# Biotic Responses to Climate Change in the Great Basin and Mojave Desert:

# Vegetation

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# Thanks!


- Funding and other support for this work:
  - NSHE NSF EPSCoR Climate Change Project
    - Faculty Sponsor Dale Devitt
  - Clark County Ecosystem Indicators Project UNR
  - US Geological Survey
  - USDA Natural Resource Conservation Service
  - US Fish and Wildlife Service
  - College of Southern Nevada
  - Wesley E. Niles Herbarium, UNLV

# Staff

- Fred Landau, UNLV
- Jim Holland, Lake Mead NRA
- Craig Westenberg, USGS Water Resources
- Angela Pitt, AWE
- Phoenix King, AWE
- Jen Leary, AWE

# The Problem

- To detect changes in vegetation as it responds to changes in climate, we must first know where the vegetation is now

# The Problem

- GAP (Geographic Approach to Protection of Biodiversity) map
  - National project to map land cover throughout the US.
  - Nevada map (Edwards et al. 1996)
- Southwest ReGAP map
  - Land cover map for southwestern US (Prior-Magee et al. 2007) to correct problems identified in GAP map

# MISINFORMATION ABOUNDS

## Life Zones In the Spring Mountains

The different climatic zones encountered as one goes up in elevation or travels northward (in the northern hemisphere) result in notable differences in vegetation type. The 10,000-foot ascent from Las Vegas to the summit of Charleston Peak is equivalent, in terms of vegetation associations, to a trip from Las Vegas to the Canadian arctic and passes through six different life zones. We will pass through only four of these life zones on the trip up Kyle Canyon. You would need to hike to the top of Charleston Peak to encounter the upper two life zones.

Artwork: Larry Jacox

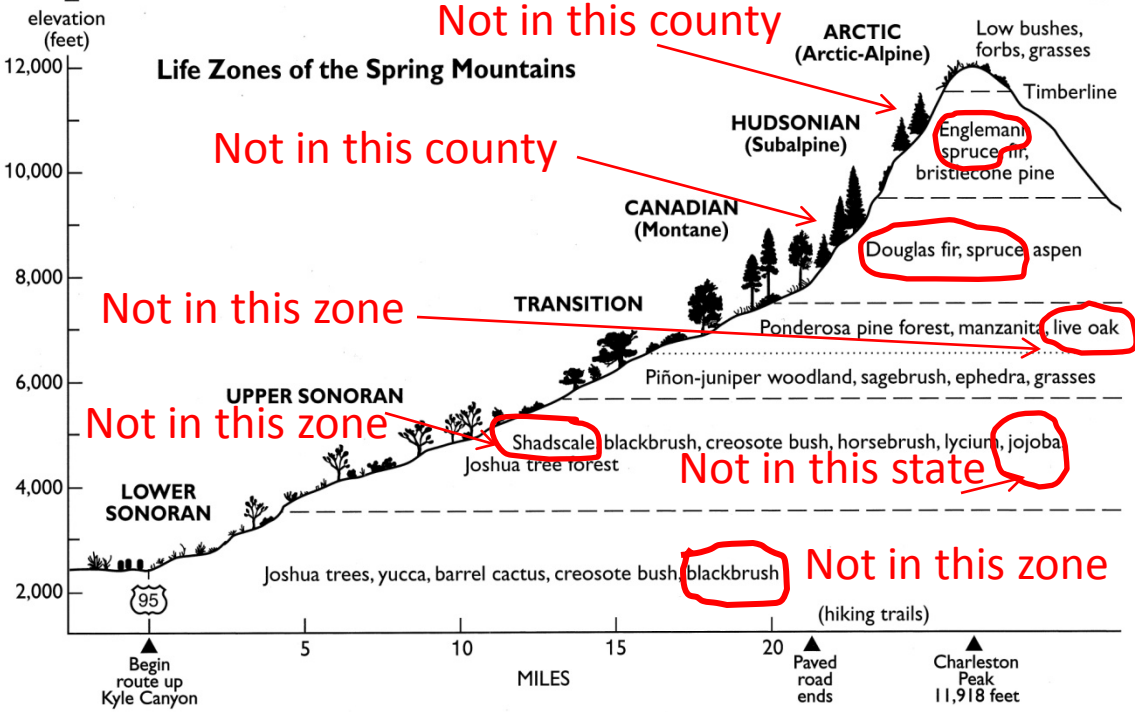



Photo: Mark Vollmer

**Line of bristlecone pine snags on the summit of Mummy Mountain (11,530 feet) northeast of Charleston Peak in the Spring Mountains.**

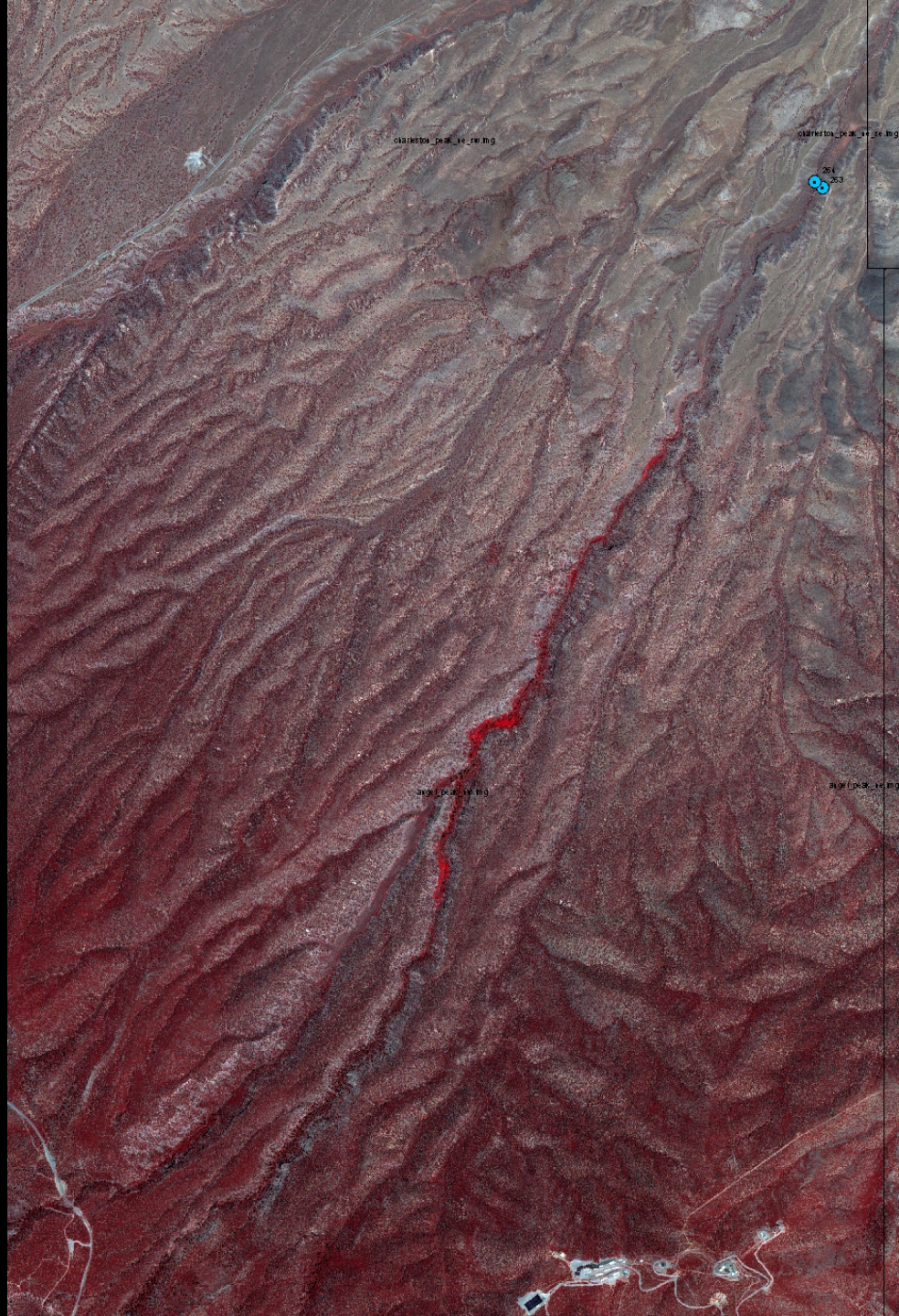
**Geologic Tours of the Las Vegas Area, NBMG 2001**

# Other Projects Linked to Nevada EPSCoR Biotic Responses to Climate Change

- Red Rock (RRCNCA) land cover map – USGS
- Clark County Ecosystem Indicators – UNR
- DNWR land cover map – US FWS
- Clark County Soil Survey map – NRCS
- Ponderosa pine genetics – BLM & USDA FS
- USDA FS Forest Health Monitoring Program

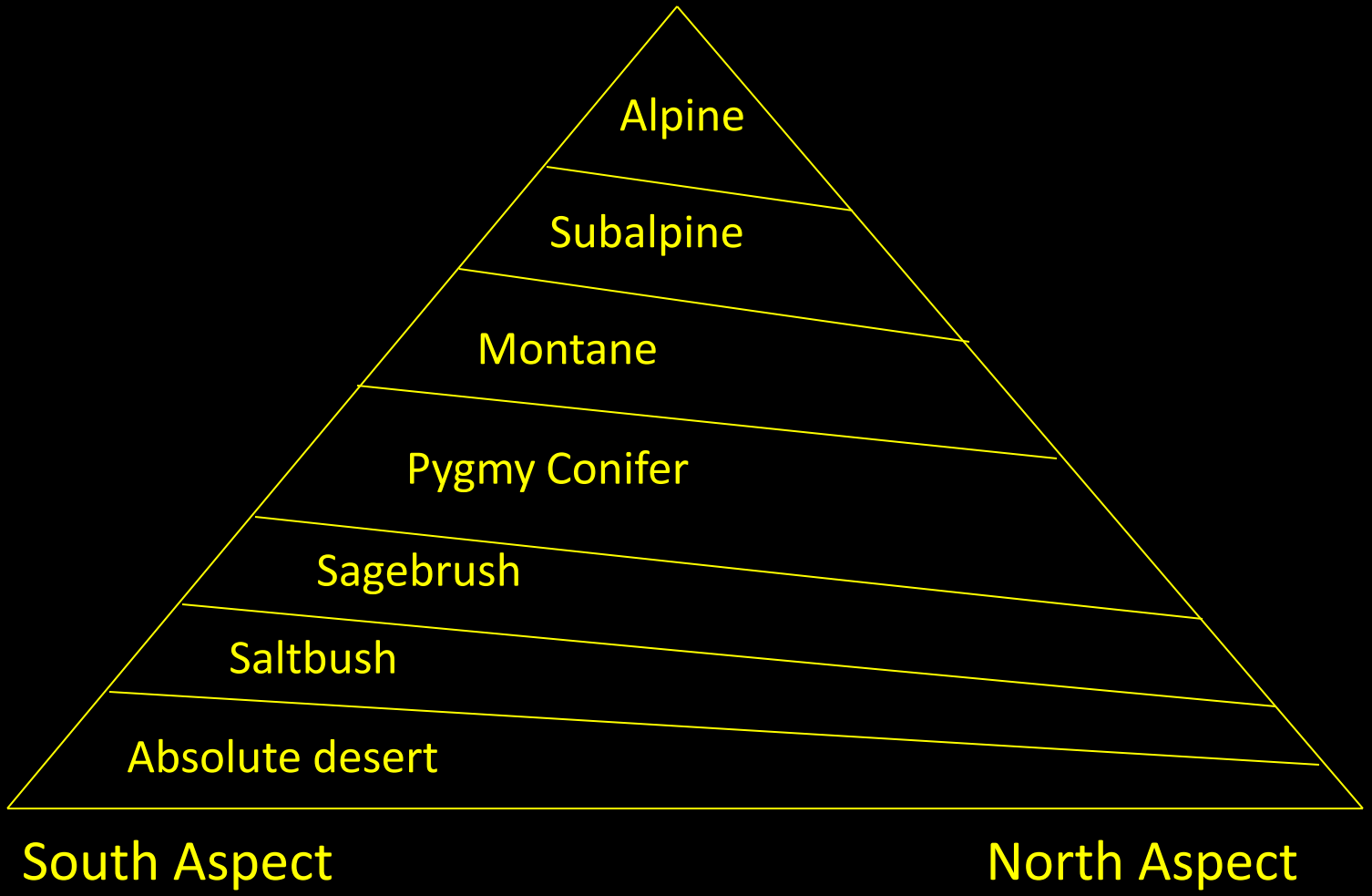
# Satellite Imagery

- Landsat TM 7
  - 30 m spatial resolution
  - 7 spectral bands
- Quickbird
  - Spatial resolution to to 0.6 m with wavelet merge
  - Spectral resolution limited to four bands

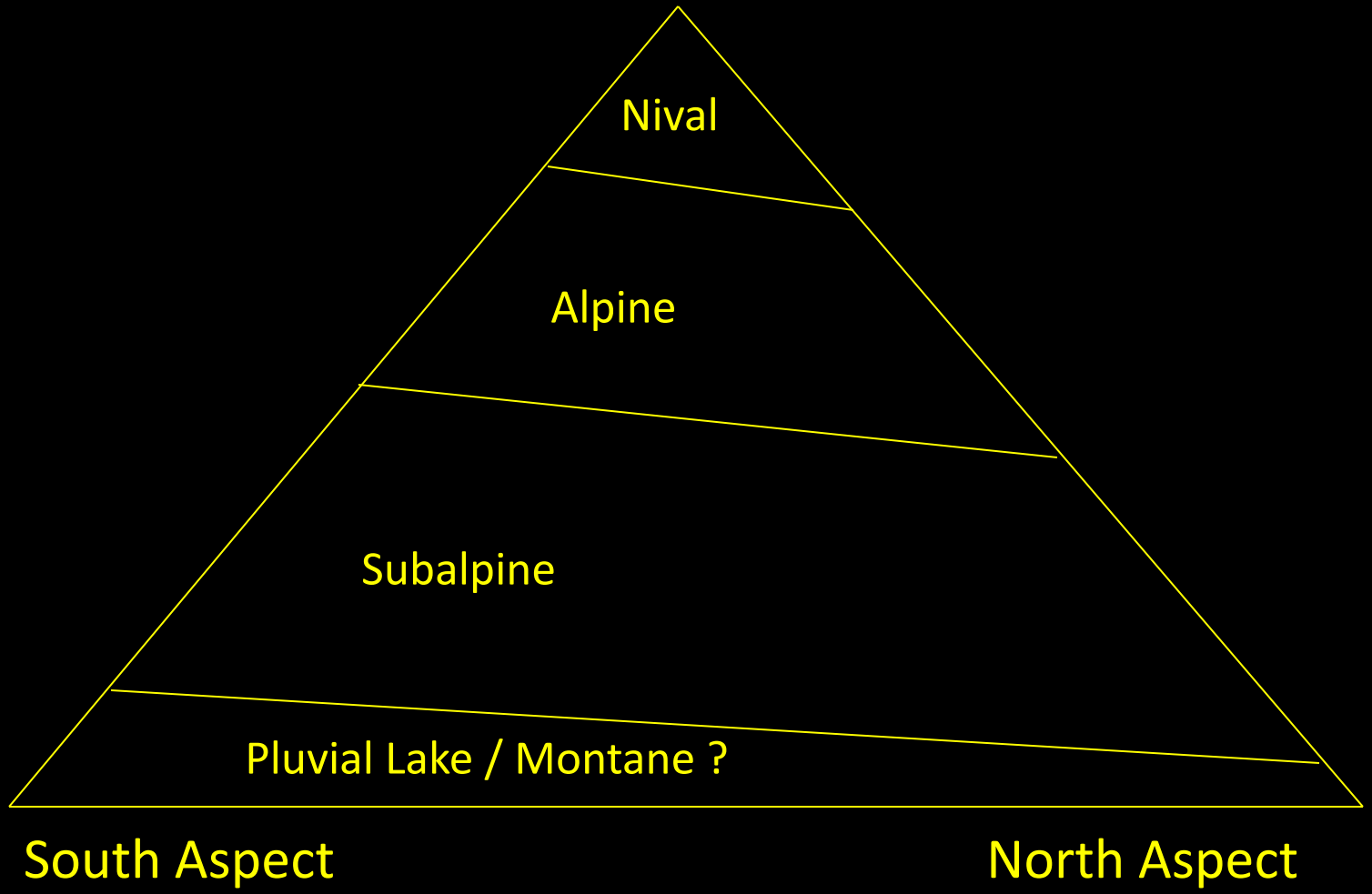


| Charlet | Billings (1951) | Merriam (1898) | MSHCP Ecosystems |
|---|---|---|---|
| Alpine | Alpine tundra MZS | Arctic-Alpine | Alpine |
| Subalpine | Limber pine-bristlecone pine MZS | Hudsonian | Bristlecone Pine |
| Montane | Yellow pine-White fir MZS | Canadian | Mixed Conifer |
| Pygmy Conifer | Pinyon-juniper MZS | Upper Sonoran | Pinyon-Juniper |
| Sagebrush | Sagebrush-grass | Upper Sonoran | Sagebrush |
| Blackbrush | Creosote-bush | Lower Sonoran | Blackbrush |
| Creosotebush | Creosote-bush | Lower Sonoran | Mojave Mixed Scrub |
| Saltbush | Shadscale | Lower Sonoran | Salt Desert Scrub |

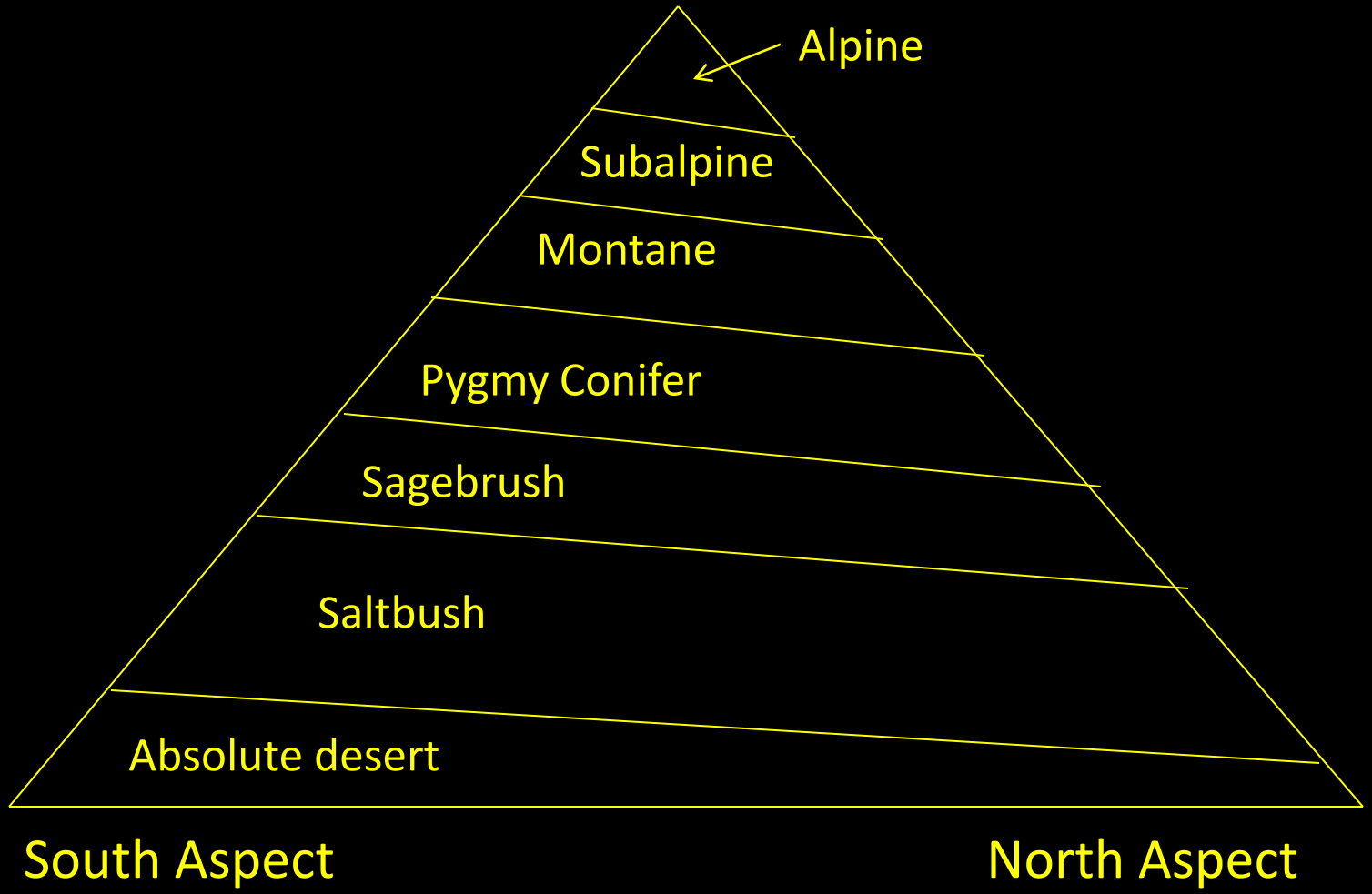
# Nevada Vegetation Zones: Great Basin Series



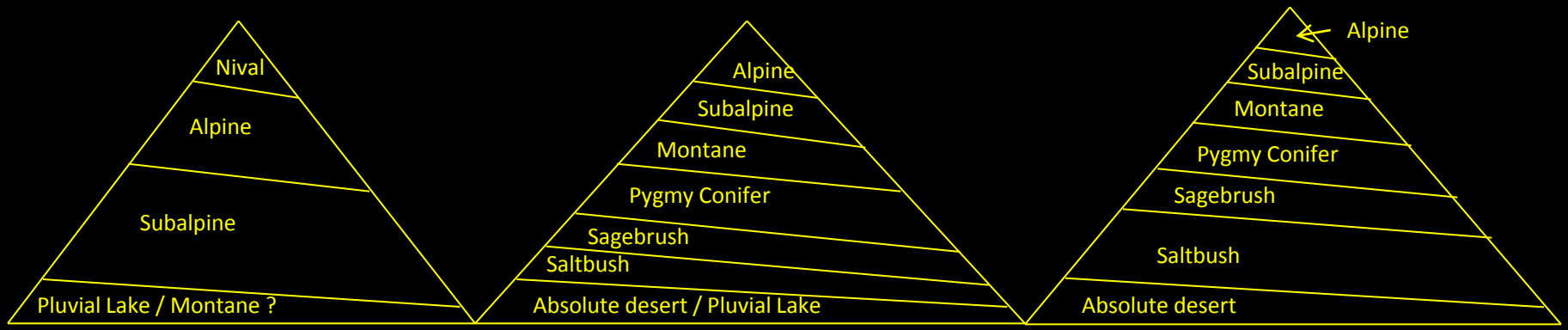
# Nevada Vegetation Zones: Great Basin Series at Full Glacial



# Nevada Vegetation Zones: Great Basin Series at ºT Max



# Great Basin Series: Hypotheses

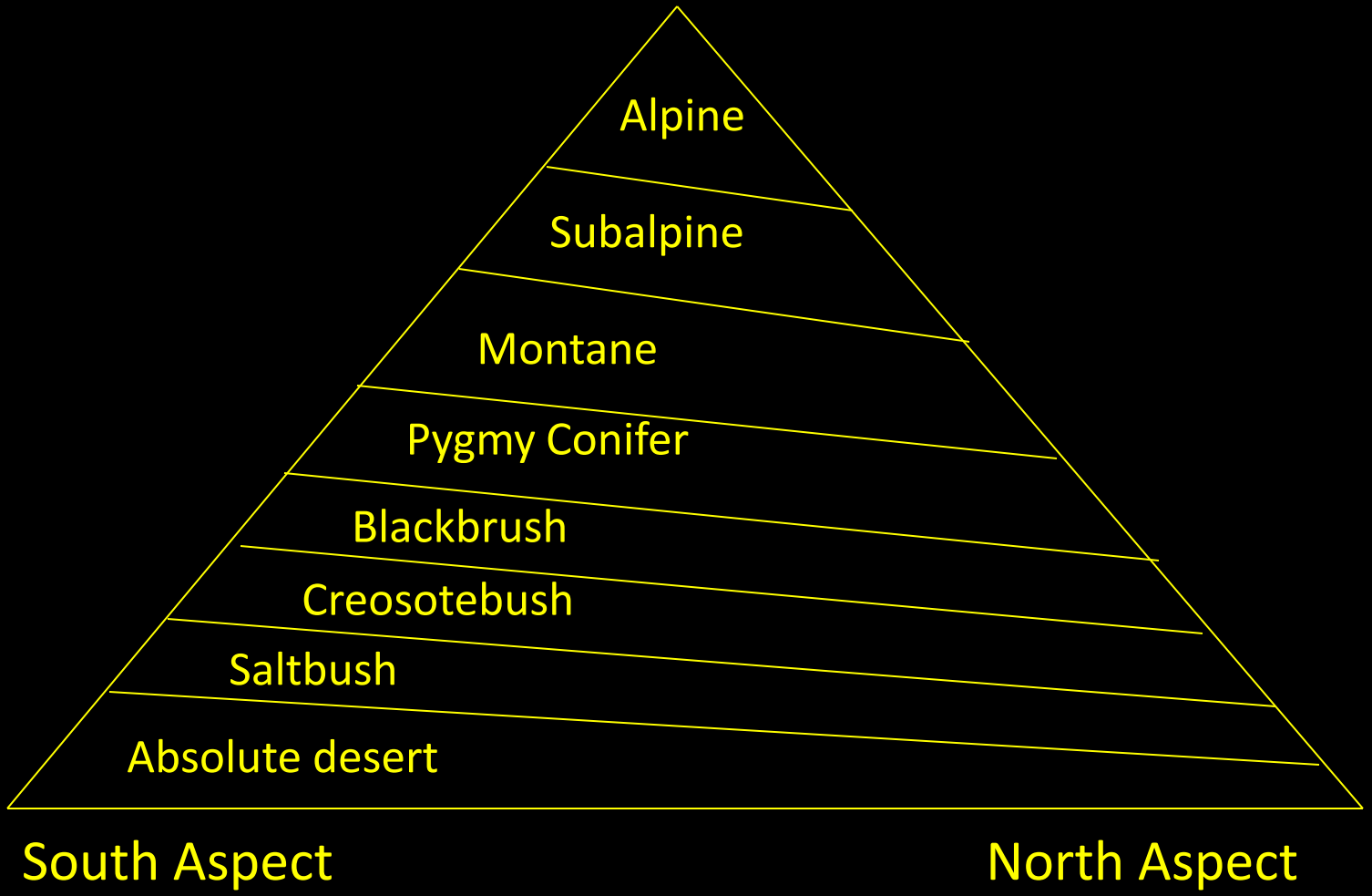



Full Glacial
$H_{A2}$

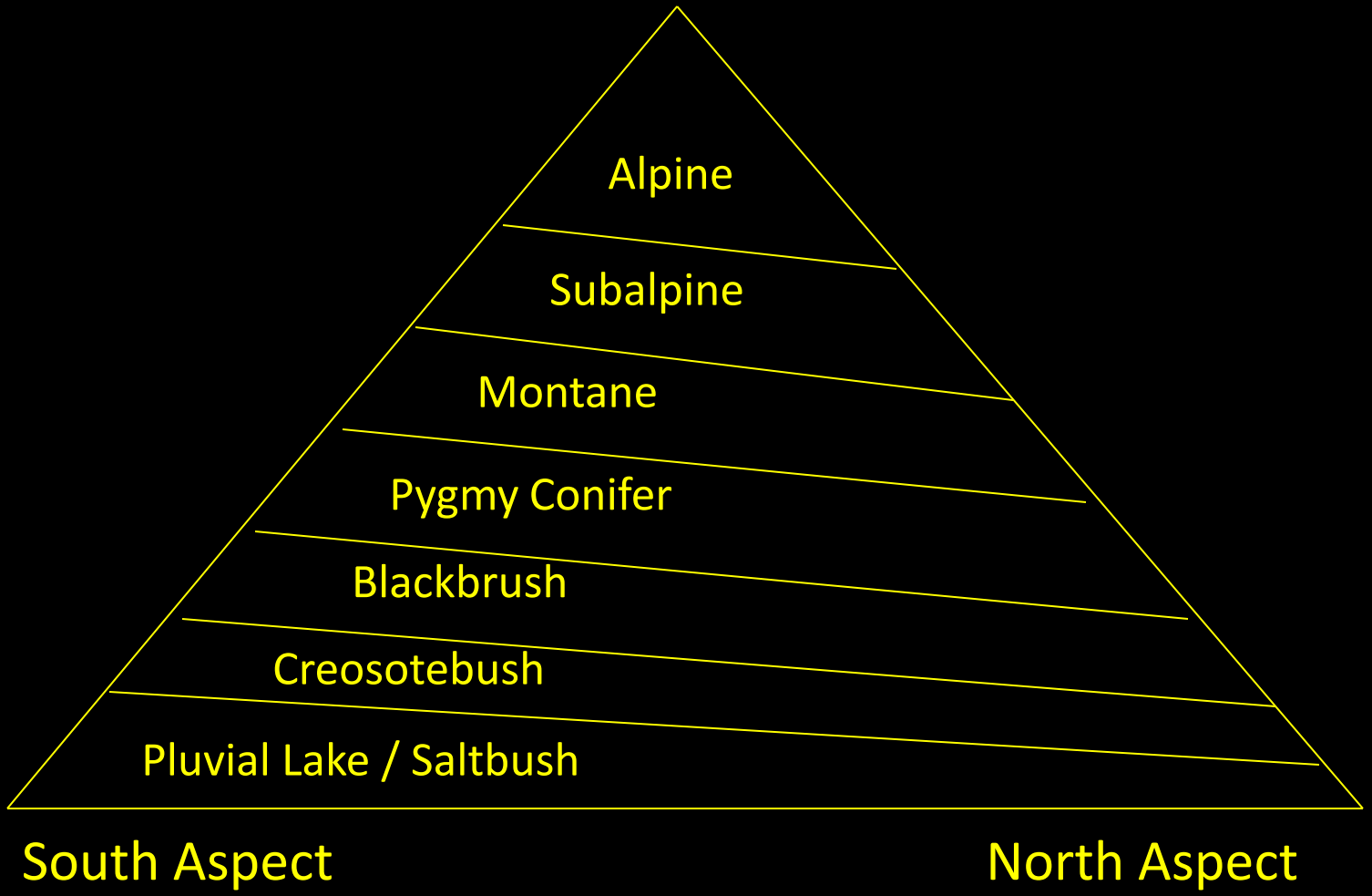
Present Day
$H_{\emptyset}$

Thermal Max
$H_{A1}$

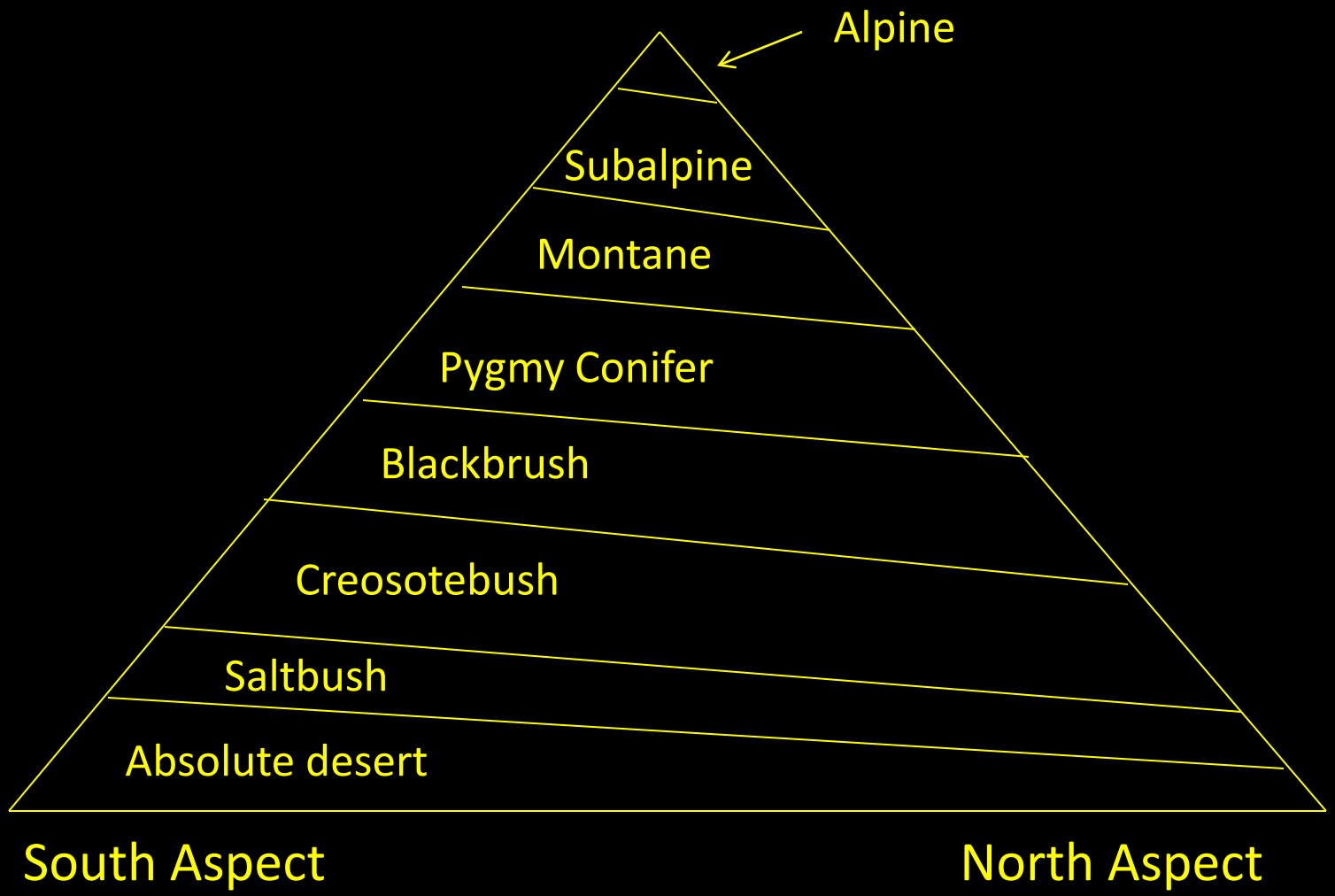
# Nevada Vegetation Zones: Mojave Series



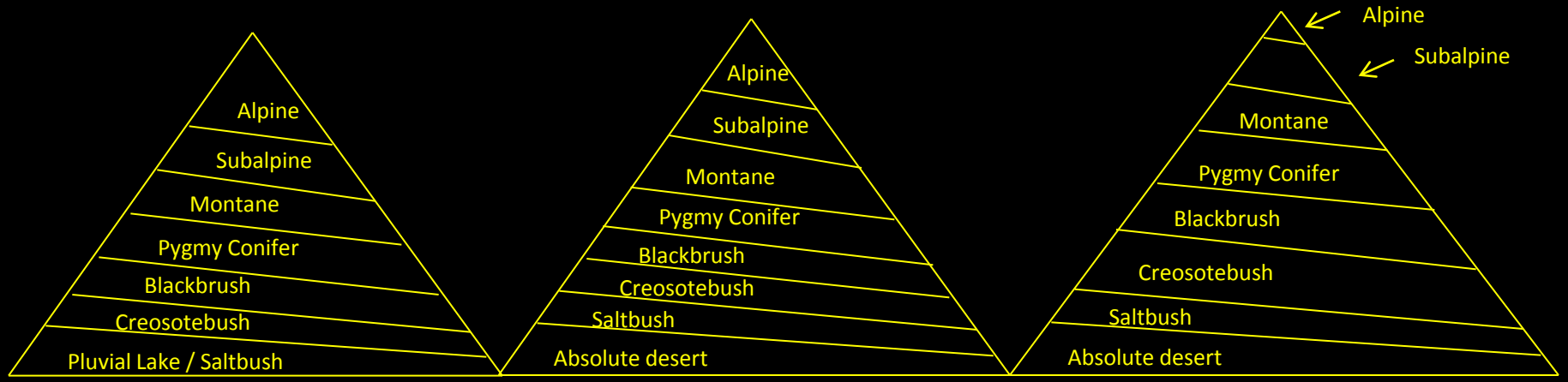
# Nevada Vegetation Zones: Mojave Series at Full Glacial



# Nevada Vegetation Zones: Mojave Series at ºT Max



# Mojave Series: Hypotheses




Full Glacial
$H_{A2}$

Present Day
$H_{\emptyset}$

Thermal Max
$H_{A1}$


Let’s Calibrate
And get some data
MAGELLAN
GARMIN
GPSmap 76


71


BRADCO
BRADCO
511
A 315

# Azonal Ecosystems

- Desert Pavement
- Bedrock Cliff and Outcrop
- Springs
- Mesquite/Catclaw
- Riparian
- Dunes

# Desert Pavement

# Bedrock, Cliffs, and Outcrops


Springs


V68

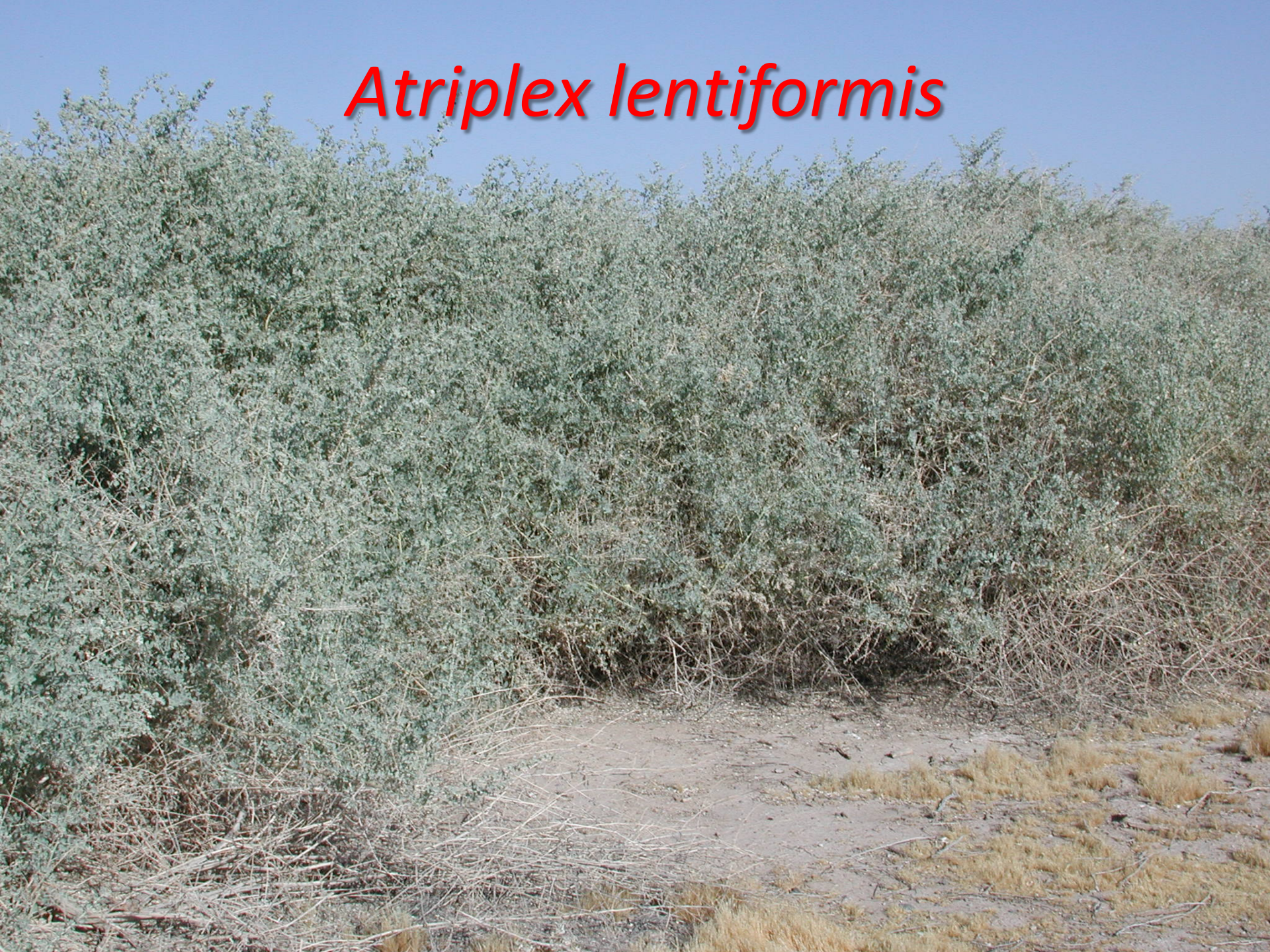

Riparian

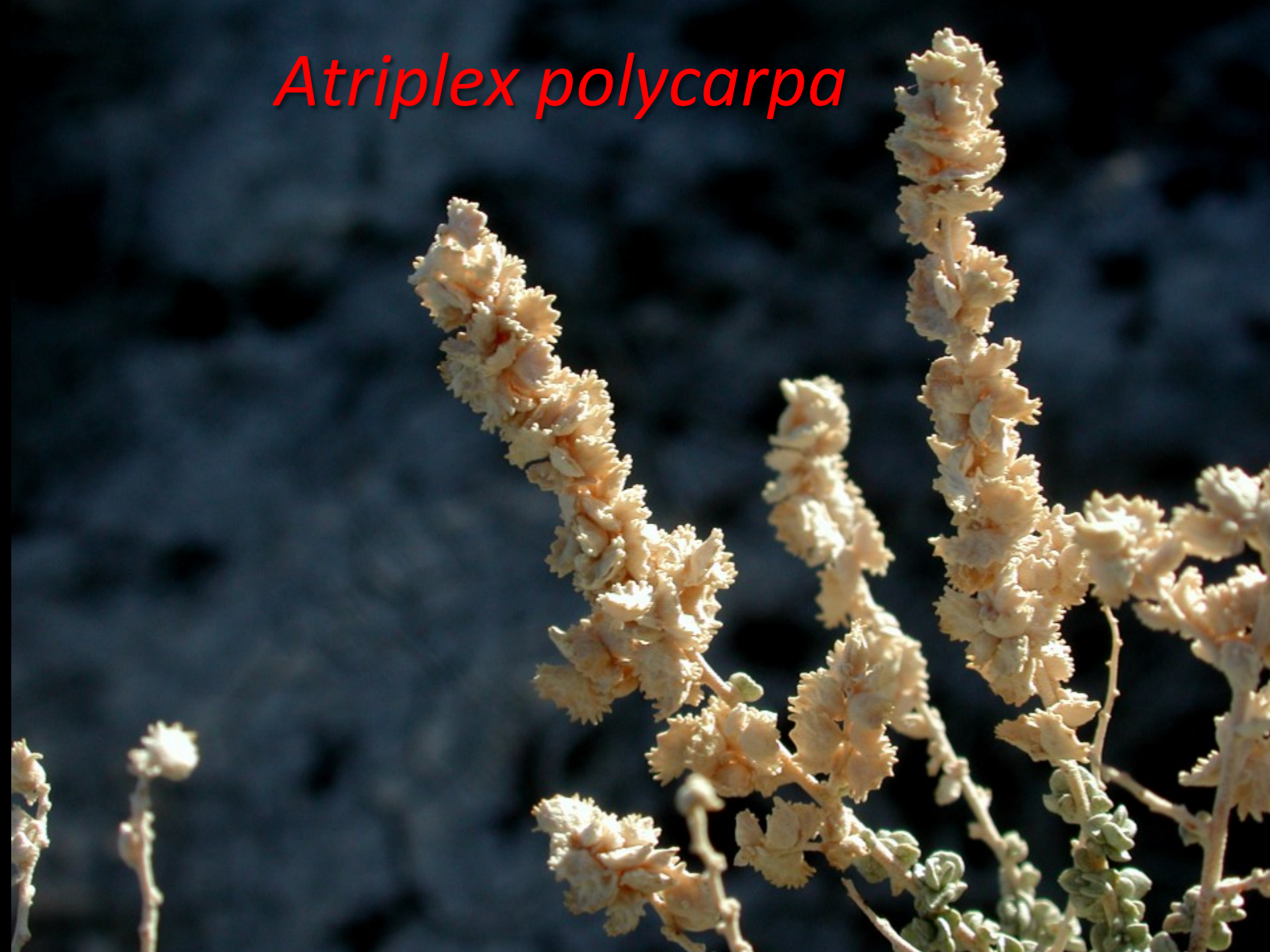
# Dunes

# Saltbush Zone

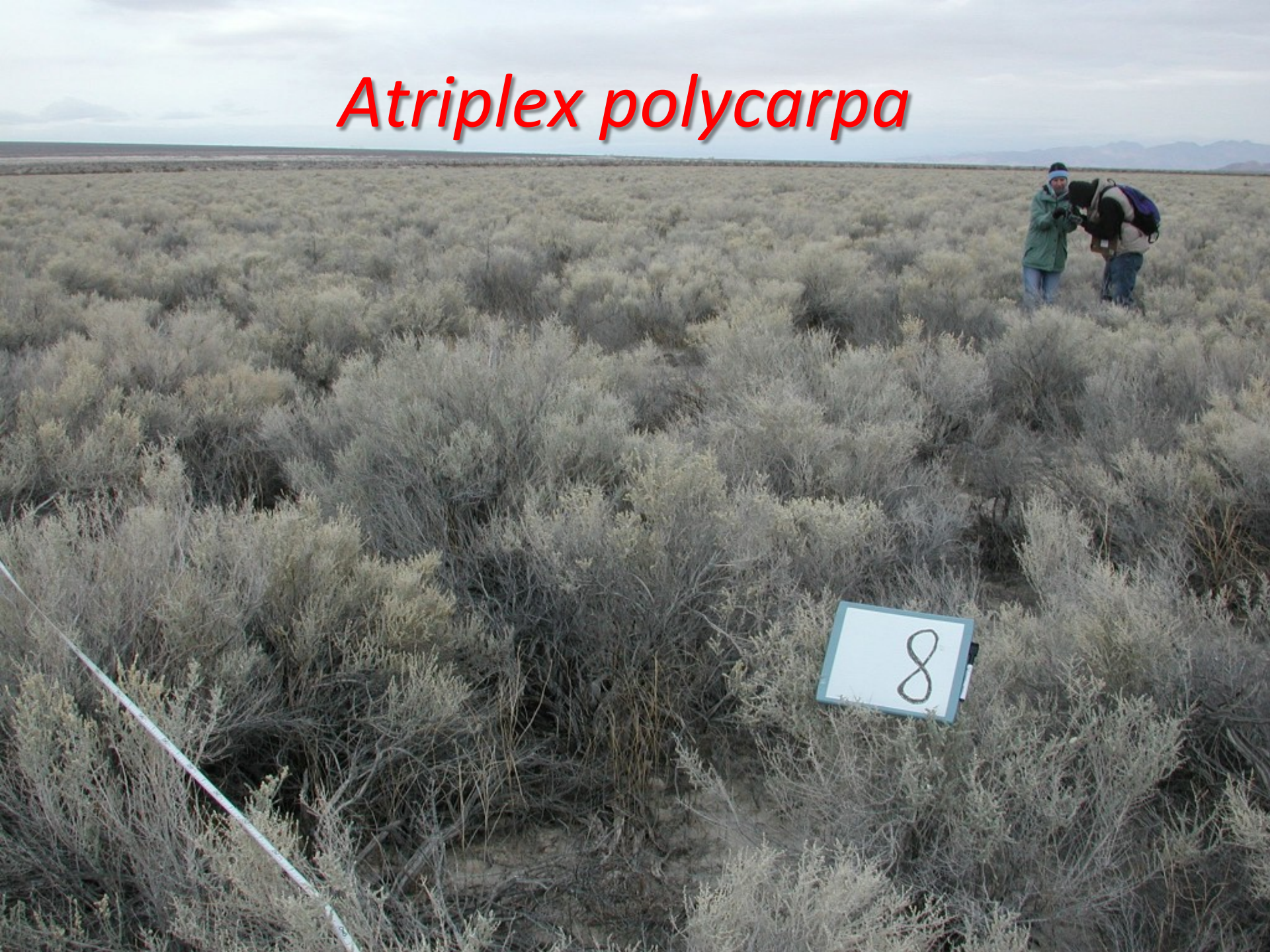

Atriplex confertifolia


Atriplex canescens


Atriplex lentiformis


Atriplex polycarpa

# *Atriplex polycarpa*



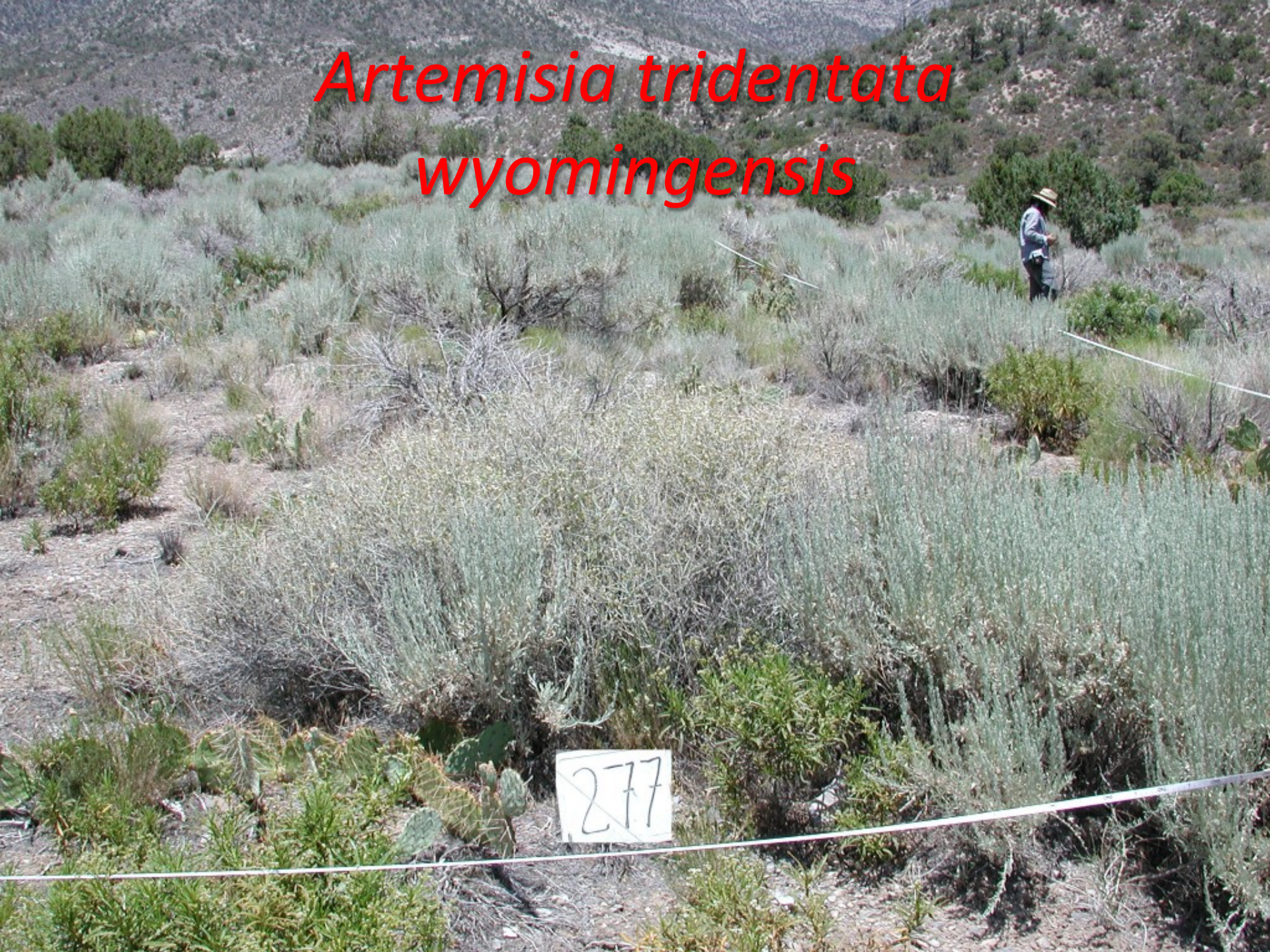
# Creosotebush Zone


Blackbrush Zone


157

# *Pleuraphis rigida* meadows

# Sagebrush Zone


Artemisia tridentata
wyomingensis
277


Artemisia tridentata vaseyana


Artemisia nova


Pygmy Conifer Zone

*Pinus monophylla*

*Juniperus osteosperma*

# *PIMO – JUOS / QUGA*


Pinus californiarum / Juniperus californica


PICA - YUBR / CORA McCullough Range


Montane Zone

*Pinus ponderosa*
Forest


Montane Forests


Montane Shrublands


Subalpine Zone

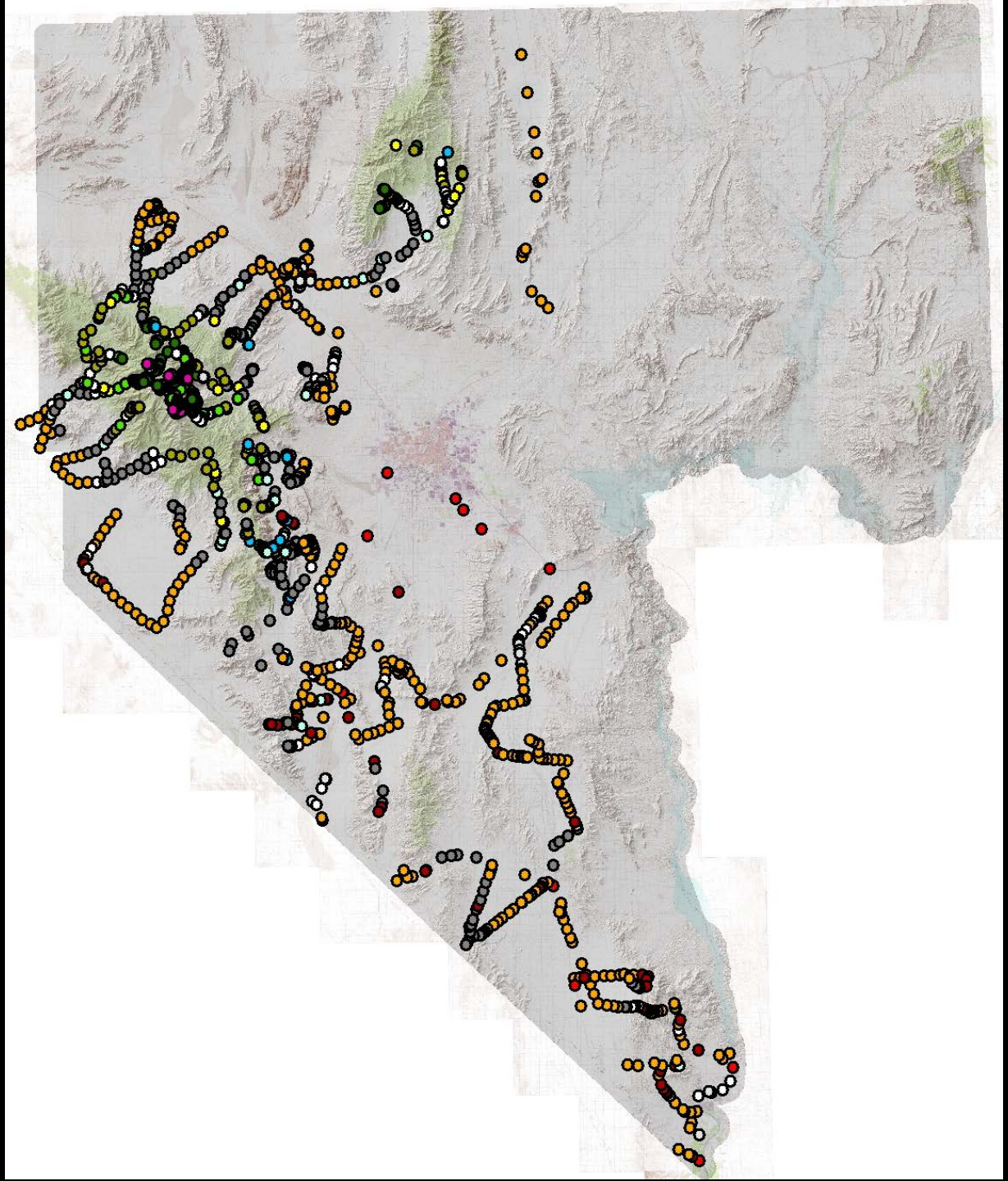

Subalpine Woodlands

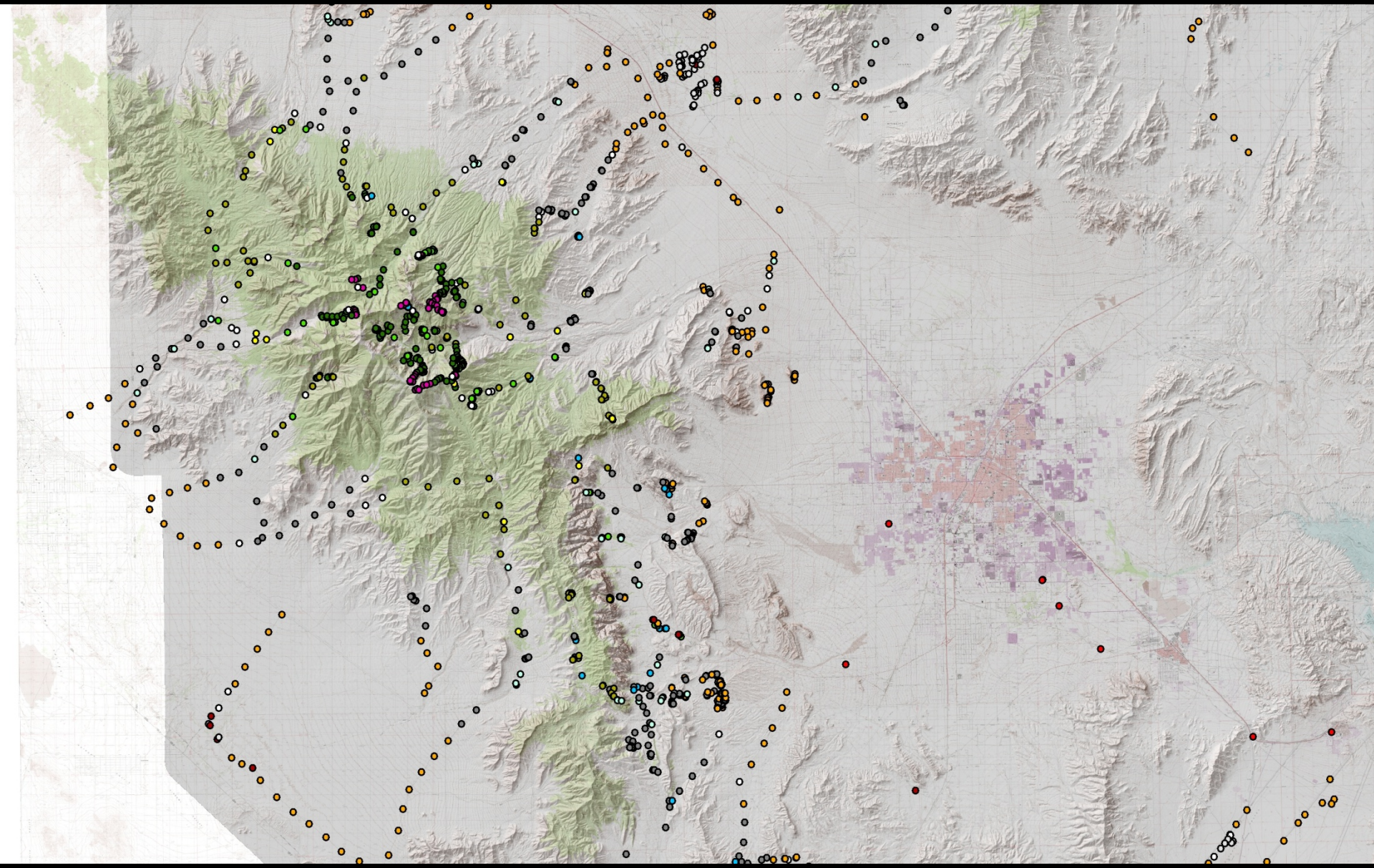
# Subalpine Meadows

# Subalpine Forests

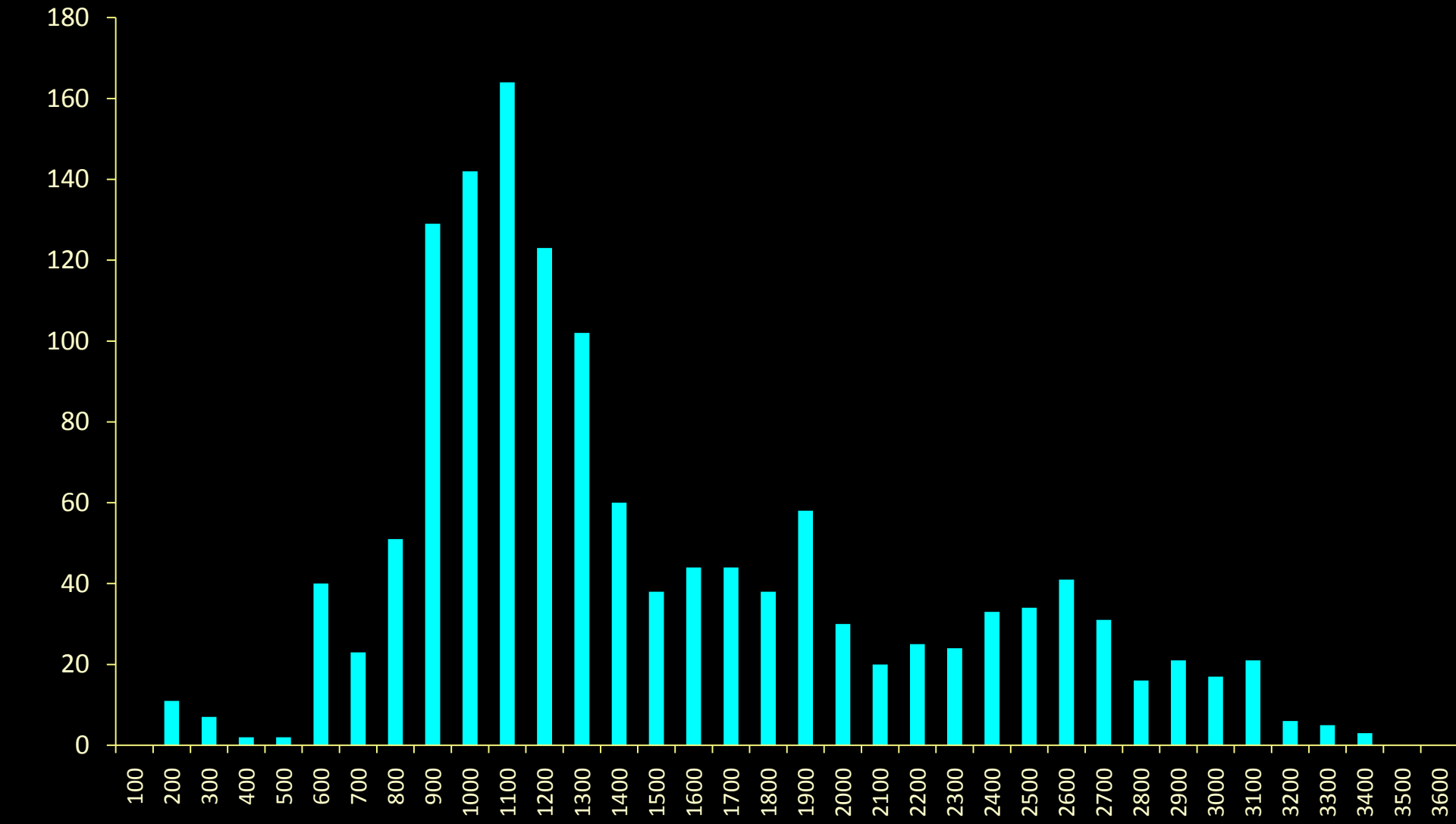
*Pinus longaeva* forest

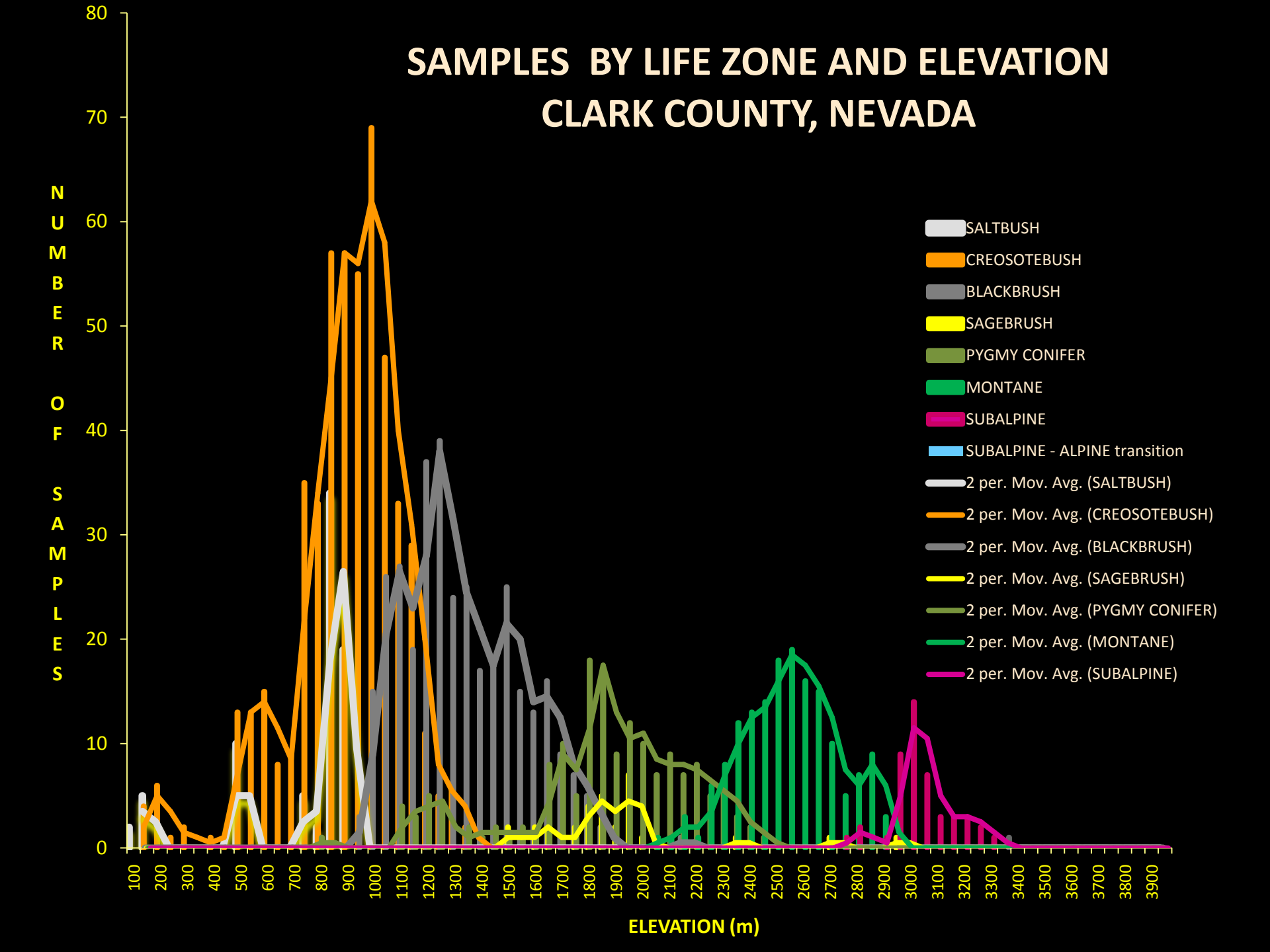
# Alpine Zone





# SAMPLES BY ELEVATION (m)




SAMPLES BY LIFE ZONE AND ELEVATION
CLARK COUNTY, NEVADA
NUMBER OF SAMPLES
0
10
20
30
40
50
60
70
80
100
200
300
400
500
600
700
800
900
1000
1100
1200
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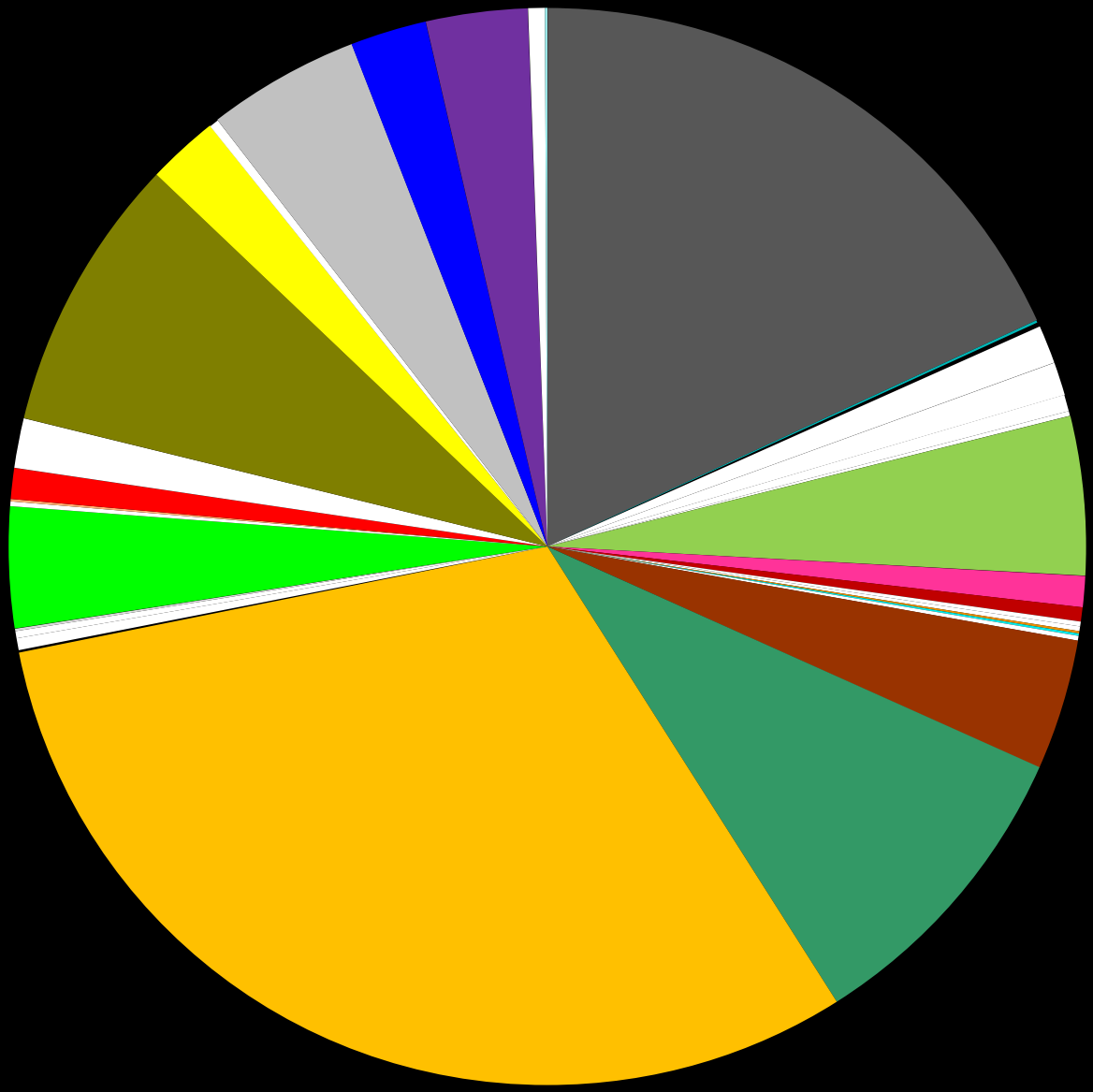
3000
3100
3200
3300
3400
3500
3600
3700
3800
3900
ELEVATION (m)
SALTBUSH
CREOSOTEBUSH
BLACKBRUSH
SAGEBRUSH
PYGMY CONIFER
MONTANE
SUBALPINE
SUBALPINE - ALPINE transition
2 per. Mov. Avg. (SALTBUSH)
2 per. Mov. Avg. (CREOSOTEBUSH)
2 per. Mov. Avg. (BLACKBRUSH)
2 per. Mov. Avg. (SAGEBRUSH)
2 per. Mov. Avg. (PYGMY CONIFER)
2 per. Mov. Avg. (MONTANE)
2 per. Mov. Avg. (SUBALPINE)

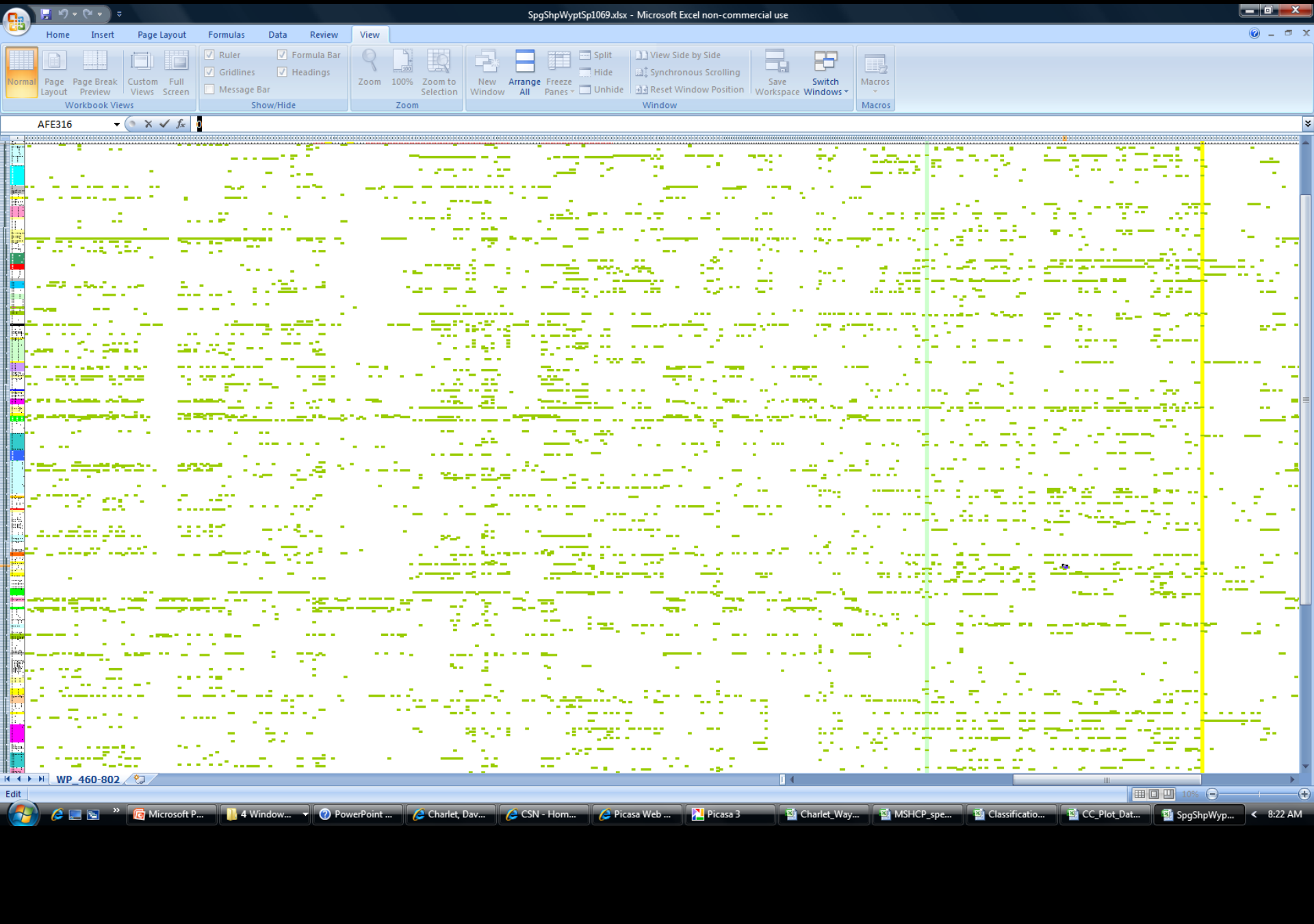
# SAMPLES BY ECOSYSTEM



- BLACKBRUSH
- Blackbrush-Burn boundary
- Blackbrush-Mojave Desert Scrub boundary
- Blackbrush-Mojave Desert Scrub transition
- Blackbrush-Pinyon/Juniper transition
- Blackbrush-Sagebrush transition
- Blackbrush-Sagebrush-Pinyon/Juniper transition
- DESERT RIPARIAN
- Developed
- MESQUITE/CATCLAW DUNE
- Mesquite/Catclaw-Blackbrush-Mojave Desert Scrub boundaries
- Mesquite/Catclaw-Mojave Desert Scrub boundary
- Mesquite/Catclaw-Pinyon/Juniper transition
- Mesquite/Catclaw-Blackbrush boundary
- Mesquite/Catclaw-Developed boundary
- MESQUITE-CATCLAW-DESERT RIPARIAN
- MIXED CONIFER
- MOJAVE DESERT SCRUB
- Mojave Desert Scrub-Pinyon/Juniper transition

# Analysis

- To date, 950 unique vegetation Associations (*n* = 1398 samples)
- Encountered 718 species of perhaps 1200
  - sampling remains inadequate
- Analyzing changes in environmental variables to changes in distribution of species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Page Layout
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Data
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Page Layout
Page Break Preview
Custom Views
Full Screen
Workbook Views
Ruler
Gridlines
Message Bar
Formula Bar
Headings
Show/Hide
Zoom
100%
Zoom to Selection
New Window
Arrange All
Freeze Panes
Split
Hide
Unhide
View Side by Side
Synchronous Scrolling
Reset Window Position
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AFE316
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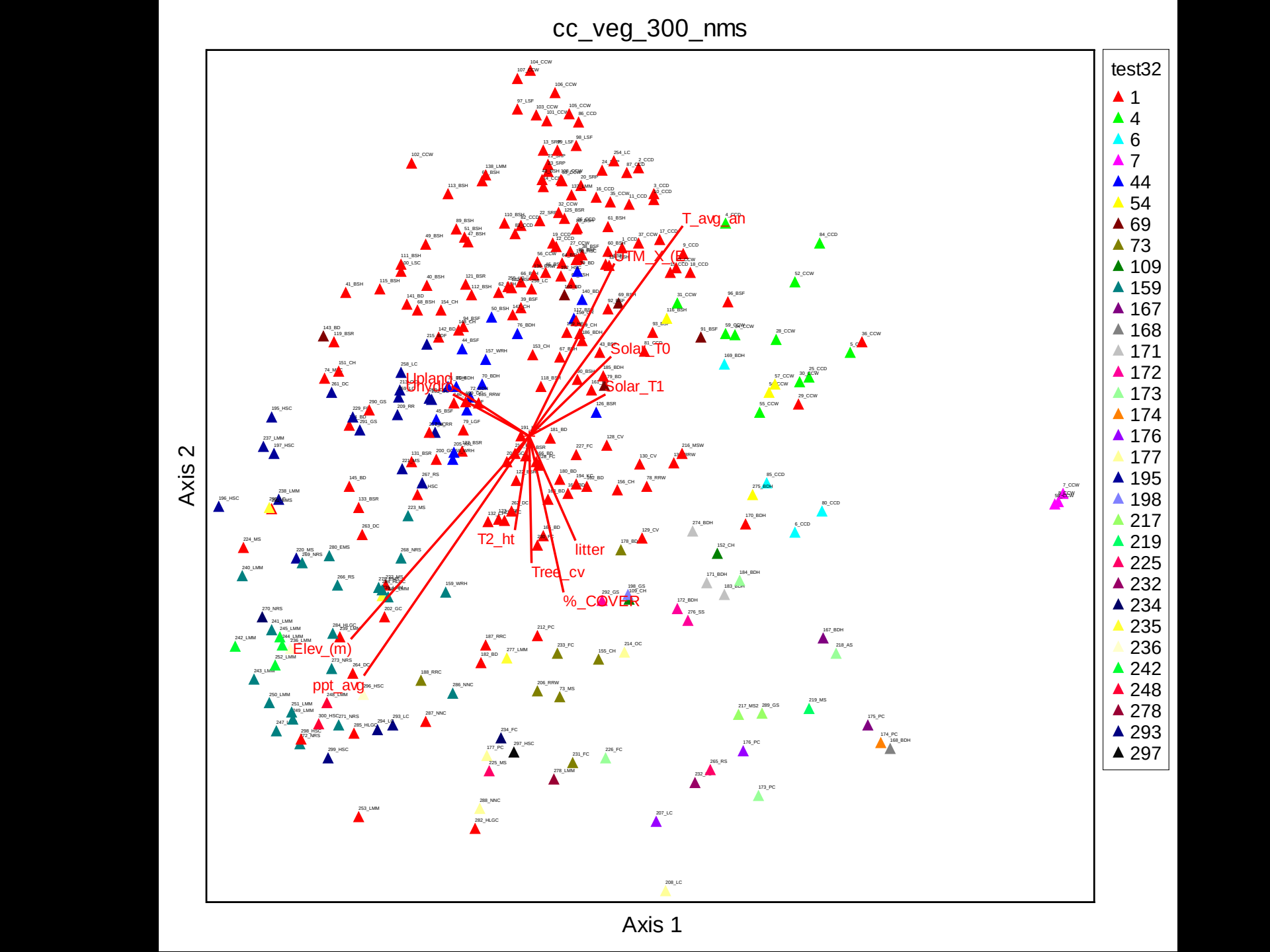
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Axis 2
Axis 1
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HTM_X_(E
Solar_T0
Solar_T1
Upland
Hydric
T2_ht
litter
Tree_cv
%_COVER
Elev_(m)
ppt_avg
test32
1
4
6
7
44
54
69
73
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167
168
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172
173
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177
195
198
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219
225
232
234
235
236
242
248
278
293
297

# Accomplishments to Date

- 1413 locations on ground in Clark County with:
  - High resolution geo-referenced photographs
    - 20,000 total, 4000 identified plant photographs
  - Plant species by waypoint matrix (718 x 1413)
  - Vegetation description, classified to Association, Alliance, Ecological System, Life Zone
  - Physical characteristics
  - 140 plant collections by Charlet, 200+ by Leary

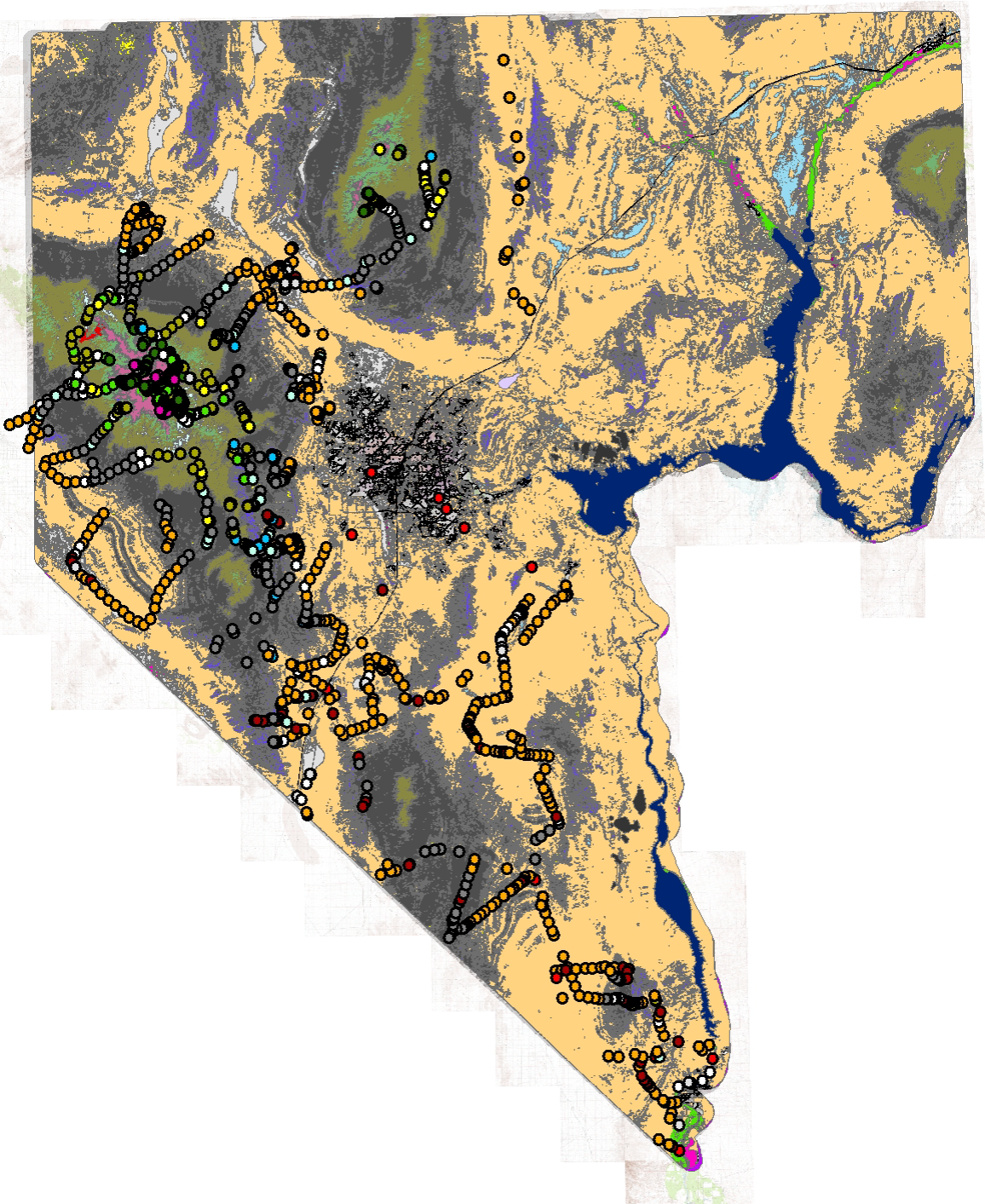
# Climate Change Monitoring

- 1413 locations to monitor vegetation response to climate change

- Detailed descriptions of associations present at all climate stations in network

# Bonus:

- Accuracy assessment for GAP, ReGAP, and new National Forest land cover maps



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Sep 12, 2009
photos: 115

September_11_2009
Sep 11, 2009
photos: 180

September_10_2009
Sep 10, 2009
photos: 219

September_04_2009
Sep 4, 2009
photos: 175

September_03_2009
Sep 3, 2009
photos: 360

August_28_2009
Aug 28, 2009
photos: 159

August_27_2009
Aug 27, 2009
photos: 148

August_21_2009
Aug 21, 2009
photos: 245

August_19_2009
Aug 19, 2009
photos: 107

August_18_2009
Aug 17, 2009
photos: 230

August_15_2009
Aug 15, 2009
photos: 291

August_14_2009
Aug 14, 2009
photos: 130

August_12_2009
Aug 12, 2009
photos: 205

DutchJohnMtn_LI
Aug 7, 2009
photos: 12

August_6_2009
Aug 6, 2009
photos: 104

August_4_2009
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photos: 66

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Jul 27, 2009
photos: 324

Movies
Jul 26, 2009
photos: 0

July_24_2008
Jul 24, 2009
photos: 217

July_23_2009
Jul 23, 2009
photos: 152

Internet

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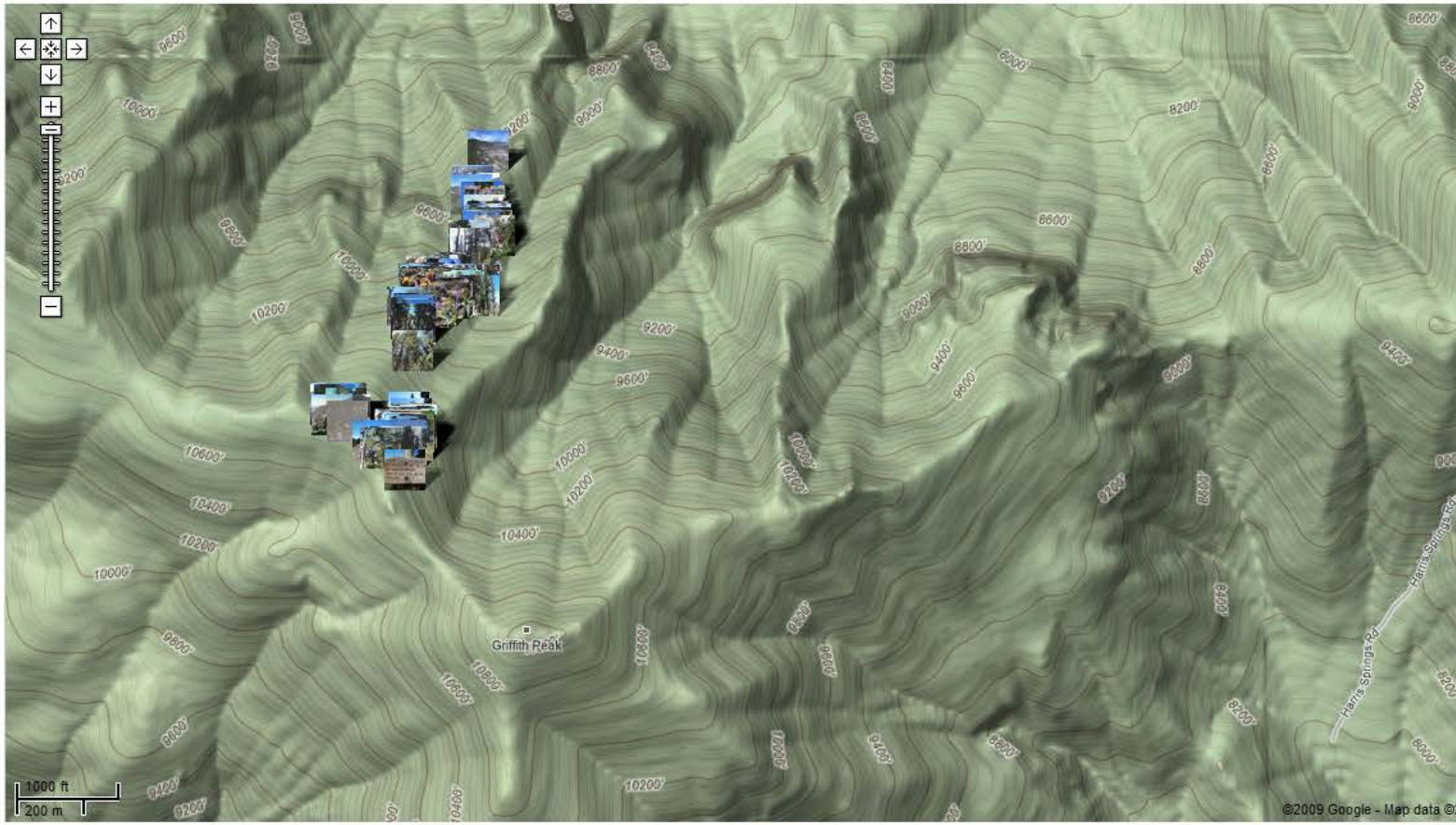




Done

Internet | Pro

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# Tie Together the Two Climate Transects


Thanks!