The J-Sprawl as a Sustainability Indicator: Analyzing ASU Faculty
INTRODUCTION
INTRODUCTION

- Individual sustainability values
- Personal mobility and climate change
- City level sustainability and their choices
- Universities role in sustainability and the influence of
  - ASU as a city
  - Their responsibilities to advocating for sustainability
INTRODUCTION

- A need to assess advocacy in the lens of sustainable transportation
- A need for another indicator other than what is available
- We aim to create a new indicator to be used to assess university sustainability transportation
- We believe that using this tool can be useful to show a university’s influence on commuting and the harms it brings
LITERATURE REVIEW

- Universities & Sustainability
- Methods of and metrics for assessing university sustainability
- University sustainability in transportation
- ASU & sustainability
- Job sprawl
Universities & Sustainability

- Sustainability reporting is relatively new for universities
- Different types of sustainability initiatives are in place at different universities
- Size and wealth of university affect likelihood of pursuing sustainability

(Lozano, 2011; ISCN, 2019; Blackburn, 2016; Stafford 2010)
Tools for Assessing Sustainability in Universities

Uses

1. External audits and certification mechanisms
2. Inform self-assessment processes for development and learning
3. Comparative data for benchmarking
4. Benchmarking for certification
   a. Similar to number 3, but avoids competition

(Fischer, 2015)
Tools for Assessing Sustainability in Universities

Good Indicators

1. Identify important issues
2. Are calculable and comparable
3. More beyond eco-efficiency
   a. Strong sustainability!!!
4. Measure processes and motivations
5. Stress comprehensibility

(Shriberg, 2002)
Tools for Assessing Sustainability in Universities

**Examples**

Table 1. List of the sustainability assessment tools analysed

<table>
<thead>
<tr>
<th>No.</th>
<th>Sustainability Assessment Tool</th>
<th>Organisation/Individual for Development</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Campus Ecology</td>
<td>Student Environmental Action Coalition (SEAC)</td>
<td>1993</td>
</tr>
<tr>
<td>3</td>
<td>University Leaders for a Sustainable Future (UNEF)</td>
<td>University Leaders for a Sustainable Future (UNEF)</td>
<td>1999</td>
</tr>
<tr>
<td>4</td>
<td>Environmental Management System Self-Assessment Checklist</td>
<td>Campus Consortium for Environmental Excellence</td>
<td>2000</td>
</tr>
<tr>
<td>5</td>
<td>Penn State Indicator Report</td>
<td>Penn State Green Destiny Council</td>
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<td>6</td>
<td>Auditing Instrument for Sustainability in Higher Education (AISHE)</td>
<td>Dutch Committee on Sustainable Higher Education (COHE)</td>
<td>2001</td>
</tr>
<tr>
<td>7</td>
<td>National Wildlife Federation's State of the Campus Environment</td>
<td>National Wildlife Federation (NWF)</td>
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<td>Campus Sustainability Selected Indicators Snapshot</td>
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<td>Campus Sustainability Assessment Review Project (CSARP)</td>
<td>Western Michigan University</td>
<td>2002</td>
</tr>
<tr>
<td>10</td>
<td>Campus Sustainability Assessment Framework (CSAF)</td>
<td>Lindsey Cole</td>
<td>2003</td>
</tr>
<tr>
<td>11</td>
<td>Higher Education Partnership for Sustainability (HEPS)</td>
<td>Forum for the Future</td>
<td>2003</td>
</tr>
<tr>
<td>12</td>
<td>Good Company's Sustainable Pathways Toolkit</td>
<td>Good Company</td>
<td>2004</td>
</tr>
<tr>
<td>13</td>
<td>Global Reporting Initiative Modified for Universities</td>
<td>Global Reporting Initiative</td>
<td>2006</td>
</tr>
<tr>
<td>14</td>
<td>Sustainability Tracking, Assessment and Rating System (STAR) for Colleges and Universities Version 8.0</td>
<td>Association for the Advancement of Sustainability in Higher Education (AASHE)</td>
<td>2007</td>
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<td>15</td>
<td>Campus Sustainability Assessment Framework Core (CSAF Core)</td>
<td>Sierra Youth Coalition</td>
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<td>16</td>
<td>College Sustainability Report Card</td>
<td>Sustainable Endowment Institute</td>
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Table 1. Overview of sustainability assessment tools (SATs) included in the study.

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<td>Higher Education 21's Sustainability Indicators</td>
<td>Higher Education Funding Council for England</td>
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<td>Western Michigan University</td>
<td>2002</td>
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Bibliography

1. Fischer, 2015
2. Shriberg, 2002
3. Yarime & Tanaka, 2012
4. (Fischer, 2015)
5. (Shriberg, 2002)
Tools for Assessing Sustainability in Universities

What next?

- Consolidate tools to build validity
- Have tools for different uses
- Use indicators that measure strong sustainability

(Fischer, 2015; Shriberg, 2002)
University sustainability in transportation

- Concepts that were cohesive from between universities (Kaplan, 2015)
  - Sustainable transportation infrastructure
    - Bike paths
    - Walking paths
  - Electric buses
- Concepts that were cohesive from between universities (O.P-18, 2018)
  - AASHE indicators
    - Campus fleet
    - Student commute modal split
    - Employee commute modal split
    - Support for sustainable transportation
ASU & Sustainability

- First U.S. degree-granting program in sustainability
- Circular resources, climate positive, collaborative action, community success, food reconnection, optimized water, personal action, and resilience
- Addressing transportation – alternative transportation
  - Bus, METRO, bikes, carpooling

(ASU’s sustainability overview, 2019; Sustainability goals and vision, 2019)
Job-Sprawl Indicator

- Employment-Residence landscape
- Modality patterns
- Estimate approximate tons of CO2 emitted
- Single-driver modality - crucial technology
- Sustainable travel practices

(Barr, 2018; Ewing et al, 2003; Glaeser et al, 2001)
GOAL OF STUDY
Goal: Used J-Sprawl as an Indicator

- Important for assessing individual-choice with regard to sustainability
- Personal modality is an important consideration for assessing sustainability
- J-Sprawl is a strong indicator that can be added to sustainability measurement toolkits
Note: Totals may not add to 100% due to rounding. Transportation emissions do not include emissions from non-transportation mobile sources such as agriculture and construction equipment. “Other” sources include buses, motorcycles, pipelines and lubricants.
J-Sprawl as a Strong Indicator

- J-Sprawl represents distance faculty travel to get to work. Further distances mean:
  - Ecological: increased CO2 emissions
  - Economic: carbon-mobility costs and “smart cities” futures (reducing demand for travel—emphasis on dwelling, VMT)
  - Social: promote long-term shifts in behavior, decrease transportation travel time, increase well-being.

(Wu & Wu, 2012)
METHODS
METHODS

- Maricopa County Assessor's Office
  - Sample size 1616, 899 found
- Gnuplots
- Faculty breakdown through Excel
RESULTS
Map Visualization

Distance from ASU Tempe by Professor Type

- Sprawl map
  - ASU at the center
  - Rings denote radial distances from ASU
  - Split by type of “professorship”
Map generated to show residential area of ASU-Tempe
  ○ What we call “ASUtown”
  ○ Used to find the appropriate area used to calculate density.

Maroon lines show effective boundaries

Density of Cities (in square miles)

<table>
<thead>
<tr>
<th>City</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tempe</td>
<td>4,812</td>
</tr>
<tr>
<td>Phoenix</td>
<td>3,207</td>
</tr>
<tr>
<td>ASU</td>
<td>2,248</td>
</tr>
<tr>
<td>Scottsdale</td>
<td>1,388</td>
</tr>
</tbody>
</table>
## Distance by School

<table>
<thead>
<tr>
<th>School</th>
<th>Average Distance (in miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New College of Interdisciplinary Arts and Sciences</td>
<td>16.7</td>
</tr>
<tr>
<td>Mary Lou Fulton Teachers College</td>
<td>10.7</td>
</tr>
<tr>
<td>W.P. Carey School of Business</td>
<td>10.4</td>
</tr>
<tr>
<td>Ira A. Fulton Schools of Engineering</td>
<td>9.9</td>
</tr>
<tr>
<td>Herberger Institute for Design and the Arts</td>
<td>8.5</td>
</tr>
<tr>
<td>Julie Ann Wrigley Global Institute of Sustainability</td>
<td>8.2</td>
</tr>
<tr>
<td>The College of Liberal Arts and Sciences</td>
<td>7.4</td>
</tr>
<tr>
<td>School for the Future of Innovation in Society</td>
<td>6.1</td>
</tr>
</tbody>
</table>
How do SOS faculty measure?

SOS Professor Distance from ASU (in miles)

<table>
<thead>
<tr>
<th></th>
<th>Average distance in miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainability School</td>
<td>8.22</td>
</tr>
<tr>
<td>Not Sustainability School</td>
<td>8.85</td>
</tr>
</tbody>
</table>
CO2 Emissions

- We calculated an estimate of the CO2 emissions that are a result of individuals driving to work.
- This assumes professors are average Americans
  - Car MPG
  - Days travelled
  - % that drive to work
- Assumes average person drives from all distances
  - This is conservative, people closer are more likely to bike or walk
- Uses 2016 data
- We used standard work days, this might be different for professors

<table>
<thead>
<tr>
<th>Figure</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Professors</td>
<td>1,616</td>
<td>Professors affiliated with ASU Tempe Campus</td>
</tr>
<tr>
<td>Average Distance in Miles</td>
<td>8.832</td>
<td>Calculated from 899 retrieved addresses</td>
</tr>
<tr>
<td>% Drive to Work</td>
<td>76.3%</td>
<td>(Tomer, 2016)</td>
</tr>
<tr>
<td>Days Travelled</td>
<td>261</td>
<td>Days in a work year</td>
</tr>
<tr>
<td>MPG</td>
<td>22</td>
<td>(Bureau of Transportation Statistics, 2016)</td>
</tr>
<tr>
<td>CO2 per Gallon of Gasoline</td>
<td>19.6</td>
<td>(U.S. Energy Information Administration, 2016)</td>
</tr>
<tr>
<td>Gallons used per year</td>
<td>258,397</td>
<td></td>
</tr>
<tr>
<td>Tons of CO2 per year</td>
<td>6.6</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION
DISCUSSION

- Carbon emissions
- Reasons behind place of residence
- J-Sprawl as a tool to influence policy at ASU
LIMITATIONS


