

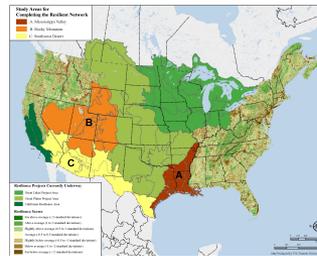
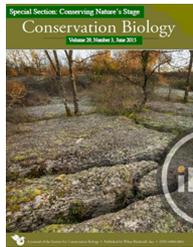
# Improved Topoclimate and Connectivity Tools

## to Inform Climate-Smart Conservation

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)

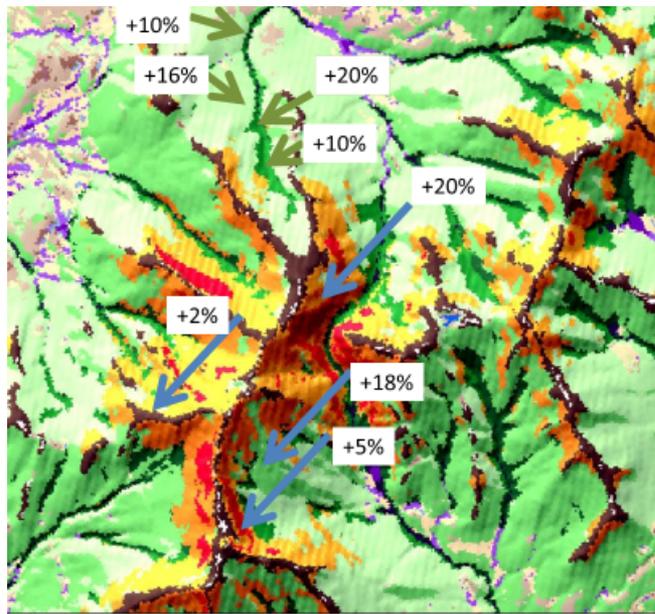


### Team:

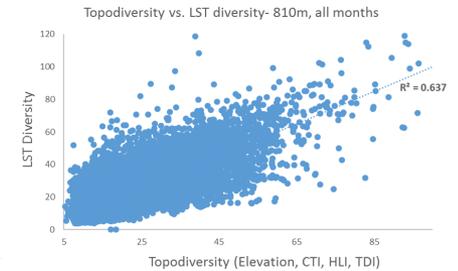
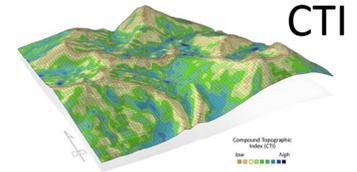
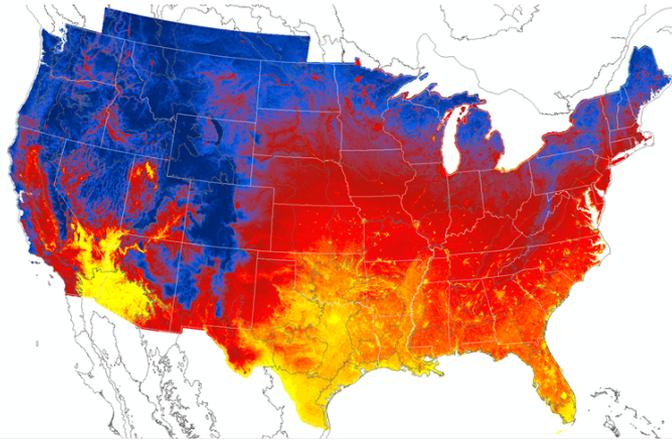
- **Brad McRae**, Senior Landscape Ecologist, The Nature Conservancy
- **Kimberly Hall**, Climate Change Ecologist, The Nature Conservancy
- **Mark Anderson**, Director of Conservation Science, EUS, The Nature Conservancy
- **Viral Shah**, Co-creator of Circuitscape, Julia Computing, Inc.
- **Solomon 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

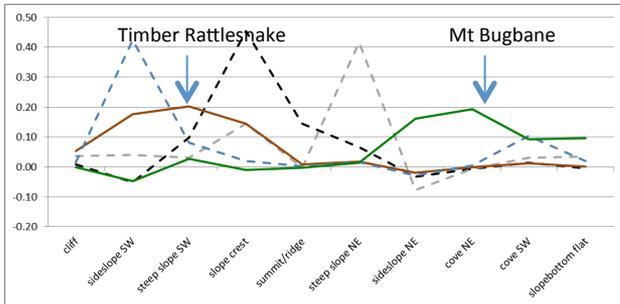
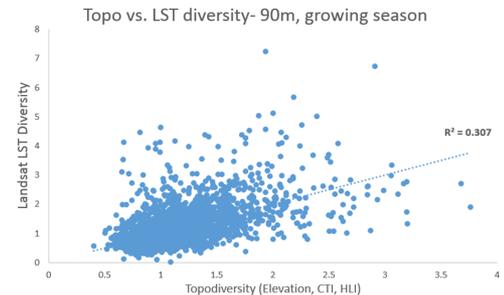
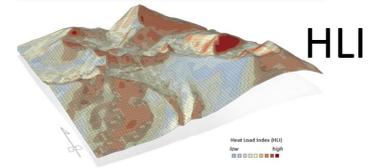
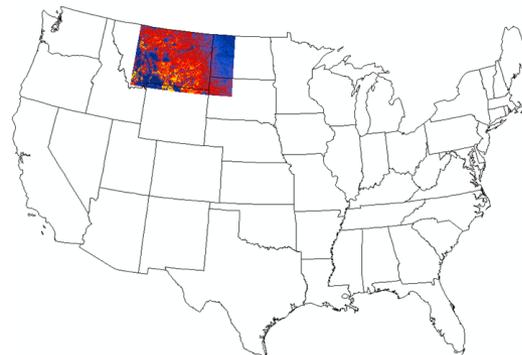


MODIS LST = Land Surface Temperature

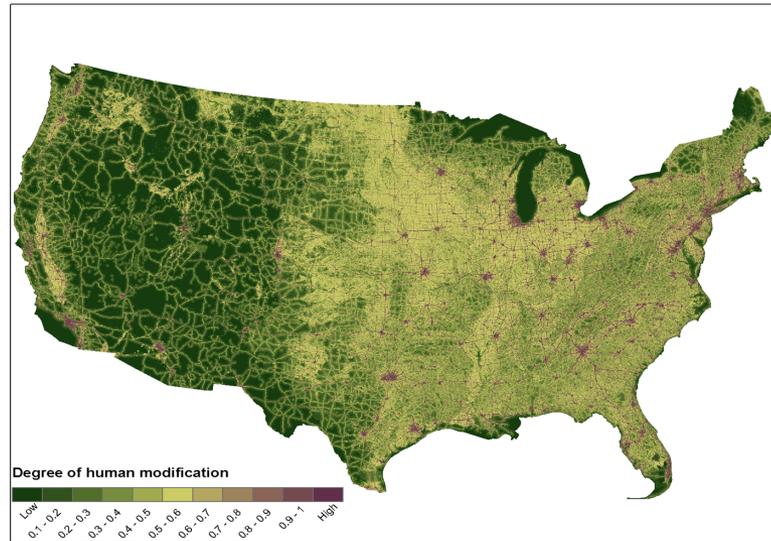
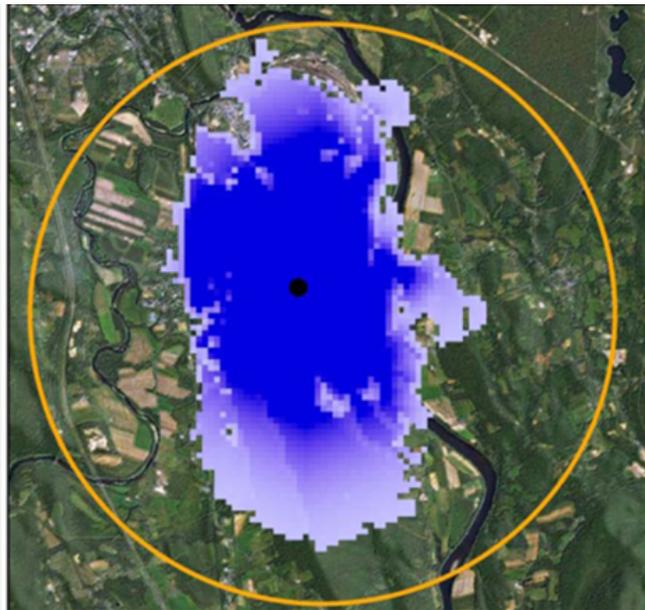


**LST diversity = f (TDI, HLI, CTI, Elev. diversity)**

Fine Scale Landsat = LST (~90 m)



# Local Connectedness



- Assigns human modification scores to different landscape features
- Empirical

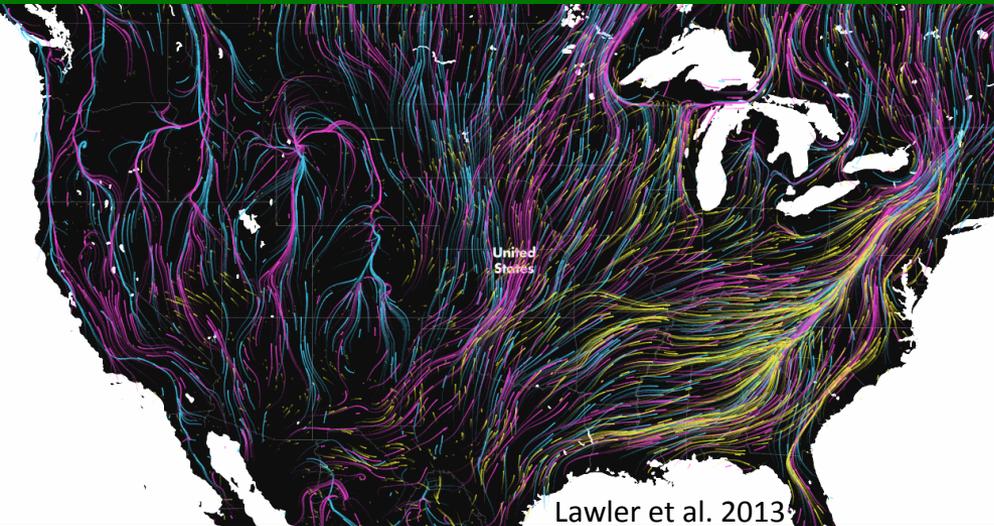
Enhance and improve the Theobald 2013 **Degree of Human Modification**

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

*In collaboration with Dave Theobald, Conservation Science Partners*

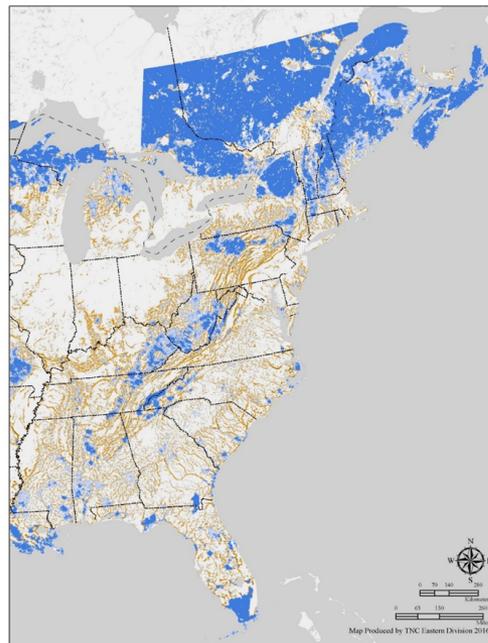
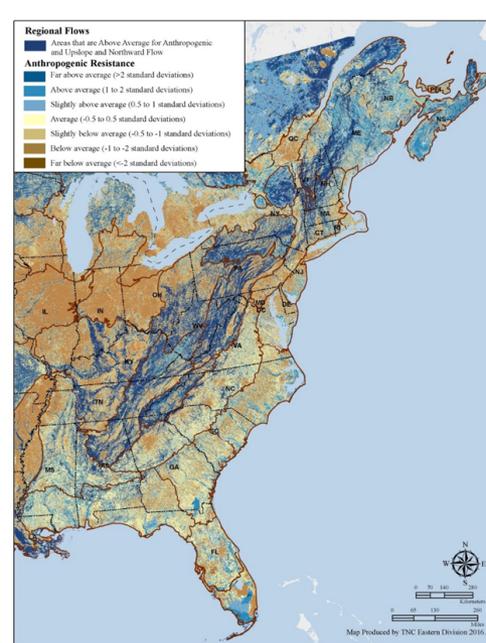
# Permeable Landscapes

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

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