 - High
- > 0.8 to 0.9
- > 0.7 to 0.8
- > 0.6 to 0.7
- > 0.5 to 0.6
- > 0.4 to 0.5
- > 0.3 to 0.4
- > 0.2 to 0.3
- > 0.1 to 0.2
- 0 to 0.1 - Low

- ☐ Population Density Index*
- ☐ Lack of Canopy Cover Index
- ☐ Low Income Index*
- ☐ Traffic Proximity Index*
- ☐ Sustainability Index

+

-

Home

Layers

Flagstaff

Show search results for Flagstaff

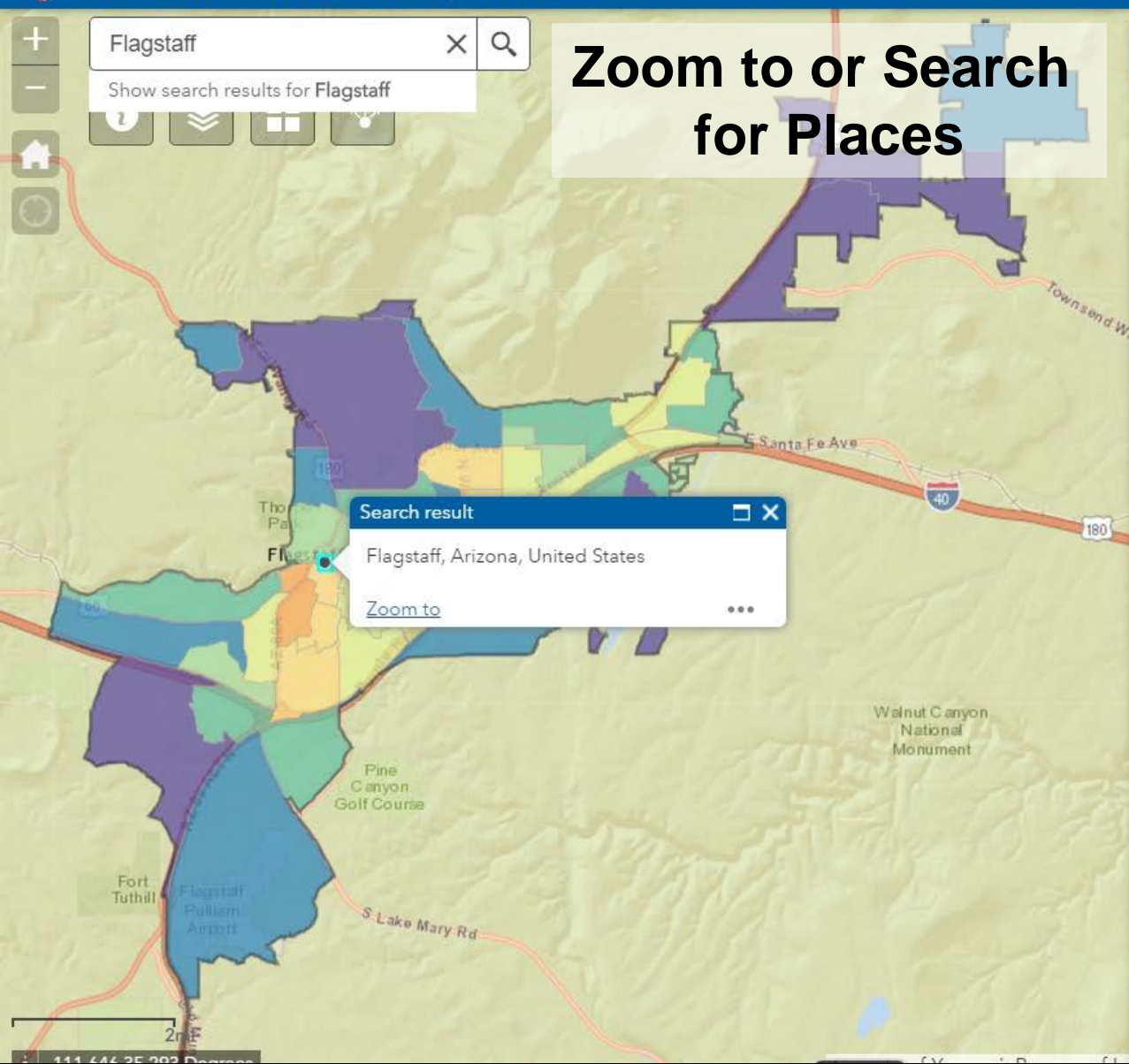
Info

Layers

Full Screen

Print

Zoom to or Search for Places



Layer List

Operational Layers

- ☒ Analysis Area
- ☒ Shade Tree Planting Prioritization Index*

Master Index*

- > 0.9 to 1 - High
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- ☐ Traffic Proximity Index*

Arizona



Change Map Background

Basemap Gallery

Dark Gray Canvas	Imagery	Imagery with Labels
Light Gray Canvas	National Geographic	Oceans
OpenStreetMap	Streets	Terrain with Labels

Layer List

Operational Layers

- ☒ Analysis Area
- ☒ Shade Tree Planting Prioritization Index*

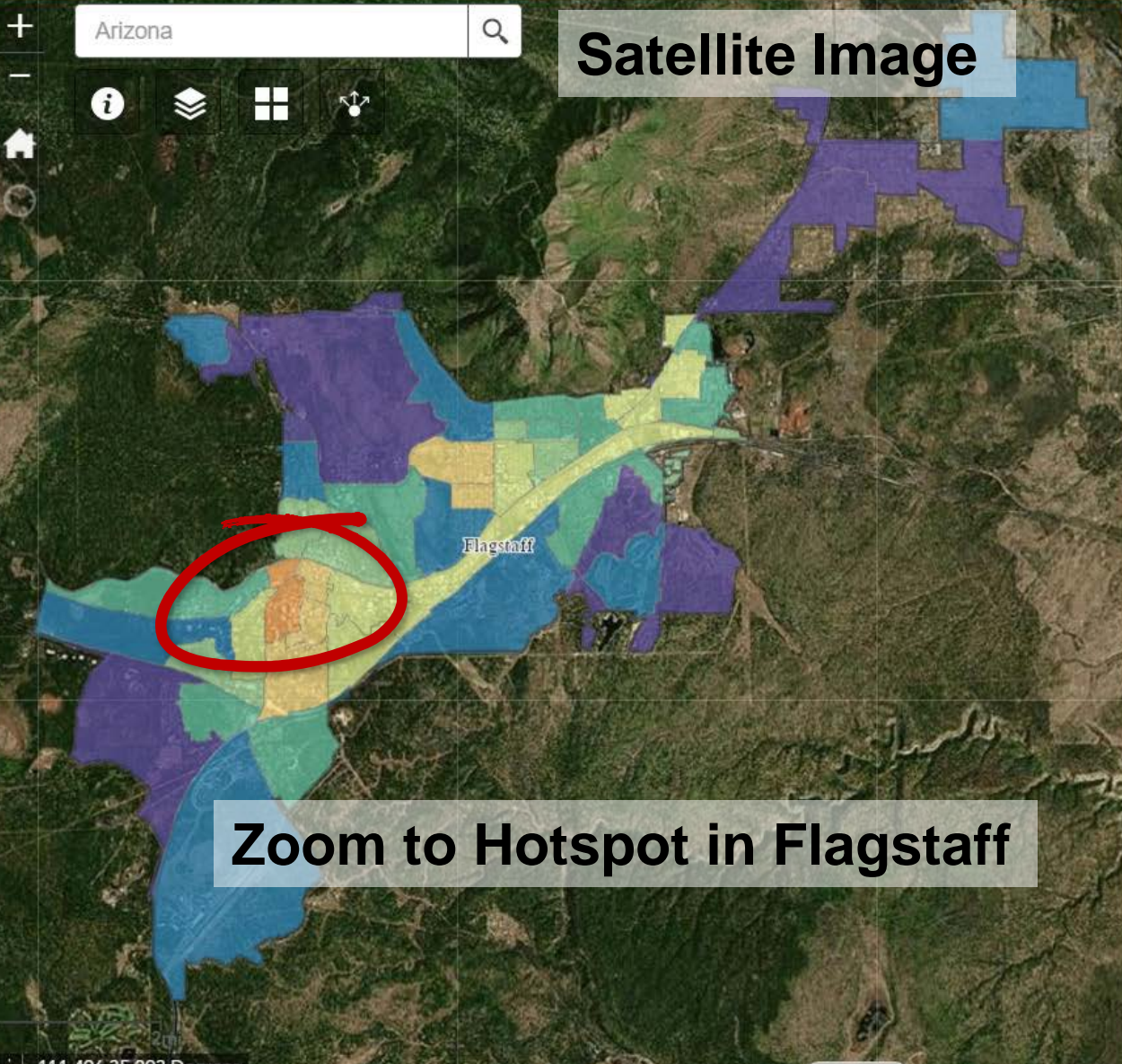
Master Index*

- > 0.9 to 1 - High
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- > 0.7 to 0.8
- > 0.6 to 0.7
- > 0.5 to 0.6
- > 0.4 to 0.5
- > 0.3 to 0.4
- > 0.2 to 0.3
- > 0.1 to 0.2
- 0 to 0.1 - Low

- ☐ Population Density Index*
- ☐ Lack of Canopy Cover Index
- ☐ Low Income Index*
- ☐ Traffic Proximity Index*

Map navigation controls: zoom in (+), zoom out (-), search (magnifying glass), info (i), layers (stack of squares), full screen (four squares), and share (network icon).

Satellite Image



Zoom to Hotspot in Flagstaff

Layer List

Operational Layers

☒ Analysis Area

☒ Shade Tree Planting Prioritization Index*

Master Index*

- > 0.9 to 1 - High
- > 0.8 to 0.9
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- > 0.3 to 0.4
- > 0.2 to 0.3
- > 0.1 to 0.2
- 0 to 0.1 - Low

“Hot”
↑
 Prioritization
Index
↓
“Cold”

☐ Population Density Index*

☐ Lack of Canopy Cover Index

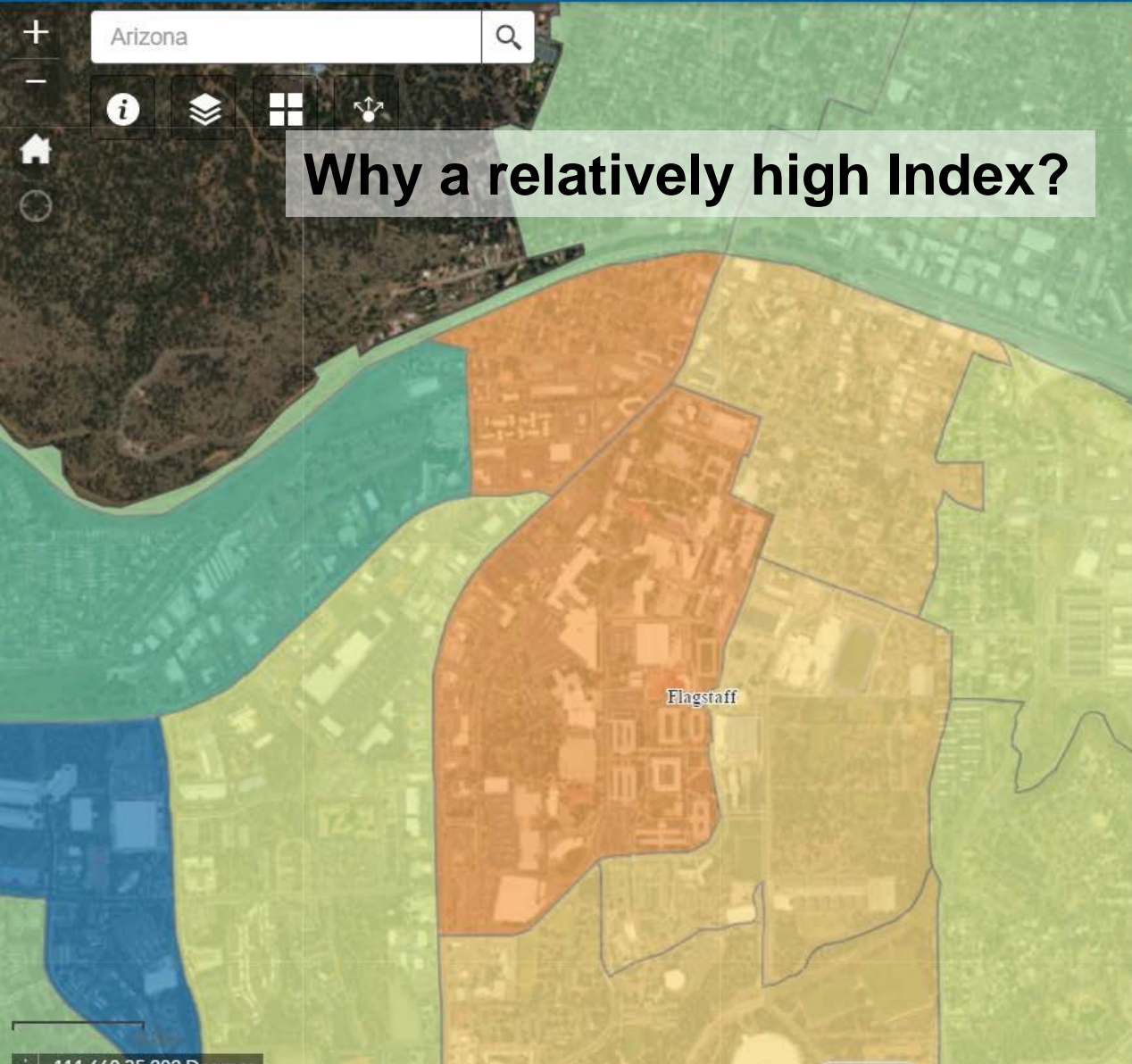
☐ Low Income Index*

☐ Traffic Proximity Index*

Arizona



Why a relatively high Index?



Layer List

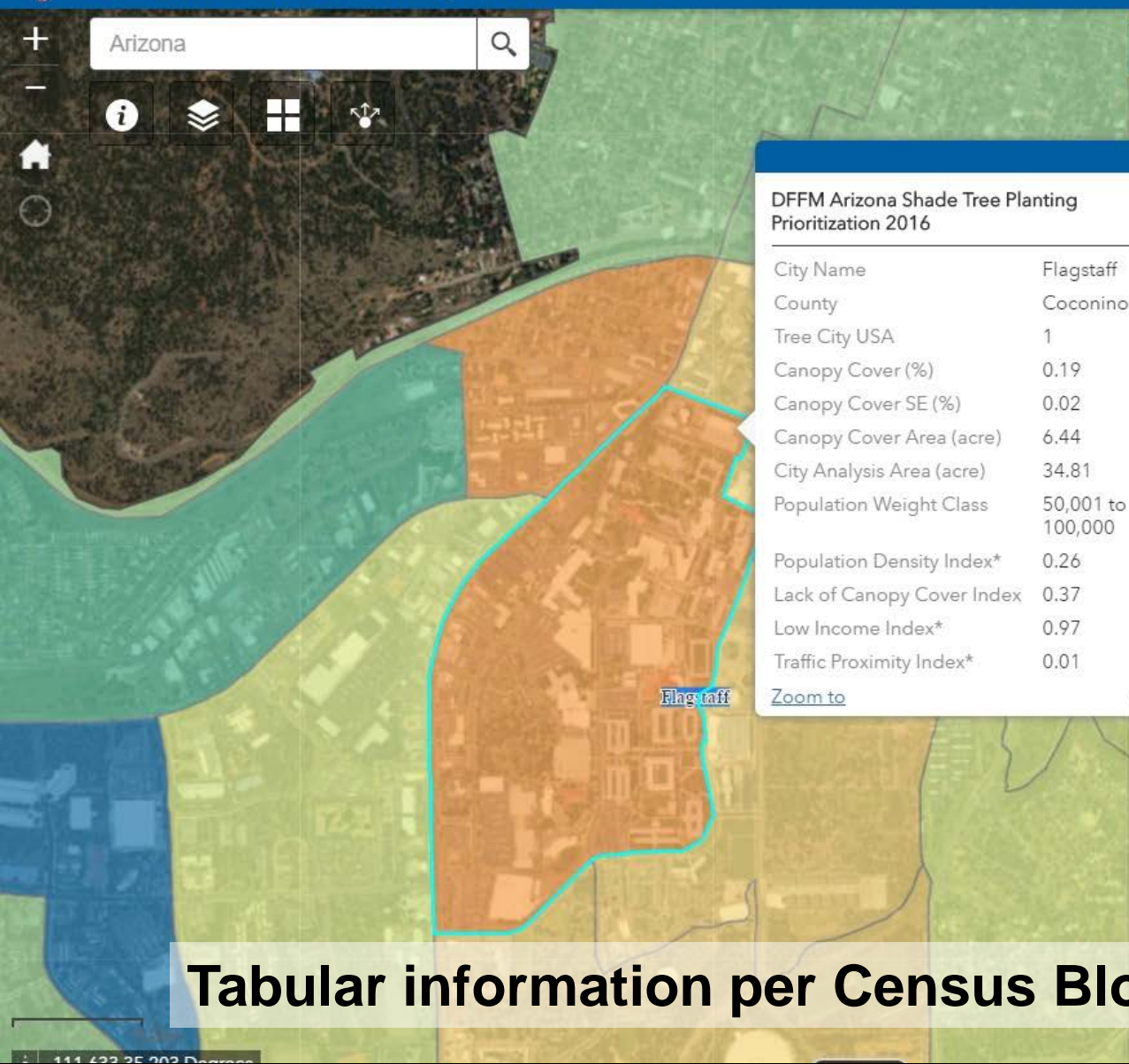
Operational Layers

- ☒ Analysis Area
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Master Index*

- ☒ > 0.9 to 1 - High
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- > 0.4 to 0.5
- > 0.3 to 0.4
- > 0.2 to 0.3
- > 0.1 to 0.2
- 0 to 0.1 - Low

- ☐ Population Density Index*
- ☐ Lack of Canopy Cover Index
- ☐ Low Income Index*
- ☐ Traffic Proximity Index*



DFFM Arizona Shade Tree Planting Prioritization 2016

City Name	Flagstaff
County	Coconino
Tree City USA	1
Canopy Cover (%)	0.19
Canopy Cover SE (%)	0.02
Canopy Cover Area (acre)	6.44
City Analysis Area (acre)	34.81
Population Weight Class	50,001 to 100,000
Population Density Index*	0.26
Lack of Canopy Cover Index	0.37
Low Income Index*	0.97
Traffic Proximity Index*	0.01

[Zoom to](#)

Layer List

Operational Layers

- ☒ Analysis Area
- ☒ Shade Tree Planting Prioritization Index*
- ☐ Master Index*

Legend for Master Index*:

- > 0.9 to 1 - High
- > 0.8 to 0.9
- > 0.7 to 0.8
- > 0.6 to 0.7
- > 0.5 to 0.6
- > 0.4 to 0.5
- > 0.3 to 0.4
- > 0.2 to 0.3
- > 0.1 to 0.2
- 0 to 0.1 - Low

☐ Population Density Index*

☐ Lack of Canopy Cover Index

☐ Low Income Index*

☐ Traffic Proximity Index*

Tabular information per Census Block Group



Arizona



Population Density Index



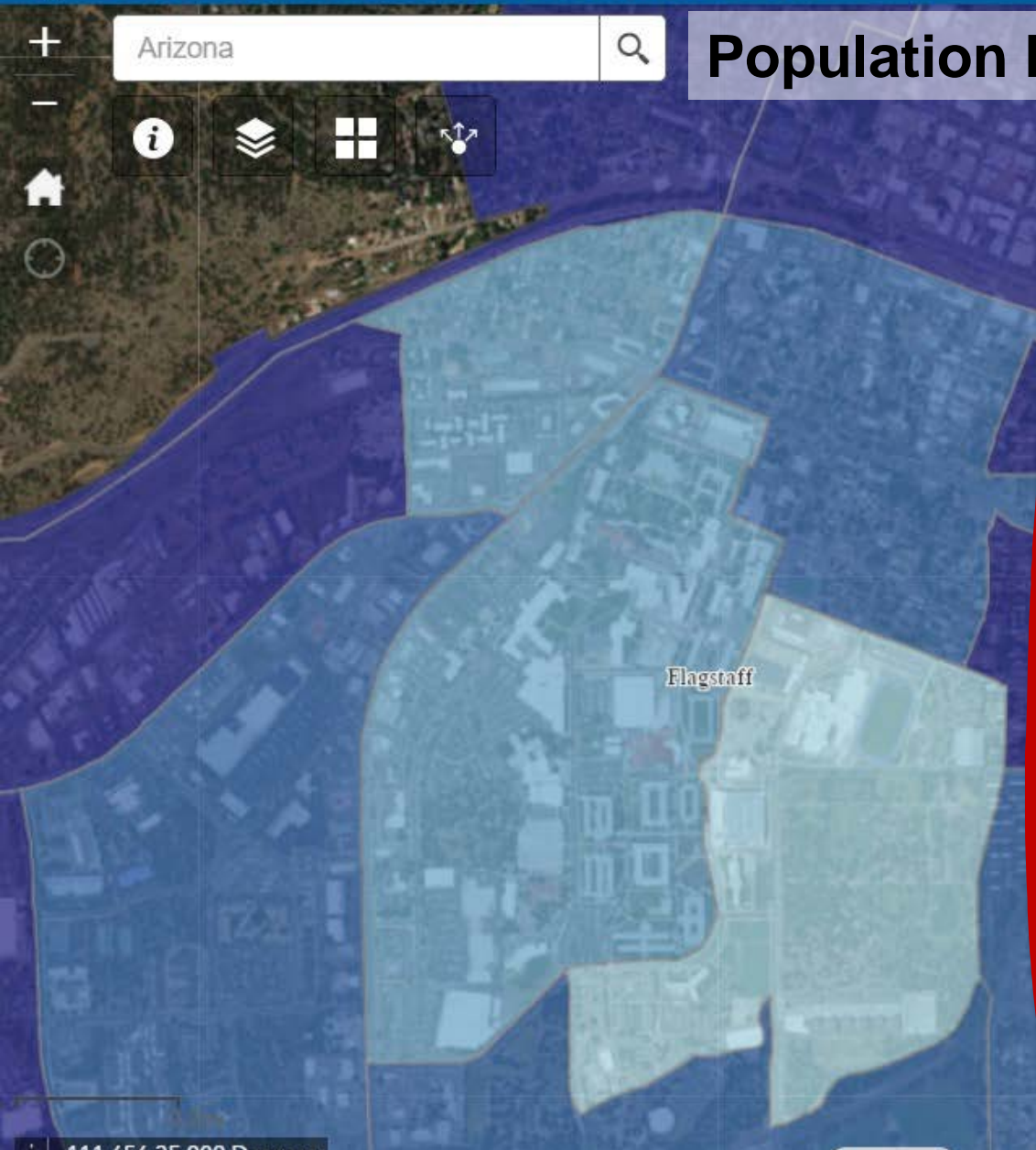
Operational Layers

- ☒ Analysis Area
- ☐ Shade Tree Planting Prioritization Index*
- ☒ Population Density Index*

Population Density Index*

- > 0.9 to 1 - High
- > 0.8 to 0.9
- > 0.7 to 0.8
- > 0.6 to 0.7
- > 0.5 to 0.6
- > 0.4 to 0.5
- > 0.3 to 0.4
- > 0.2 to 0.3
- > 0.1 to 0.2
- 0 to 0.1 - Low

- ☐ Lack of Canopy Cover Index





Arizona













City-wide Lack of Canopy Cover Index

Layer List

- ☐ Shade Tree Planting Prioritization Index*
- ☐ Population Density Index*
- ☒ Lack of Canopy Cover Index
- ☐ Low Income Index*
- ☐ Traffic Proximity Index*

Lack of Canopy Cover Index

-  > 0.9 to 1 - High
-  > 0.8 to 0.9
-  > 0.7 to 0.8
-  > 0.6 to 0.7
-  > 0.5 to 0.6
-  > 0.4 to 0.5
-  > 0.3 to 0.4
-  > 0.2 to 0.3
-  > 0.1 to 0.2
-  0 to 0.1 - Low

Flagstaff

0.2mi

111.45435203 Degrees



Arizona



Low Income Index













☐ Lack of Canopy Cover Index



☒ Low Income Index*



Low Income Index*

-  > 0.9 to 1 - High
-  > 0.8 to 0.9
-  > 0.7 to 0.8
-  > 0.6 to 0.7
-  > 0.5 to 0.6
-  > 0.4 to 0.5
-  > 0.3 to 0.4
-  > 0.2 to 0.3
-  > 0.1 to 0.2
-  0 to 0.1 - Low

☐ Traffic Proximity Index*



☐ Sustainability Index



☐ Air Quality Index*



Flagstaff

0.2mi

111.45835203 Degrees



Arizona



Traffic Proximity Index



☐ Lack of Canopy Cover Index




☐ Low Income Index*





☒ Traffic Proximity Index*





Traffic Proximity Index*


 > 0.9 to 1 - High


 > 0.8 to 0.9


 > 0.7 to 0.8


 > 0.6 to 0.7


 > 0.5 to 0.6

 > 0.4 to 0.5

 > 0.3 to 0.4

 > 0.2 to 0.3

 > 0.1 to 0.2

 0 to 0.1 - Low

☐ Sustainability Index



☐ Air Quality Index*



Flagstaff

0.2mi

111.44435203 Degrees











Arizona

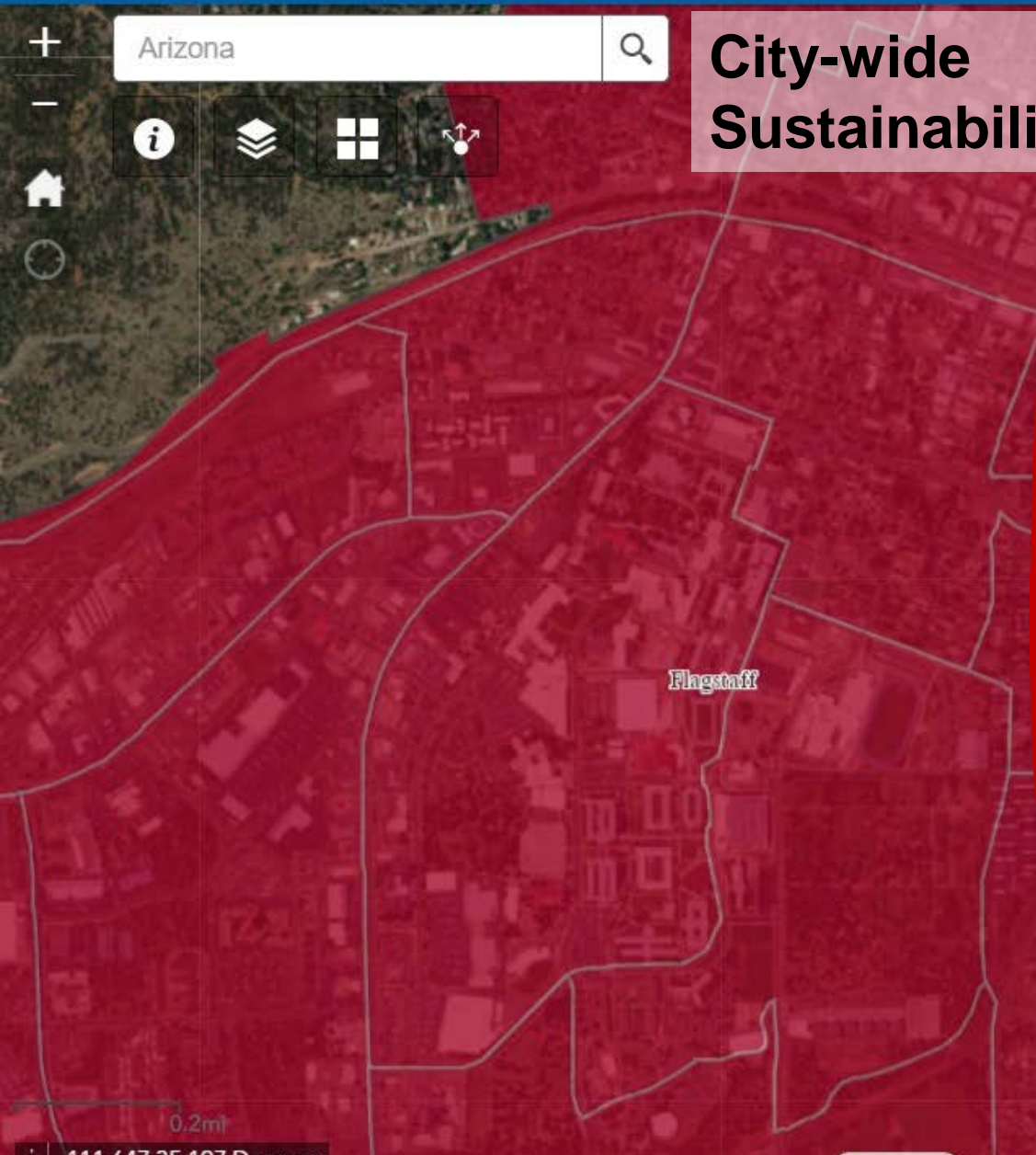
City-wide Sustainability Index

Layer List

- ☐ Traffic Proximity Index*
- ☒ Sustainability Index

Sustainability Index

 -  > 0.9 to 1 - High
 -  > 0.7 to 0.9
 -  > 0.7 to 0.7
 -  > 0.6 to 0.7
 -  > 0.5 to 0.6
 -  > 0.4 to 0.5
 -  > 0.3 to 0.4
 -  > 0.2 to 0.3
 -  > 0.1 to 0.2
 -  0 to 0.1 - Low
- ☐ All Quality Index*
- ☐ Heat and Developed Imperviousness Index*
- ☐ Average Master Index by City



Arizona

Air Quality Index (Ozone, PM 2.5)



Flagstaff

0.2mi

111.64235203 Degrees

- ☐ Traffic Proximity Index*
 - ☐ Sustainability Index
 - ☒ Air Quality Index*
 - ☐ Heat and Developed Imperviousness Index*
 - ☐ Average Master Index by City
- Air Quality Index***
- > 0.9 to 1 - High
 - > 0.8 to 0.9
 - > 0.7 to 0.8
 - > 0.6 to 0.7
 - > 0.5 to 0.6
 - > 0.4 to 0.5
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Arizona



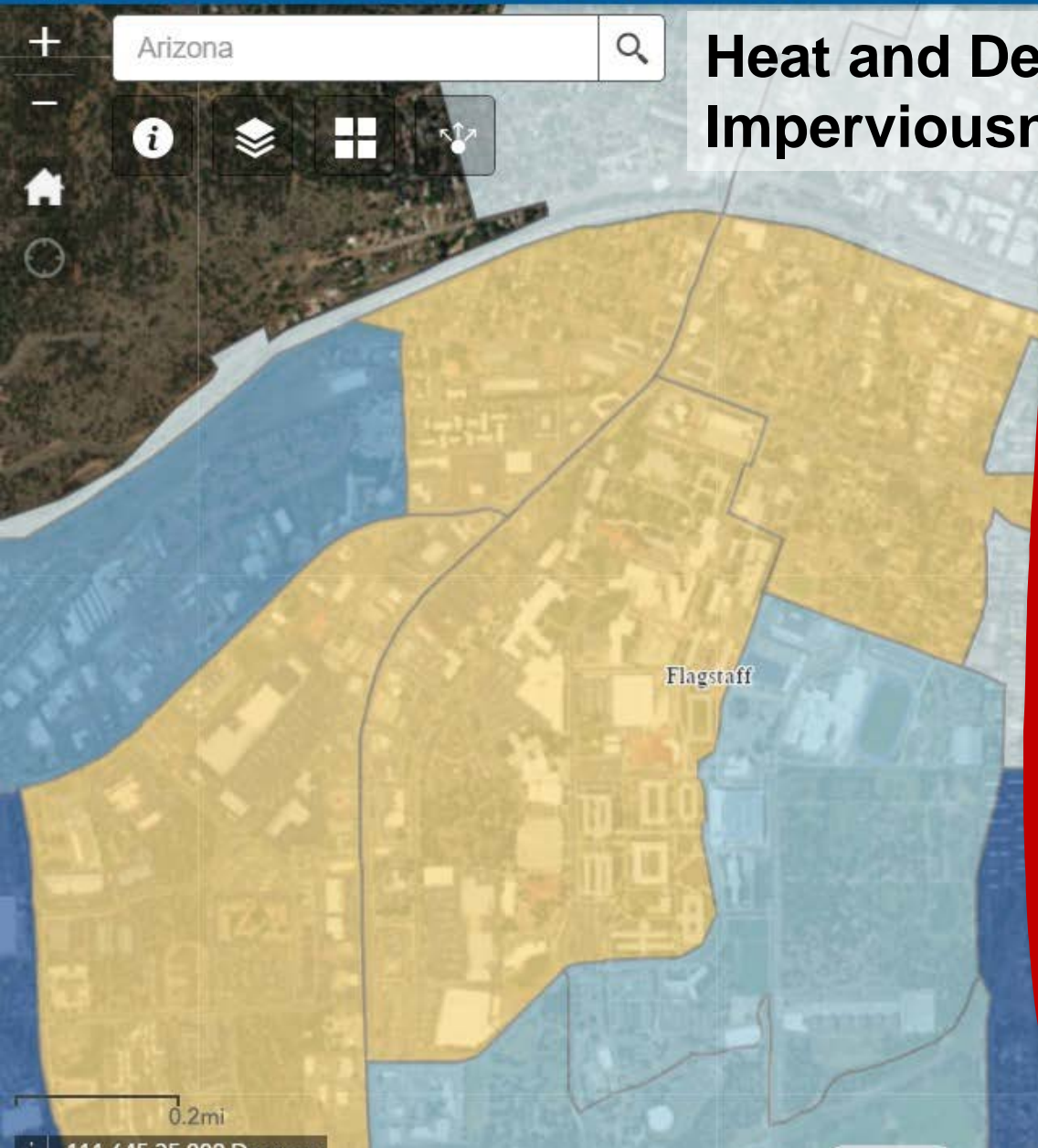
Heat and Developed Imperviousness Index

- ☐ Traffic Proximity Index*
- ☐ Sustainability Index
- ☐ Air Quality Index*
- ☒ Heat and Developed Imperviousness Index*

Heat and Developed Imperviousness Index*

- > 0.9 to 1 - High
- > 0.8 to 0.9
- > 0.7 to 0.8
- > 0.6 to 0.7
- > 0.5 to 0.6
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- 0 to 0.1 - Low

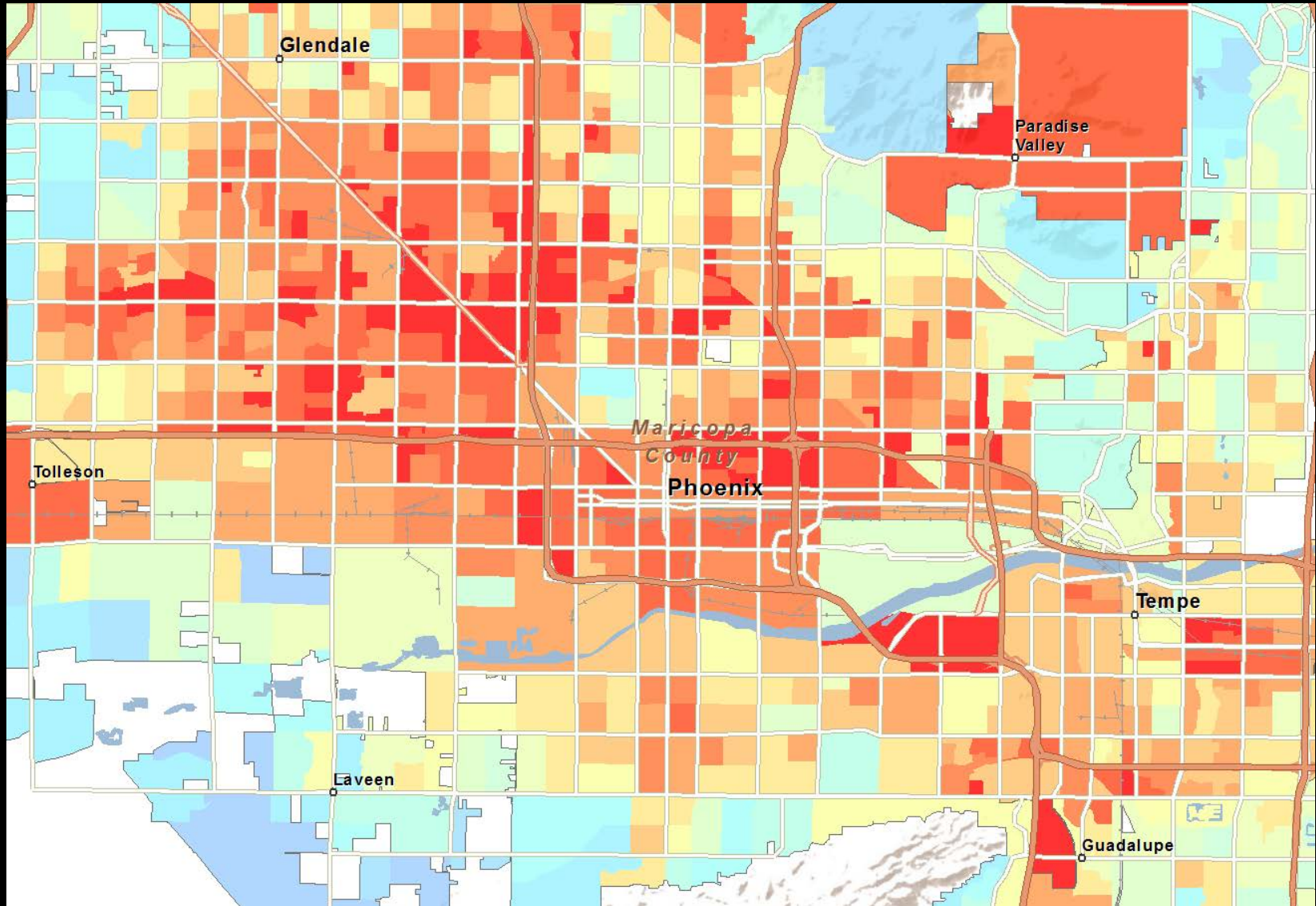
- ☐ Average Master Index by City



0.2mi

111.645 35.202 Degrees

Example from Phoenix, AZ





Additional Information

- Shade Tree Planting Prioritization products at:
 - <https://dffm.az.gov/forestry-community-forestry/urban-community-forestry/projects/stpp>
- Tech questions and suggestions to Wolfgang Grunberg:
 - WGrunberg@dffm.az.gov



Thank You



Alix Rogstad

ARogstad@dfm.az.gov
602.771.1427

Urban & Community Forestry Program |
Forest Health Program,
Arizona Department of Forestry
and Fire Management
Phoenix, Arizona