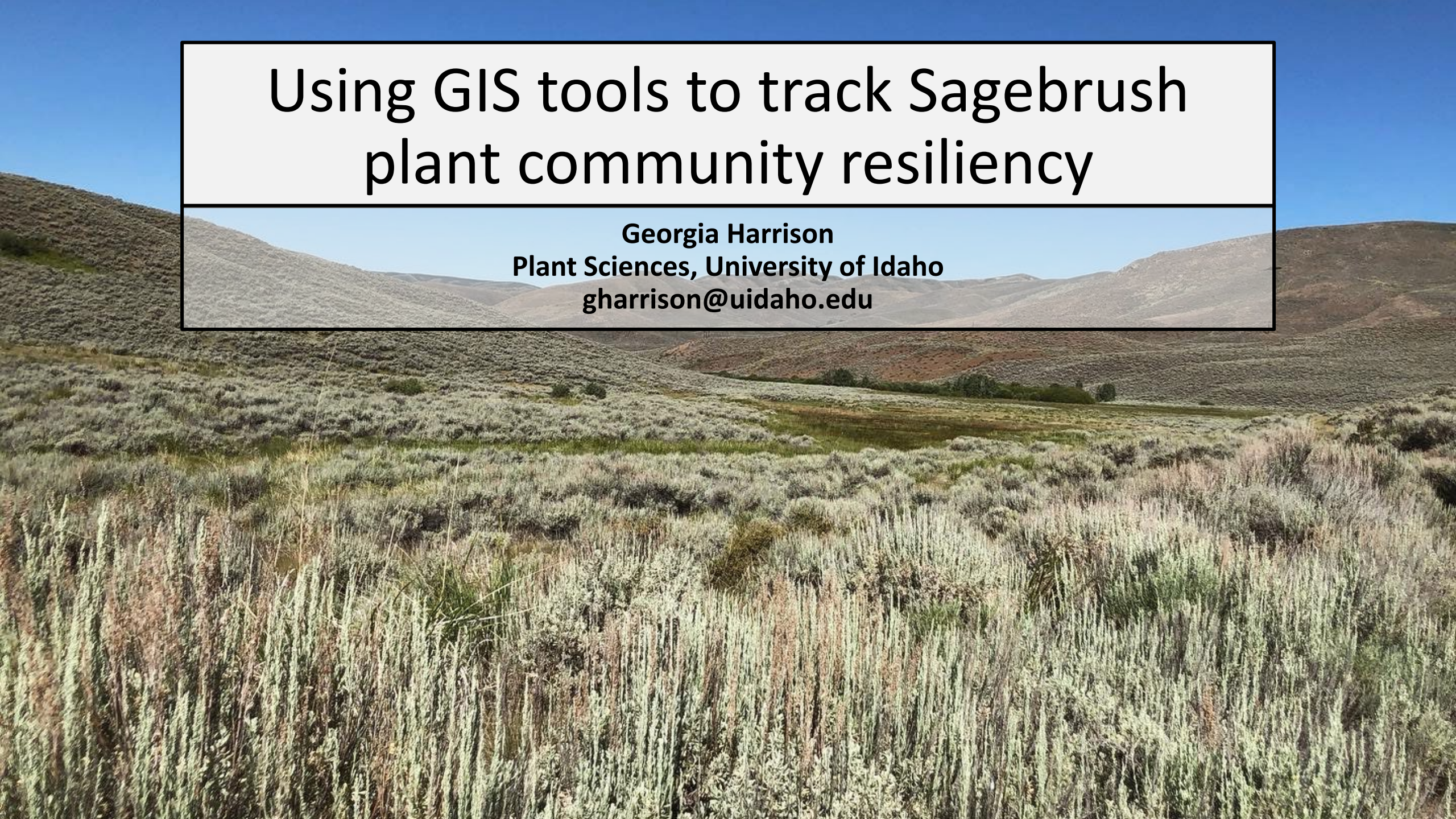
# Using GIS tools to track Sagebrush plant community resiliency

**Georgia Harrison**
**Plant Sciences, University of Idaho**
**gharrison@uidaho.edu**



# Ecosystem resiliency

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

Helpful or unhelpful

**(Standish et al. 2014; Wainright et al. 2020)**

# Sagebrush plant communities

- Invasive plant disturbance
  - Soil moisture
  - Temperature regime

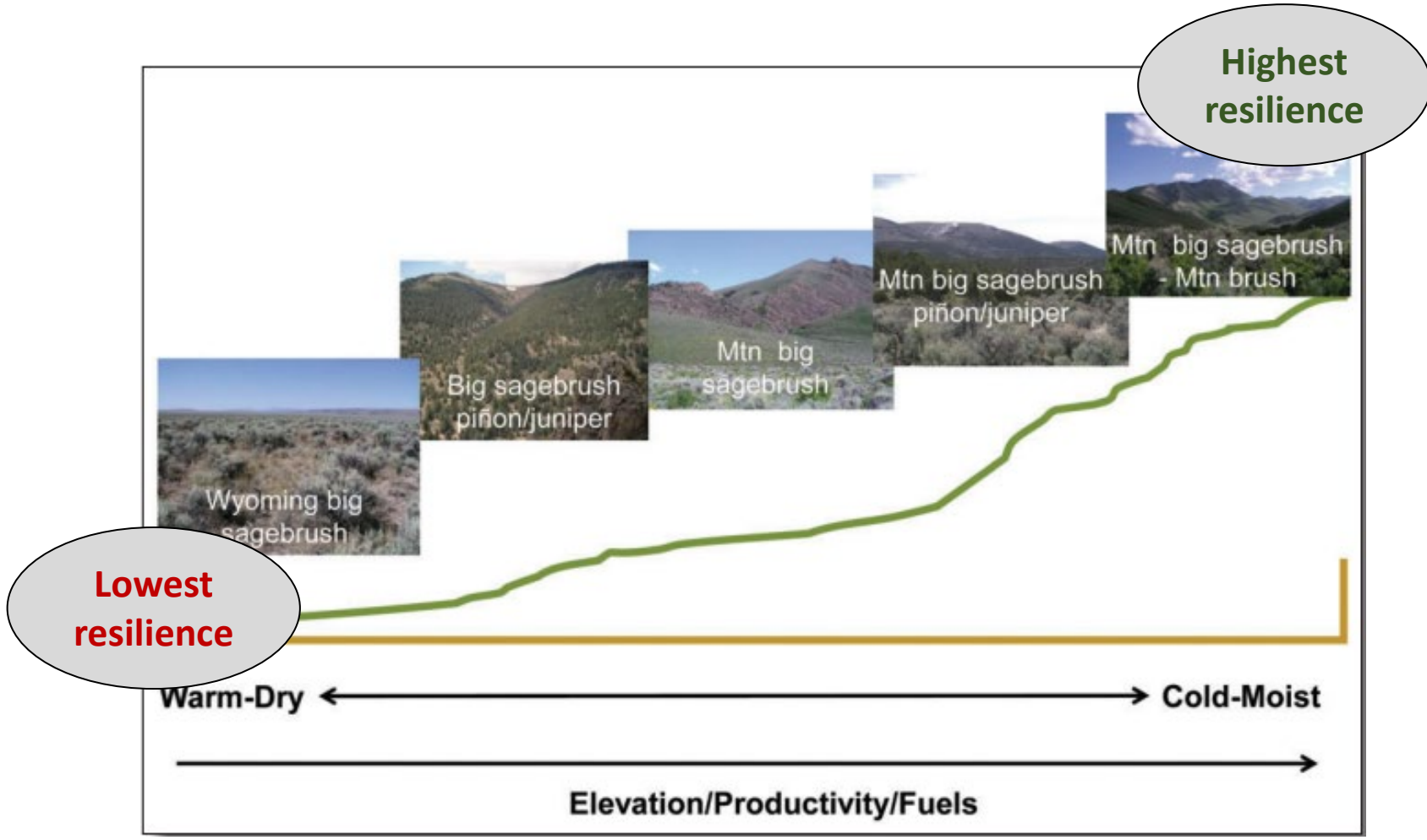



**Fig. 6 from Chambers et al. (2014)**

# Tracking plant cover & assessing change over time

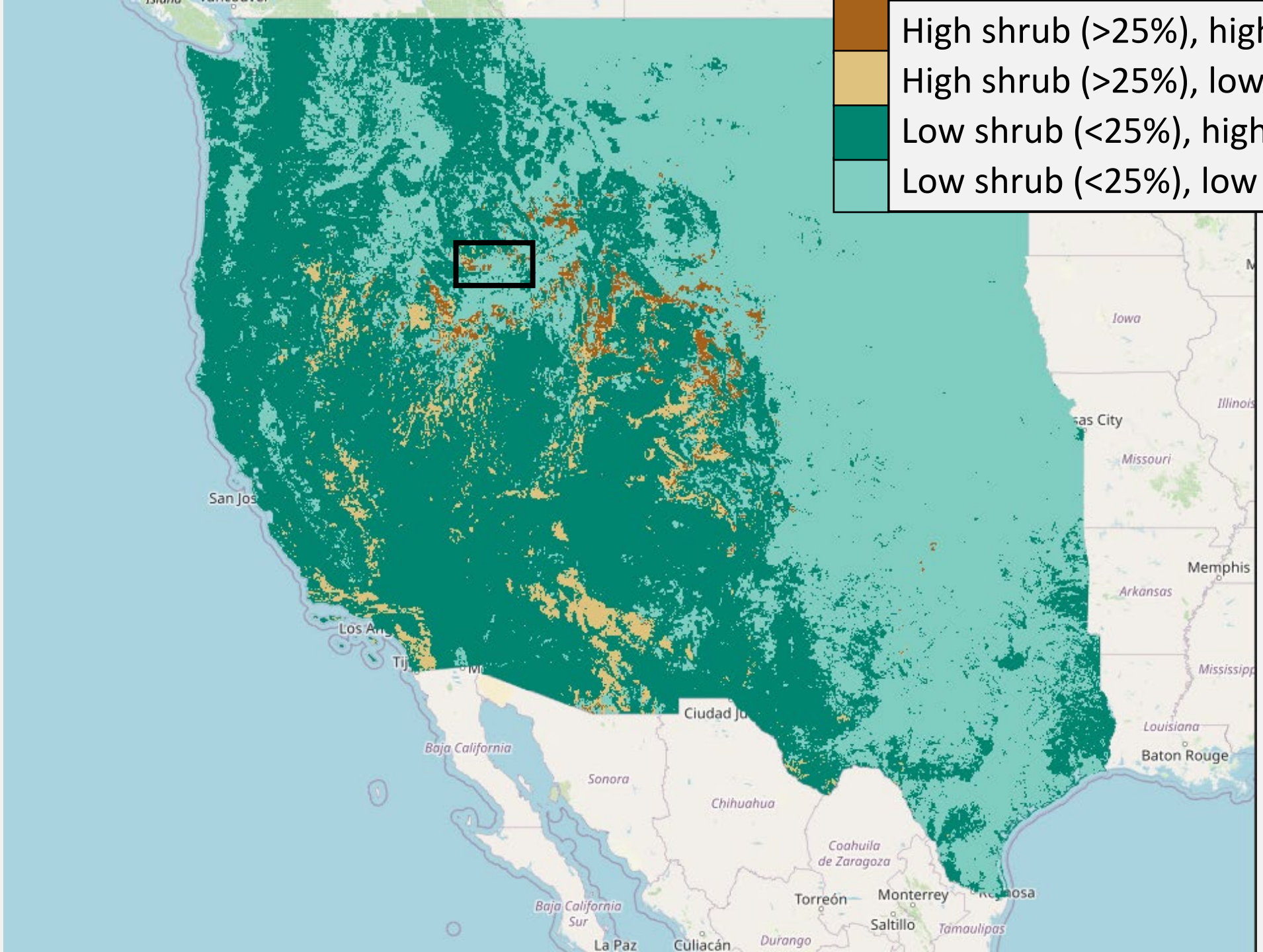
- Summer 2021 sampling locations
- Plant community type based on shrub and perennial herbaceous cover

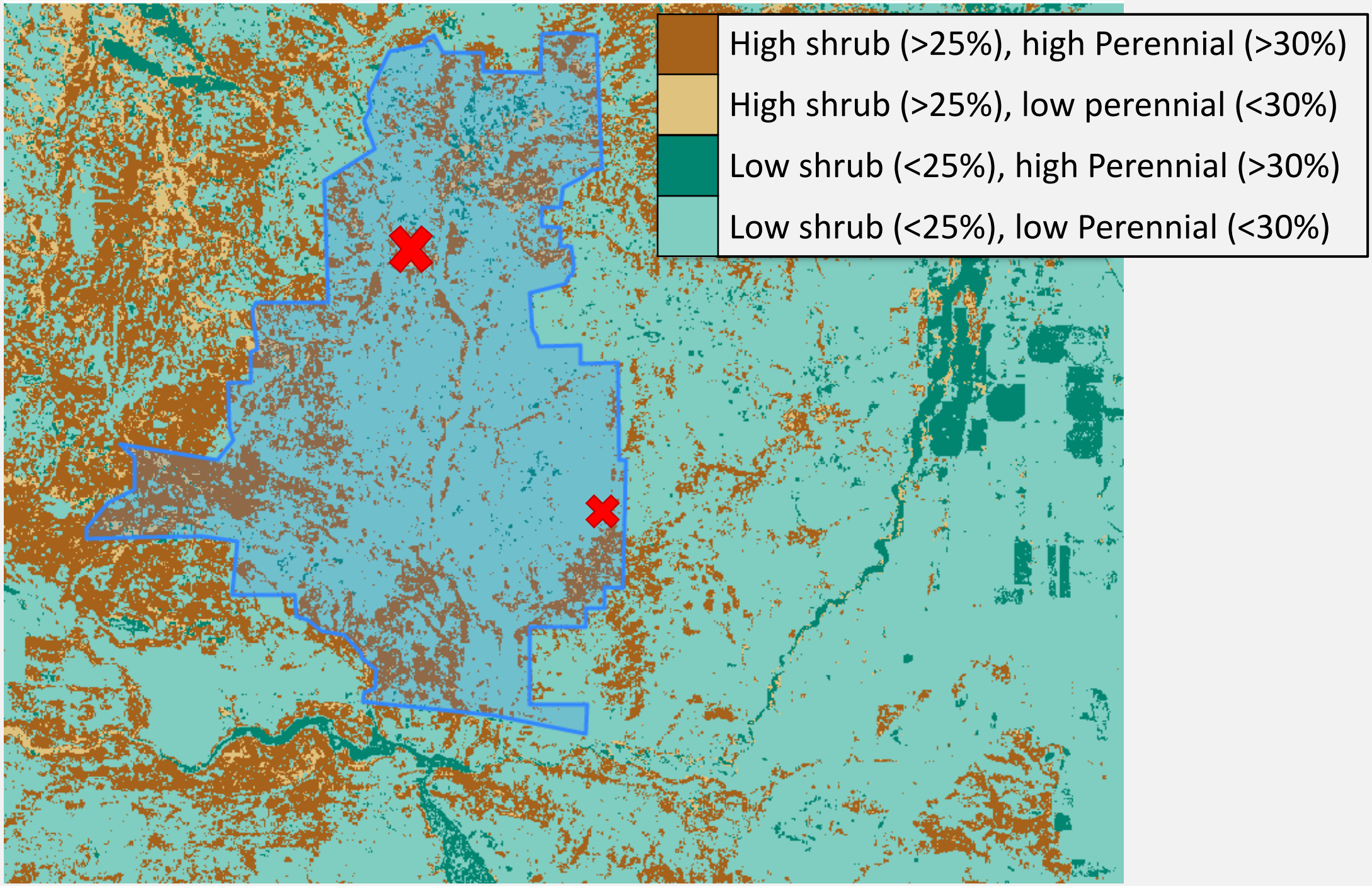
# Google earth engine + python

- 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 (>
High shrub (>25%), low perennial (<
Low shrub (<25%), high Perennial (>
Low shrub (<25%), low Perennial (<
Iowa
Illinois
Missouri
Memphis
Arkansas
Mississipp
Louisiana
Baton Rouge
Baja California
Sonora
Chihuahua
Coahuila de Zaragoza
Torreón
Monterrey
Saltillo
Tamaulipas
Baja California Sur
La Paz
Culiacán
Durango


High shrub (>25%), high Perennial (>30%)
High shrub (>25%), low perennial (<30%)
Low shrub (<25%), high Perennial (>30%)
Low shrub (<25%), low Perennial (<30%)

## Processing steps

Gather plot names and locations

## Corresponding code

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

# Result

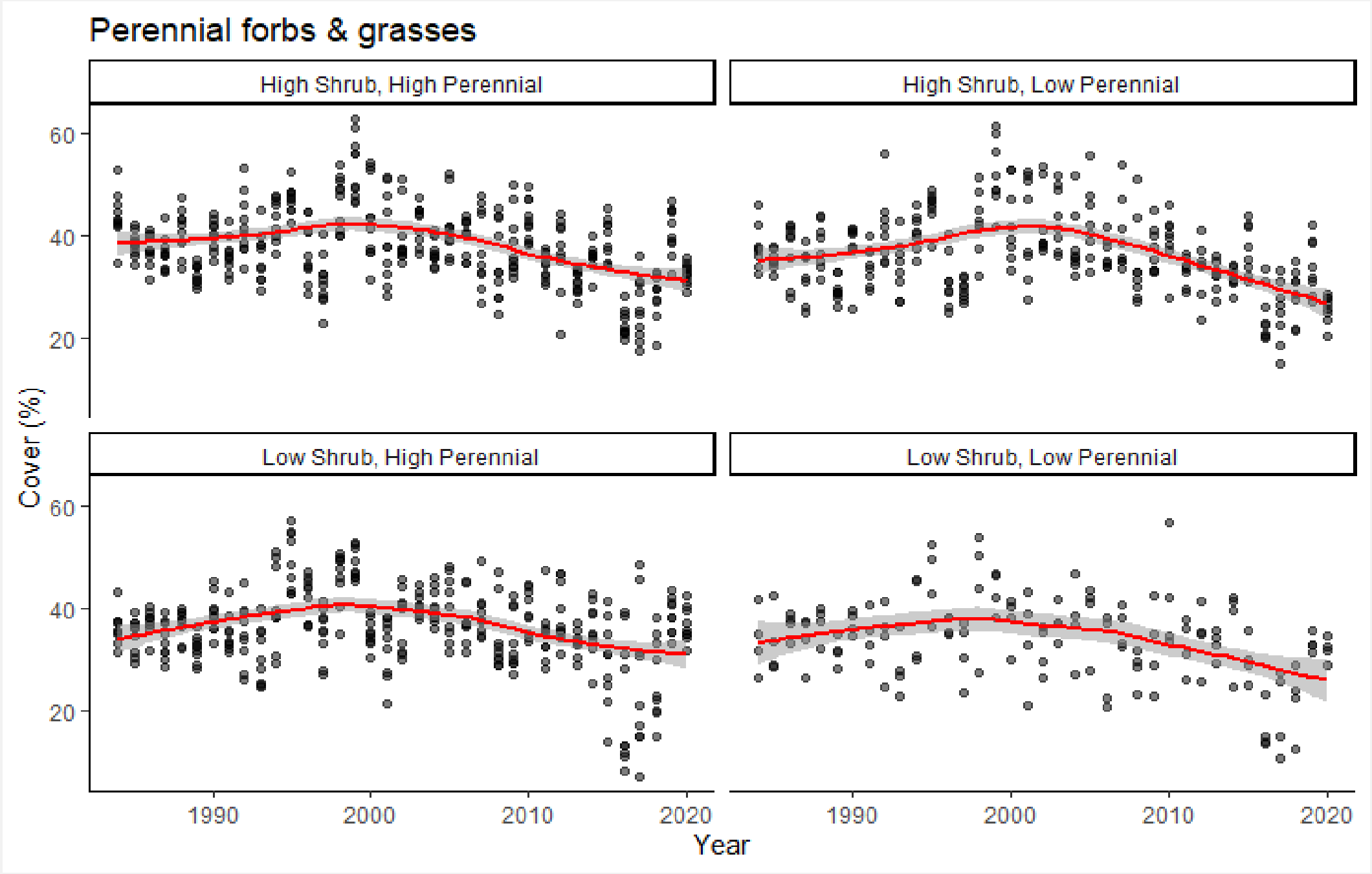
| year | plot_name | PFC | cover |
|---|---|---|---|
| 1984 | HSHG_C_1 | AFGC | 15.56 |
| 1985 | HSHG_C_1 | AFGC | 2.33 |
| …. | …. | … | … |
| 2018 | HSHG_C_1 | AFGC | 19.08 |
| 2019 | HSHG_C_1 | AFGC | 10.34 |
| 2020 | HSHG_C_1 | AFGC | 5.61 |
| 1984 | HSHG_C_1 | BG | 4.48 |
| 1985 | HSHG_C_1 | BG | 5.55 |
| …. | …. | … | … |
| 2018 | HSHG_C_1 | BG | 2.78 |
| 2019 | HSHG_C_1 | BG | 3.76 |

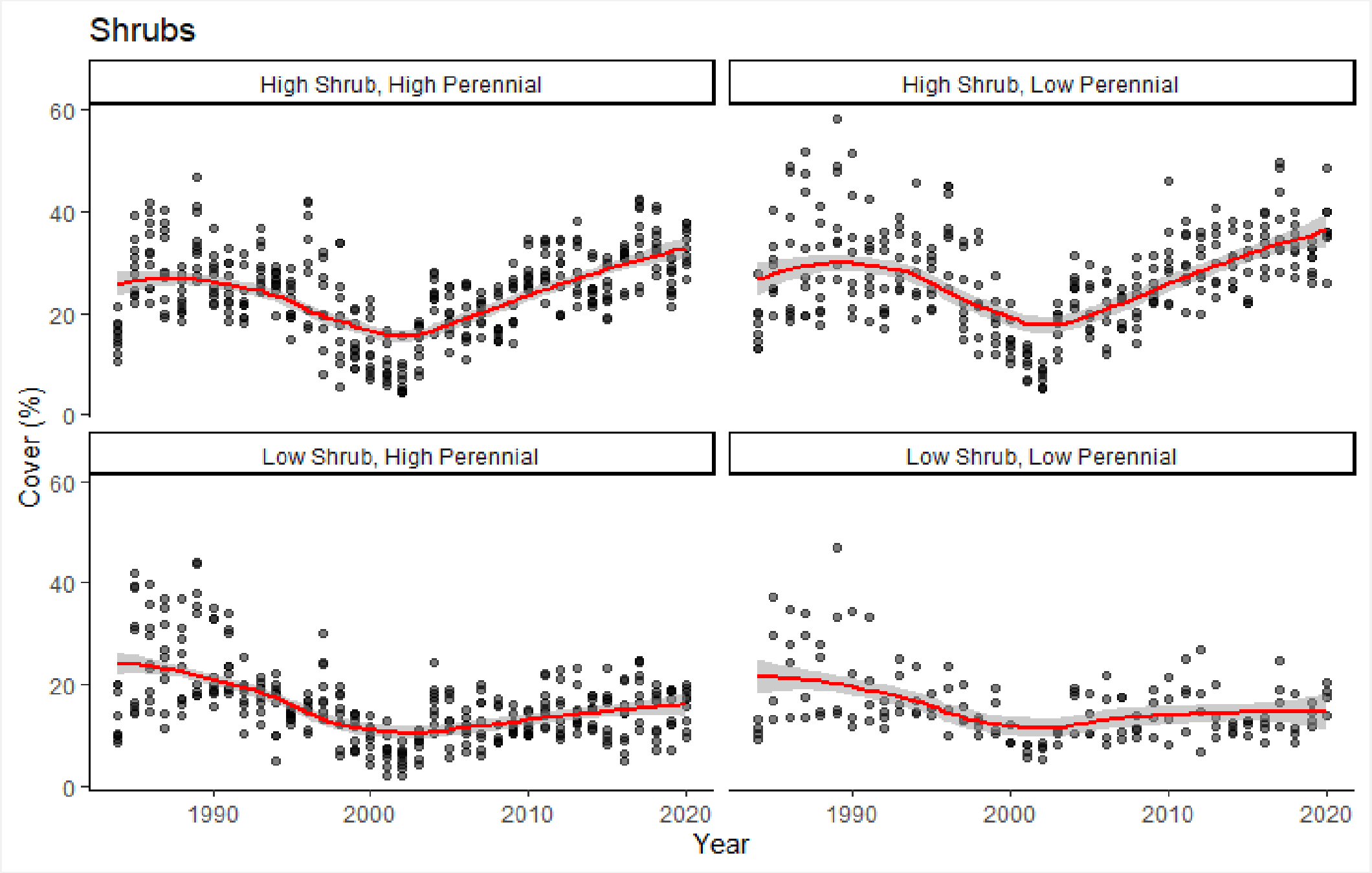
- 1984 – 2020
- 30 sampling locations
- Each plant functional group & their uncertainty

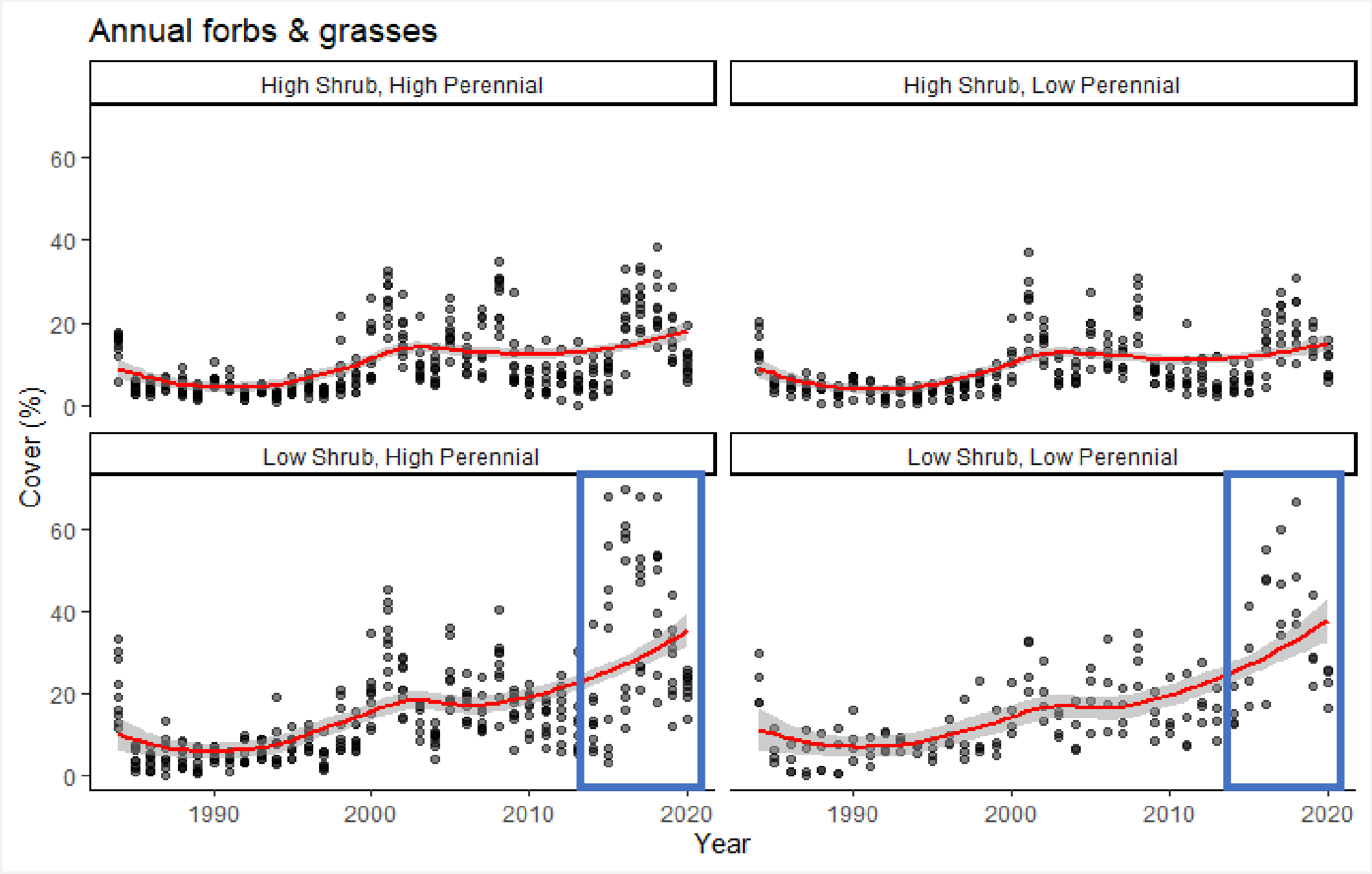
# Let’s plot functional group cover with plant community strata

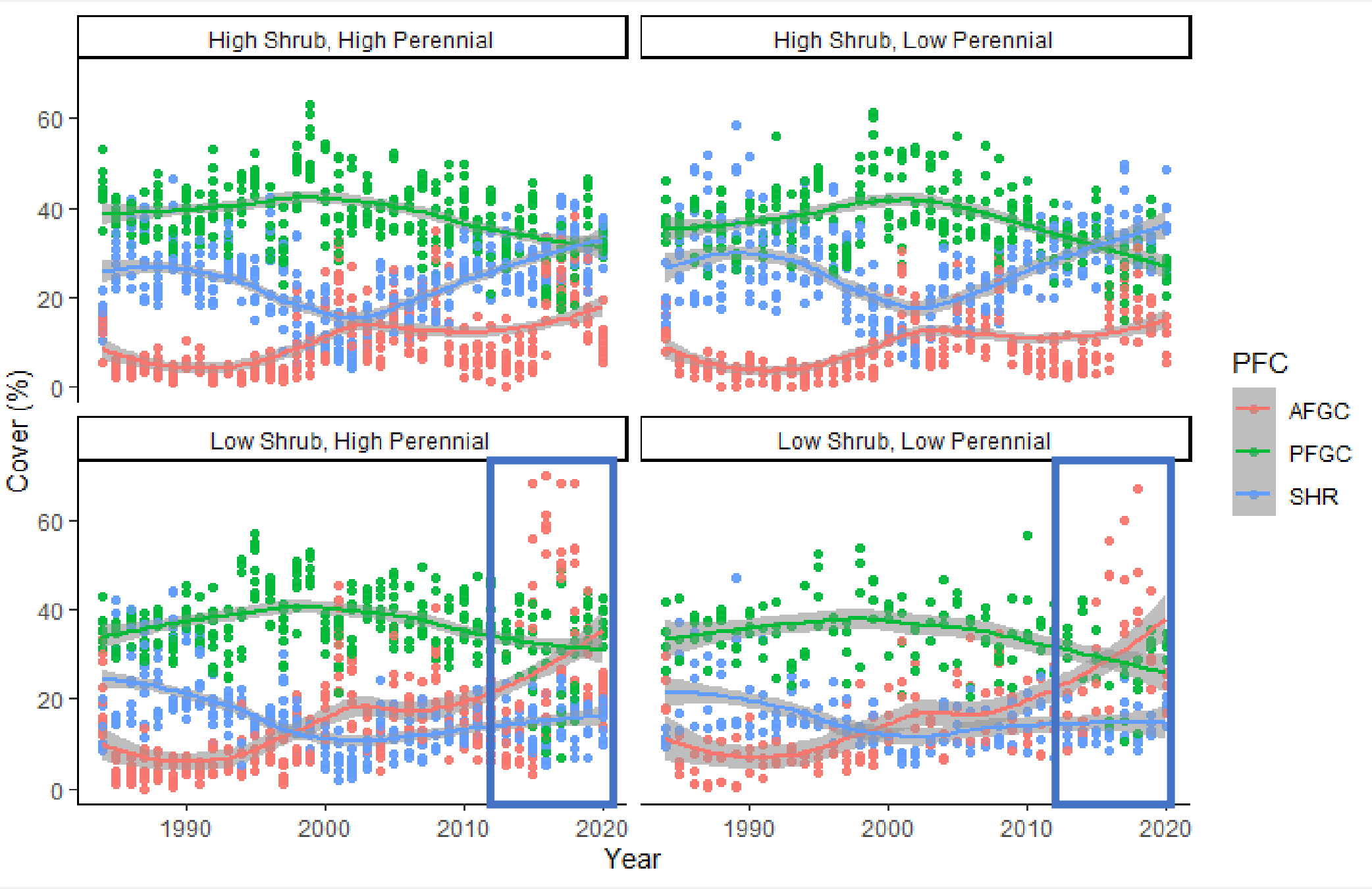
**Where has annual grass cover increased?**

**Which areas exhibit a variable response to disturbance?**


Perennial forbs & grasses
High Shrub, High Perennial
High Shrub, Low Perennial
Low Shrub, High Perennial
Low Shrub, Low Perennial
Cover (%)
60
40
20
1990
2000
2010
2020
Year


Shrubs
High Shrub, High Perennial
High Shrub, Low Perennial
Low Shrub, High Perennial
Low Shrub, Low Perennial
Cover (%)
0
20
40
60
1990
2000
2010
2020
Year


Annual forbs & grasses
High Shrub, High Perennial
High Shrub, Low Perennial
Low Shrub, High Perennial
Low Shrub, Low Perennial
Cover (%)
0
20
40
60
1990
2000
2010
2020
Year


High Shrub, High Perennial
High Shrub, Low Perennial
Low Shrub, High Perennial
Low Shrub, Low Perennial
Cover (%)
0
20
40
60
1990
2000
2010
2020
Year
PFC
AFGC
PFGC
SHR

# 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!