Using GIS tools to track Sagebrush plant community resiliency

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Ecosystem resiliency

- The ability to maintain structure and function following alteration
- **Resistance**: retain structure and function
- **Stability**: maintain successional trajectory

(Standish et al. 2014; Wainright et al. 2020)
Sagebrush plant communities

- Invasive plant disturbance
  - Soil moisture
  - Temperature regime

Fig. 6 from Chambers et al. (2014)
Tracking plant cover & assessing change over time

- Summer 2021 sampling locations
- Plant community type based on shrub and perennial herbaceous cover
Google earth engine + python

• Google Earth Engine
  • Satellite imagery
  • Climate & weather
  • Geophysical (i.e. Terrain, Land Cover)
  • + Others uploaded for specific projects

• Earth Engine API in Python (also available in JavaScript)
• Percent cover estimates of plant functional groups for western US
• 60,000 field plots + Landsat
• Methods & error estimates: Allred et. al (2021)

Explore the data yourself and use the app rangelands.app
High shrub (>25%), high Perennial (>30)
High shrub (>25%), low perennial (<30)
Low shrub (<25%), high Perennial (>30)
Low shrub (<25%), low Perennial (<30)
Gather plot names and locations

Corresponding code:

```python
plot_lats = list(summer2021[summer2021.geometry.x])
plot_longs = list(summer2021[summer2021.geometry.x])
```
## Result

<table>
<thead>
<tr>
<th>year</th>
<th>plot_name</th>
<th>PFC</th>
<th>cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>HSHG_C_1</td>
<td>AFGC</td>
<td>15.56</td>
</tr>
<tr>
<td>1985</td>
<td>HSHG_C_1</td>
<td>AFGC</td>
<td>2.33</td>
</tr>
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<td></td>
<td>...</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td>2018</td>
<td>HSHG_C_1</td>
<td>AFGC</td>
<td>19.08</td>
</tr>
<tr>
<td>2019</td>
<td>HSHG_C_1</td>
<td>AFGC</td>
<td>10.34</td>
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<tr>
<td>2020</td>
<td>HSHG_C_1</td>
<td>AFGC</td>
<td>5.61</td>
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<tr>
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<td>HSHG_C_1</td>
<td>BG</td>
<td>4.48</td>
</tr>
<tr>
<td>1985</td>
<td>HSHG_C_1</td>
<td>BG</td>
<td>5.55</td>
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<tr>
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<td>BG</td>
<td>3.76</td>
</tr>
</tbody>
</table>

- 1984 – 2020
- 30 sampling locations
- Each plant functional group & their uncertainty
Let’s plot functional group cover with plant community strata

Where has annual grass cover increased?

Which areas exhibit a variable response to disturbance?
Implications

• Identifying locations for management activities based on goals
• Understand how this year’s data fit into a larger trend
• No need to reinvent the wheel – use existing datasets!