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
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?

Figure AZ-5.—Percentage tree canopy cover within county subdivisions.

UCF Program, DFFM, 2016

Legend

AZUTM Inventoried Communities

Percent Urban Canopy Cover

Legend

AZUTM Counties by Percent Urban Canopy Cover

- 0.1% - 2.6%
- 2.7% - 6.7%
- 6.8% - 15.2%
- 15.3% - 27.8%
- 27.9% - 65.7%

Nowak and Greenfield (GTR NRS-63, 2010)
Setting the Stage

2012-2015
AZUTM
- Urban tree inventory tools and services
- Empower communities to manage trees
- 31 communities submitted inventories
DFFM, UofA, Partners

2015-2016
Canopy Assessment
- Urban canopy cover estimates
- State-wide analysis to fill information gap
- i-Tree Canopy estimates for 94 towns
UofA

2016
Shade Tree Prioritization Map
- STPM analysis, report, maps, & GIS data
- Strategic planning analysis for DFFM
- ~3,731 Census Block Groups in 94 towns
DFFM
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)

Simple Online Map
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

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
<th>Data Source</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Population Density</td>
<td>2010 Census population density per Census Block Group (pop / square mile)</td>
<td>EPA EJSCREEN; Census Bureau</td>
<td>Index = normalized population density</td>
</tr>
<tr>
<td>B Lack of Canopy Cover</td>
<td>2015/2016 i-Tree Canopy urban canopy cover estimate per incorporated or major community (%)</td>
<td>UCF</td>
<td>Index = normalized % urban tree cover</td>
</tr>
<tr>
<td>C Low-Income</td>
<td>2010 Census population at below two times the poverty level per Census Block Group (%)</td>
<td>EPA EJSCREEN; Census Bureau</td>
<td>Index = normalized % Low-Income</td>
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<tr>
<td>D Traffic Proximity</td>
<td>EPA traffic proximity index per Census Block Group</td>
<td>EPA EJSCREEN</td>
<td>Index = normalized traffic proximity index</td>
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<tr>
<td>E Sustainability</td>
<td>2016 Tree City USA status per incorporated community (1, 0)</td>
<td>Tree City USA</td>
<td>Index = normalized Tree City USA status</td>
</tr>
<tr>
<td>F Air Quality</td>
<td>Combination of EPA Ozone and PM 2.5 concentration scores per Census Block Group</td>
<td>EPA EJSCREEN</td>
<td>Score = normalized Ozone concentration + normalized PM 2.5 concentration</td>
</tr>
<tr>
<td>G Heat and Developed Imperviousness</td>
<td>Product of Nightly MODIS Land Surface Temperature (LST, 1 km resolution) averages (June 2013, 2014, 2015; in Fahrenheit) and NLCD 2011 Percent Developed Imperviousness (%)</td>
<td>MODIS; NLCD</td>
<td>Index = normalized Score</td>
</tr>
</tbody>
</table>
| Shade Tree Planting Prioritization Index | 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):  
  - 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 = $\frac{(A + B + C + D + E + F + G)}{7}$  
Index = normalized Scores 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.

<table>
<thead>
<tr>
<th>Population 1 to 1,000</th>
<th>1,001 to 5,000</th>
<th>5,001 to 10,000</th>
<th>10,001 to 50,000</th>
<th>50,001 to 100,000</th>
<th>100,001 and higher</th>
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<tbody>
<tr>
<td>15. Tombstone</td>
<td>15. Wickenburg</td>
<td>15. Wickenburg</td>
<td>15. Maricopa</td>
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<td>17. Douglas</td>
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<td>18. Queen Creek</td>
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<td>19. Sierra Vista</td>
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<td>20. Cottonwood</td>
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<td>21. Nogales</td>
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<td>22. Chino Valley</td>
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<td>23. Payson</td>
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<td>24. Oro Valley</td>
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<td>25. Prescott</td>
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<td>26. Sedona</td>
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<td></td>
<td>27. Sahuarita &amp; Green-Valley</td>
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</tr>
</tbody>
</table>
STPM Online Products

- Report
- Atlas (PDF)
- Simple and Advanced Interactive Maps
- GIS Data Download
Advanced Interactive Map
2016 Shade Tree Planting Prioritization

Zoom to or Search for Places

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*
Change Map Background
Satellite Image

Zoom to Hotspot in Flagstaff

Prioritization Index

“Hot”

“Cold”
Why a relatively high Index?
### Tabular Information per Census Block Group

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

**Legend:**
- Green: 0 to 0.1 - Low
- Yellow: 0.1 to 0.2
- Orange: 0.2 to 0.3
- Red: 0.3 to 0.4
- Dark Red: 0.4 to 0.5
- Maroon: 0.5 to 0.6
- Dark Purple: 0.6 to 0.7
- Terra Cotta: 0.7 to 0.8
- Coral: 0.8 to 0.9
- Purple: > 0.9 to 1 - High
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
City-wide Lack of Canopy Cover 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
Air Quality Index (Ozone, PM 2.5)

<table>
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<td>&gt; 0.9 to 1 - High</td>
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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
- > 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
Example from Phoenix, AZ
Additional Information

• Shade Tree Planting Prioritization products at:

• Tech questions and suggestions to Wolfgang Grunberg:
  - WGrunberg@dffm.az.gov
Thank You

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