8 years of research by TNC scientists to Identify Climate-Resilient Sites.

Bring Earth Observation into:

1. **Topoclimates** (modeling topographic microclimates)
2. **Connectedness** (mapping human land use intensity)
3. **Flow** (modeling landscape connectivity)

Team:

- **Brad McRae**, Senior Landscape Ecologist, The Nature Conservancy
- **Kimberly Hall**, Climate Change Ecologist, The Nature Conservancy
- **Mark Anderson**, Director of Conservation Science, EUS, The Nature Conservancy
- **Solomon Dobrowski**, Asst. Professor of Forest Landscape Ecology, University of Montana
- **David Theobald**, Senior Scientist, Conservation Science Partners Inc.
- **Alan Edelman**, Professor of Applied Mathematics, Massachusetts Institute of Technology
- **Josh Lawler**, Professor of Sustainable Resource Sciences, University of Washington
Species Relevant Topoclimates

MODIS LST = Land Surface Temperature

LST diversity = f (TDI, HLI, CTI, Elev. diversity)

Fine Scale Landsat = LST (~90 m)

In collaboration with Solomon Dobrowski, University of Montana
Local Connectedness

Enhance and improve the Theobald 2013 Degree of Human Modification

- Peer-reviewed
- Wall-to-wall
- Human land use
- Uncertainty
- Agriculture (CDL, Housing density)
- Roads
- Energy infrastructure
- Oil and gas development
- Night lights data

Assigns human modification scores to different landscape features

Empirical

In collaboration with Dave Theobald, Conservation Science Partners
Permeable Landscapes

Improve the power and function of Circuitscape

Circuitscape:
- the most widely used connectivity analysis software in the world,
- 80+ journal articles/year.
- Can map wall-to-wall permeability to simulate range shifts in response to climate change

With this NASA project, we plan to:
• increase computational power to handle larger datasets more quickly;
• add functionality and improve ease of use; and
• integrate with cloud computing infrastructure

In collaboration with
Viral Shah, Co-creator of Circuitscape, Julia Computing Inc.
Alan Edelman, MIT,
Josh Lawler, University of Washington
### Earth Observation Data

<table>
<thead>
<tr>
<th>Term</th>
<th>Variable</th>
<th>Data Source</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>land surface</td>
<td>LST&lt;sub&gt;day&lt;/sub&gt; LST&lt;sub&gt;night&lt;/sub&gt;</td>
<td>MODIS Aqua MYD11A2 8 day Landsat</td>
<td>monthly climatological means</td>
</tr>
<tr>
<td>temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x, y, z</td>
<td>Latitude, longitude, elevation</td>
<td>SRTM NASA v3; NASADEM (when avail.)</td>
<td>NASADEM products anticipated from JPL late 2016/early 2017</td>
</tr>
<tr>
<td>land surface</td>
<td>NDVI</td>
<td>MODIS Terra MOD13A3</td>
<td>10-year (2003-12) monthly means</td>
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<tr>
<td>NDVI</td>
<td>MODIS Terra MOD13A3</td>
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<tr>
<td>Snow</td>
<td>MODIS Terra MOD10A2 8-day snow cover product</td>
<td>10-year (2003-12) monthly means</td>
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<tr>
<td>terrain</td>
<td>SRAD</td>
<td>Derived from DEM above</td>
<td>Monthly mean clear sky radiation</td>
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<tr>
<td>terrain</td>
<td>TPI</td>
<td>Derived from DEM</td>
<td>Topographic position index</td>
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<tr>
<td></td>
<td>CTI</td>
<td>Derived from DEM</td>
<td>Topographic wetness index</td>
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<td>HLI</td>
<td>Derived from DEM</td>
<td>Heat load index</td>
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<td>land cover</td>
<td>NLCD</td>
<td>USGS NLCD</td>
<td>USGS land use and land cover product derived from Landsat TM</td>
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<tr>
<td>night lights</td>
<td>DMSP and VIIRS</td>
<td>DMSP-OLS Nighttime Lights Time Series</td>
<td>To be updated with NASA VIIRS when annual composite available</td>
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<tr>
<td>night lights</td>
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