



# GWG – HWG Update

Vegetated Dune Areas (VDAs)

# Agenda

- Vegetated Dune Area (VDA) RPP Objectives
- Workplan Implementation Update
  - Timeline of activities
  - Preliminary findings
  - Remaining work

# VDA – RPP Objectives

- Goal: Develop (through collaboration) a Resource Protection Protocol (RPP) to protect VDAs from potential impacts due to groundwater pumping
  - Define appropriate resource protection criteria (RPCs)
  - Define appropriate monitoring parameters
  - Develop a tiered management approach with management triggers
    - Tier 1 - Early warning
    - Tier 2 – Management
    - Tier 3 – Stop Pumping
- VDA Workplan Implementation
  - Phase 1
    - Historical baseline data development on all VDAs
    - Detailed data collection, characterization, and monitoring on specific VDAs
    - Conceptual model development
  - Phase 2
    - Develop RPP based on Phase 1 results

# Detailed view of VDA 11



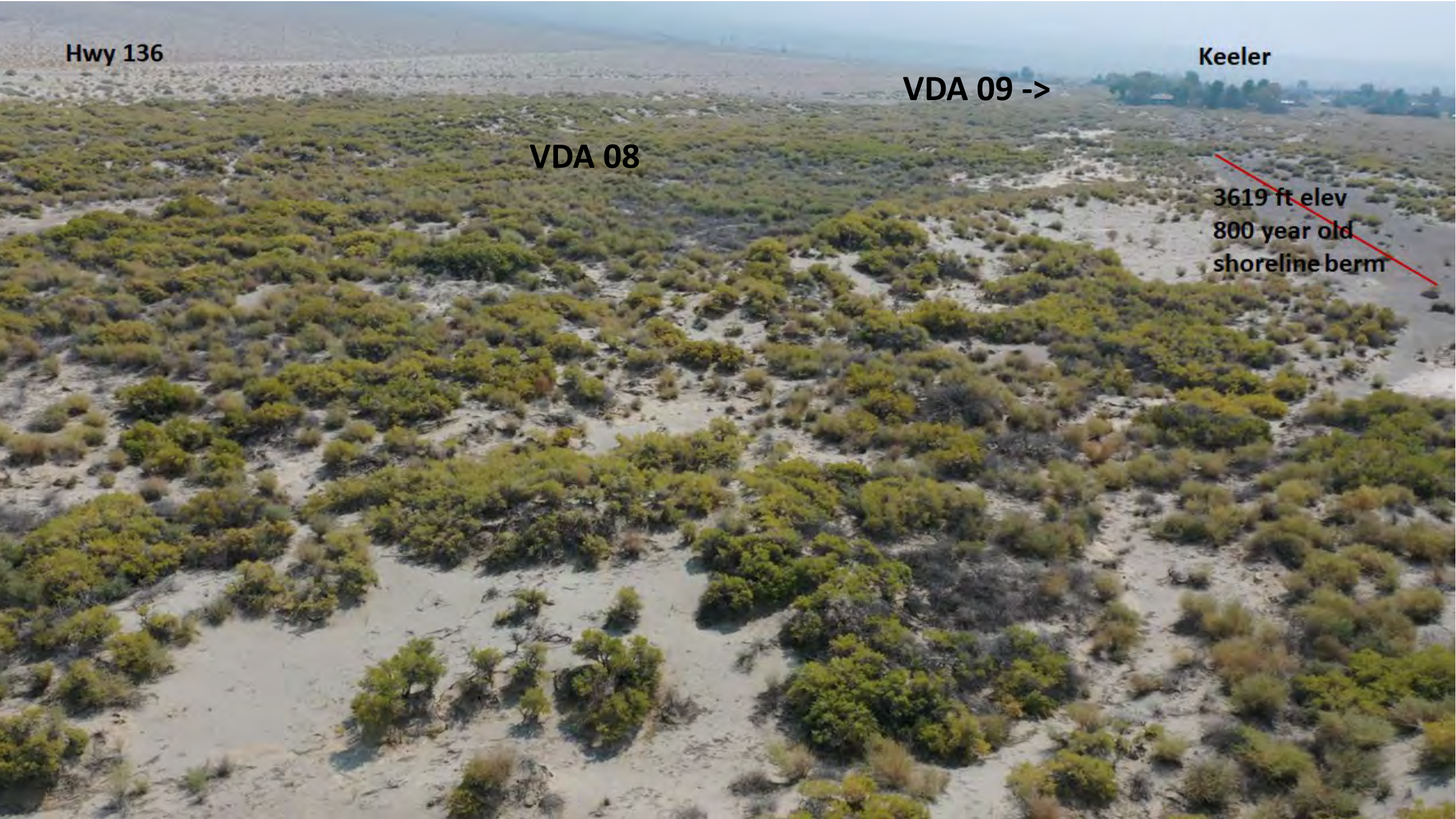
Hwy 136

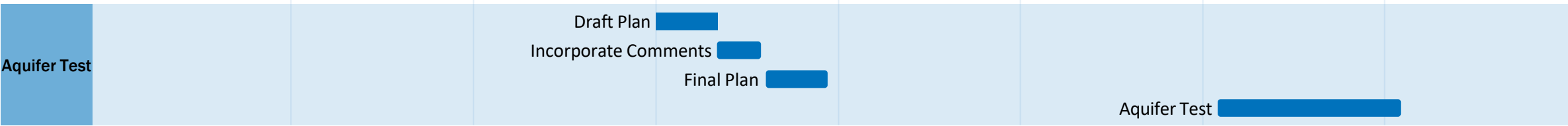
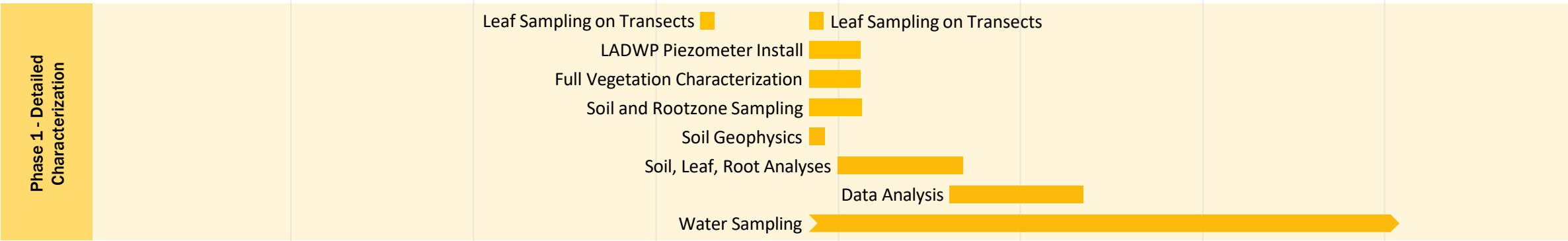
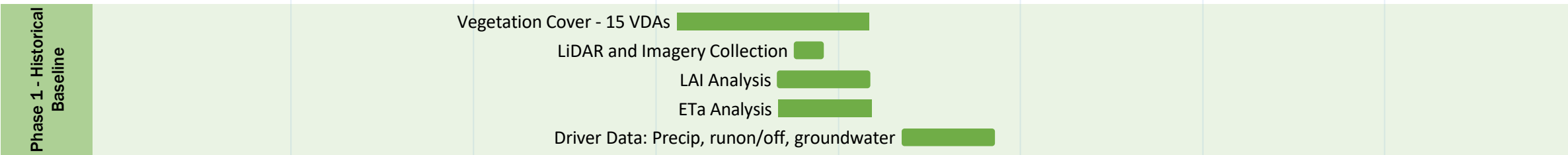
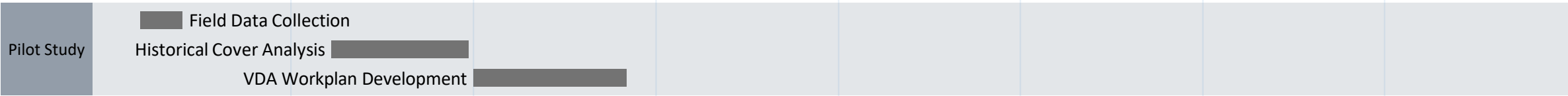
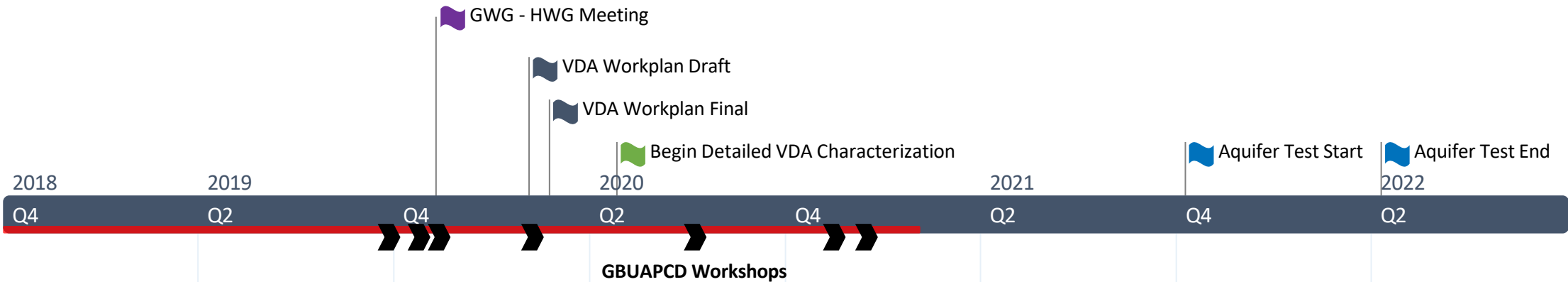
Keeler

VDA 09 ->

VDA 08

3619 ft elev  
800 year old  
shoreline berm





# Phase 1 Activities

## Historical Baseline Data Development (All 15 VDAs)

Vegetation  
Cover

Historical Cover

Leaf Area Index and  
Evapotranspiration

Landsat 1985 to 2020

Analysis, Drivers of Cover Variability & Early  
Warning Triggers

## Detailed Data Collection, Characterization & Monitoring (4 VDAs plus 3 non-invasive VDAs)

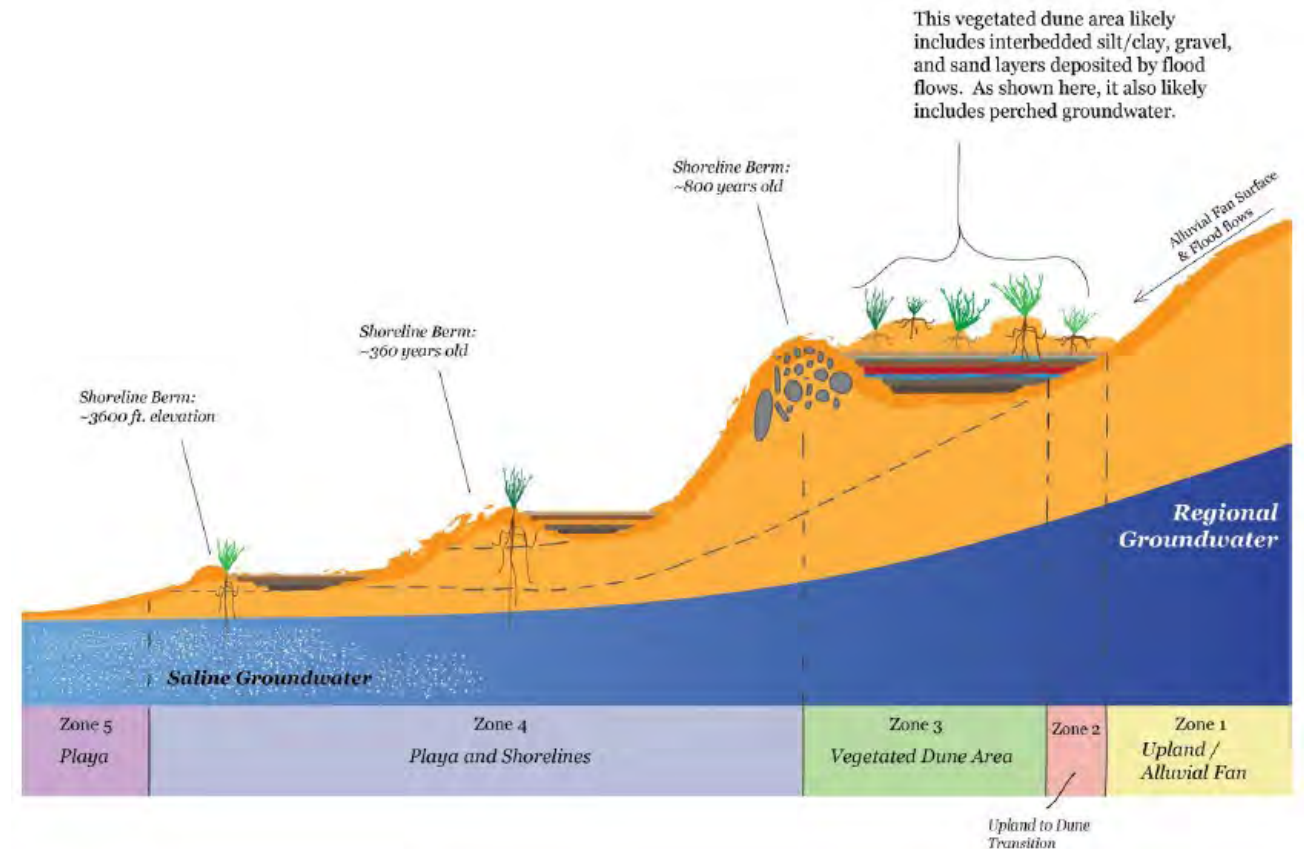
Soil and Root-zone  
Characteristics

Soil Geophysics

Vegetation

Groundwater

## Refine Conceptual Model



# Historical Baseline Data Development

## Historical Baseline Data Development (All 15 VDAs)

### Vegetation Cover

2020 LiDAR and  
imagery

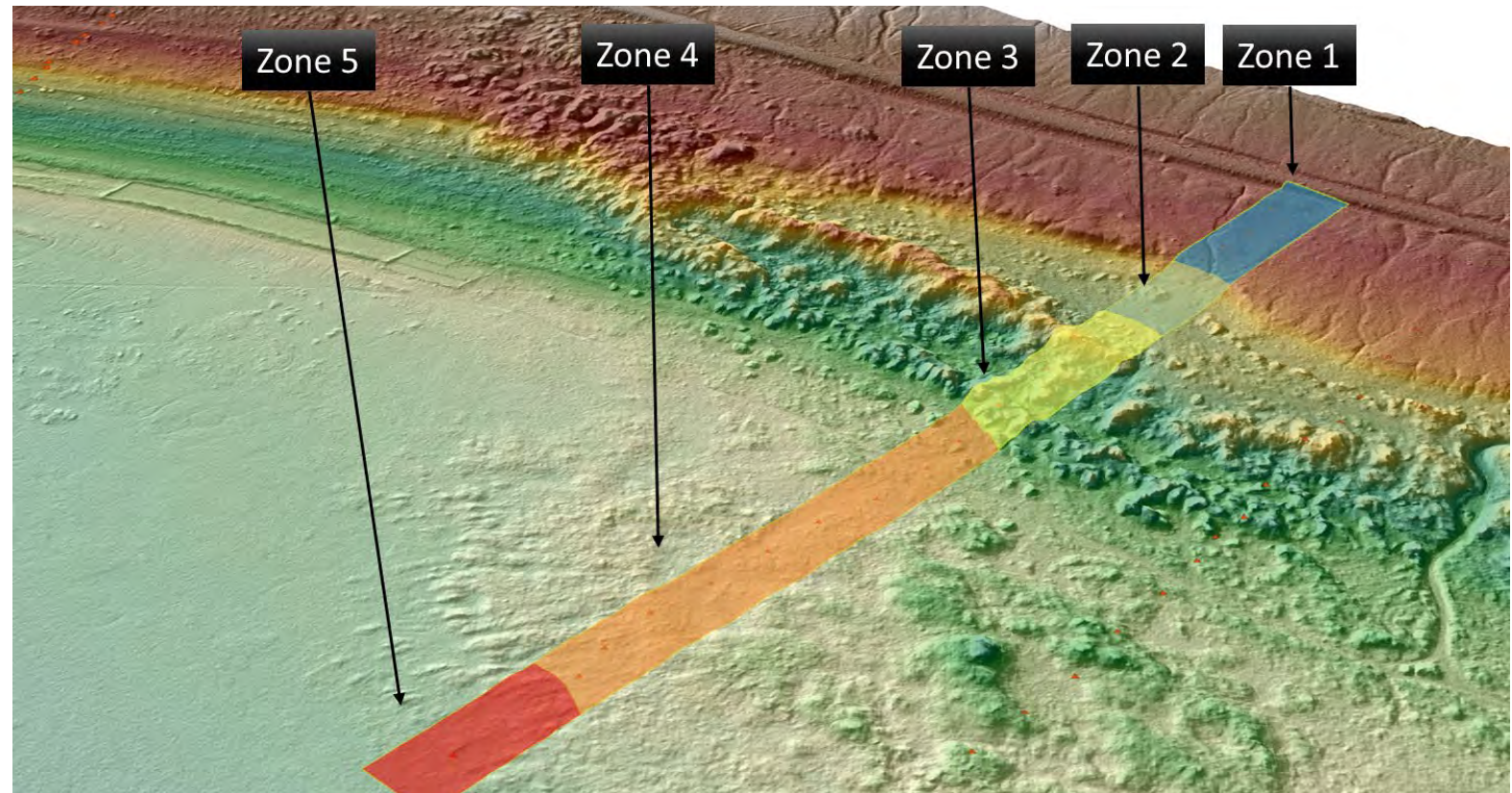
#### Transects:

- 2018
- 2016
- 2015
- 2014
- 2012
- 2009
- 1996
- 1977

### Leaf Area Index and Evapotranspiration

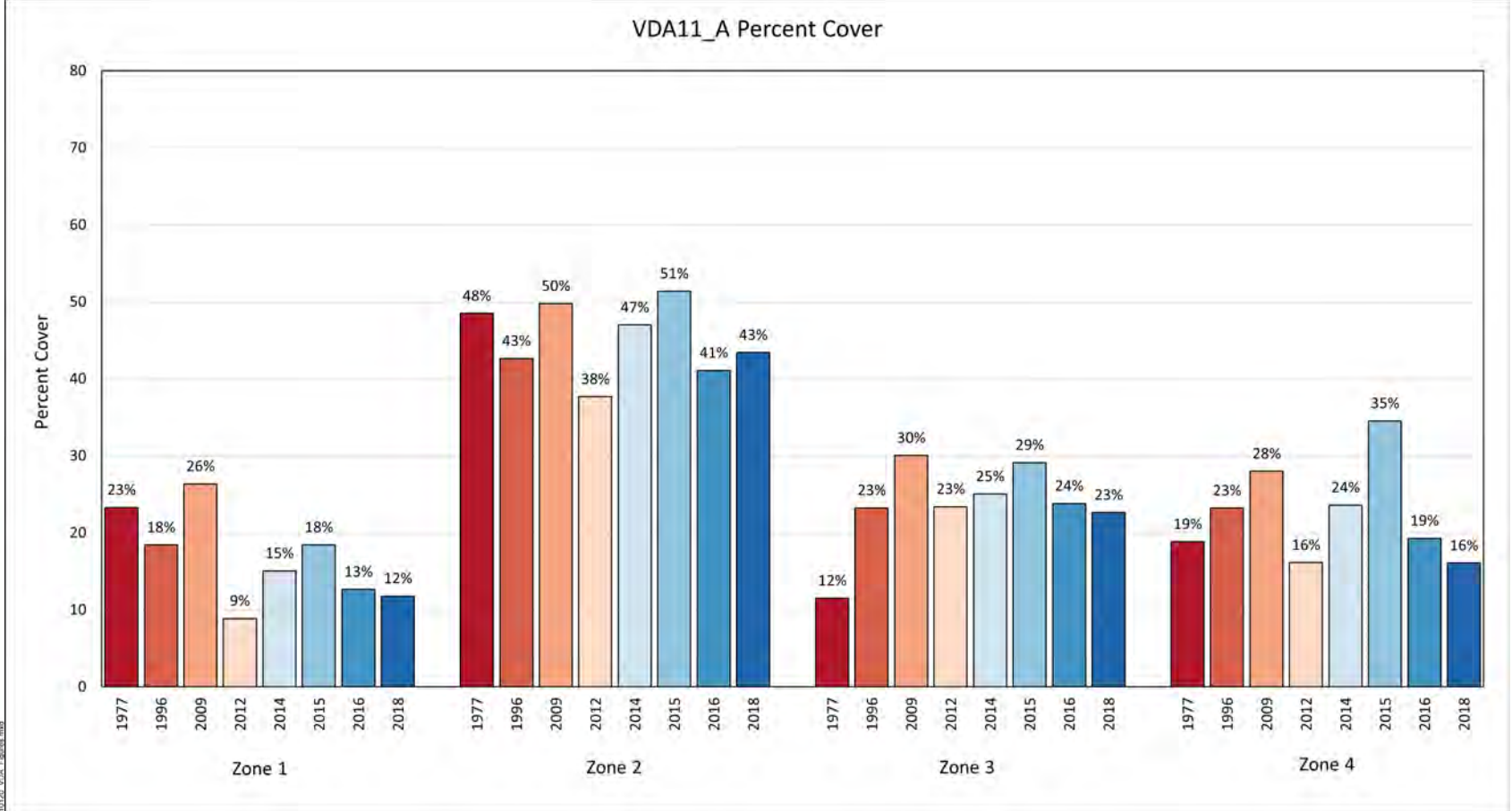
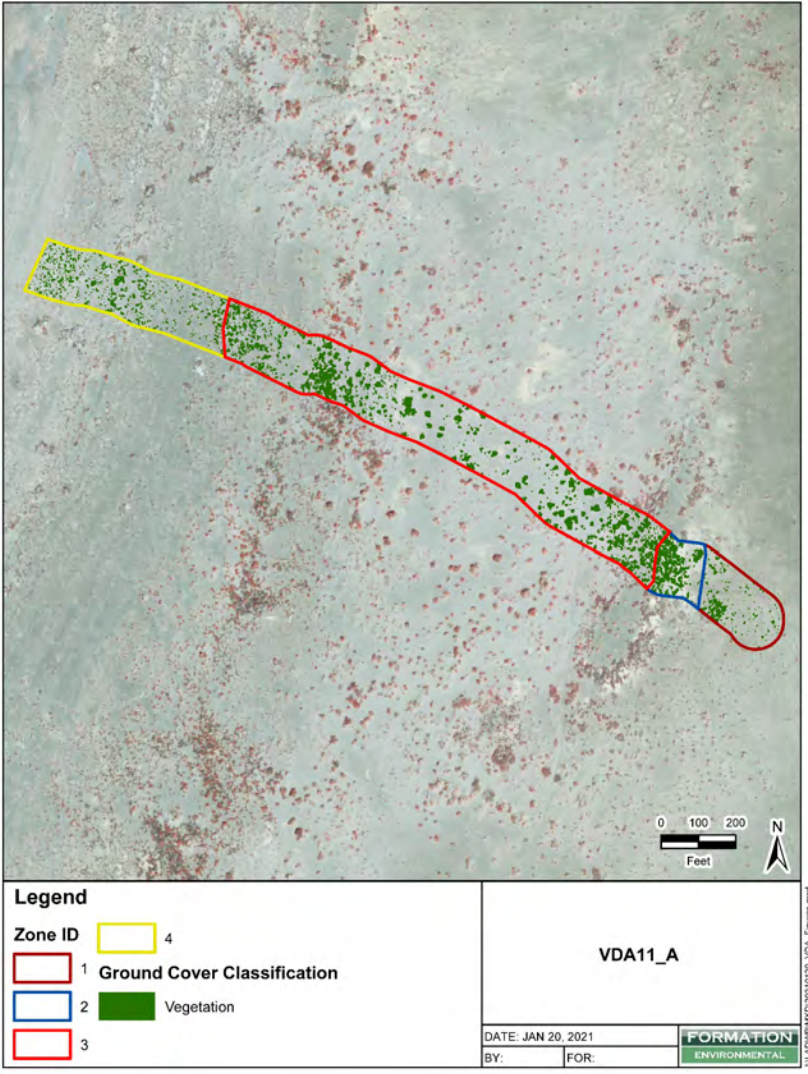
Landsat 1985 to 2020

Analysis, Drivers of Cover Variability & Early  
Warning Triggers

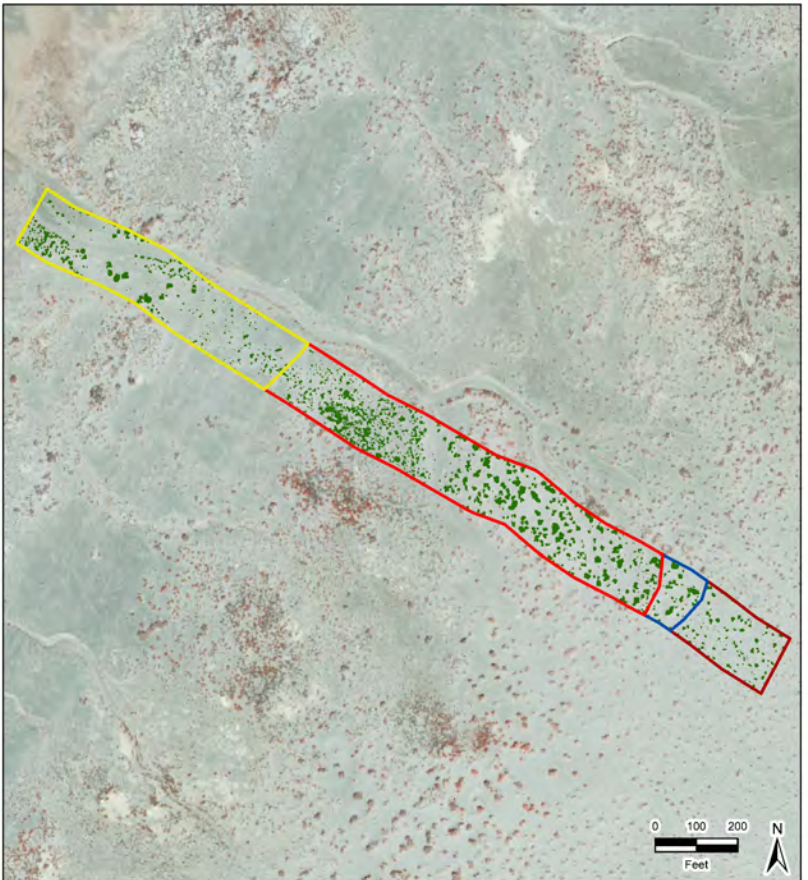




# Background Imagery and Vegetation Classifications are from 2018



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**Legend**

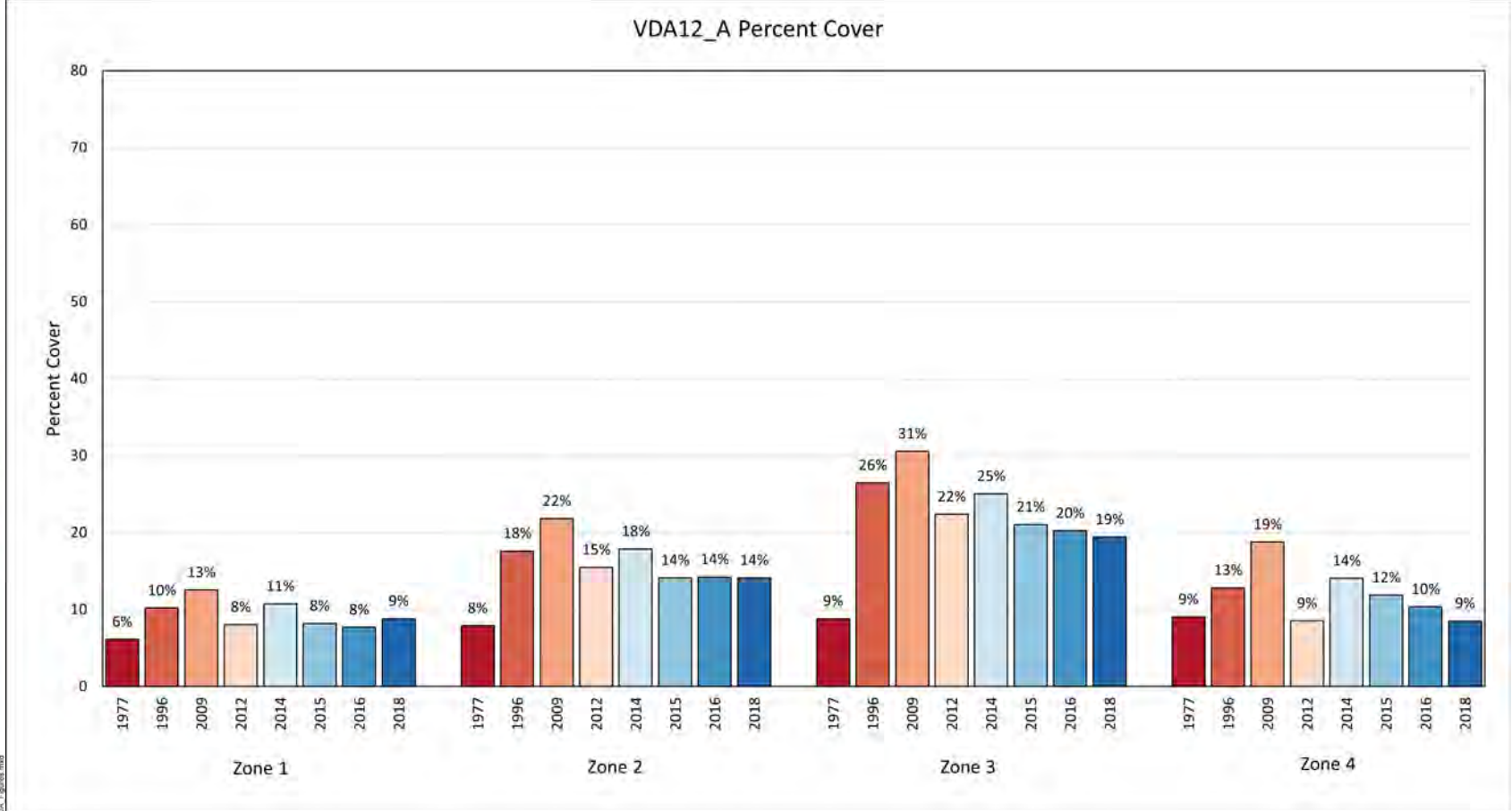
- Zone ID 4
- 1 Ground Cover Classification
- 2 Vegetation
- 3

**VDA12\_A**

DATE: JAN 20, 2021

BY: FOR:

**FORMATION**  
ENVIRONMENTAL

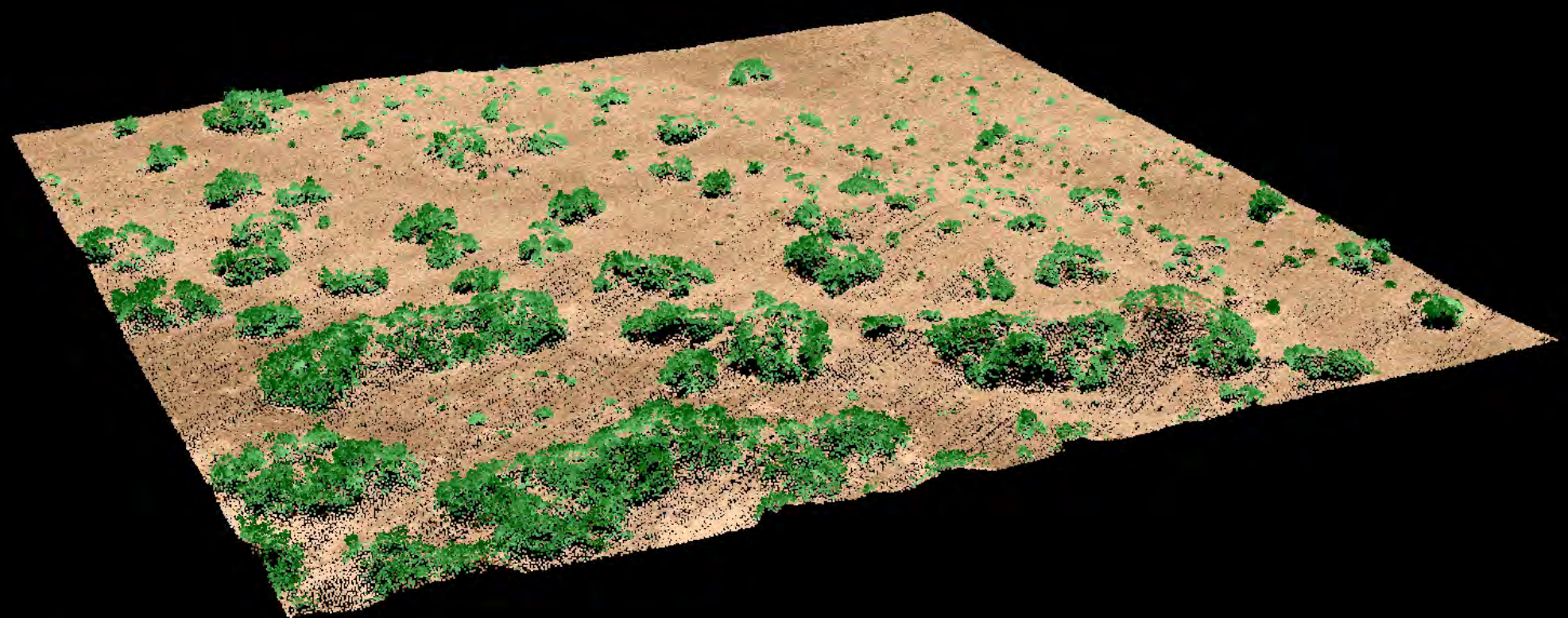
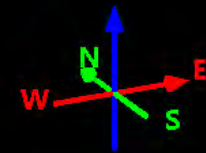


# Drivers of Cover Variability

- Statistical analysis on variability across VDAs, transects, zones, and years
- Precipitation
  - Statistical analysis of long-term data available vs. spatial variability of precipitation
  - A-Tower, B-Tower, Coso Junction H2S, Coso Navy, Coso View, Delta, Mill and Keeler MET and Keeler Rain Gauge
  - Data through 2020
- Runoff
  - Owens Valley runoff. Yearly, cumulative deviation from mean
- Groundwater
  - Hydrographs from monitoring wells/piezometers at some VDAs
- Other factors
  - Succession, Sand movement (erosion/deposition), Disturbance

# Historical Baseline Data Development





Classification  
2

# Detailed Data Collection

- Field data collection (May, August, and October 2020)
- Vegetation sampling
- Soil borings
  - Detailed logs
  - Soil sampling
  - Root density
- Groundwater
  - Shallow piezometer
  - Pressure transducer
  - Water quality sampling
- Soil profile logs in cuts
- Soil geophysics
  - Infer soil properties
  - Conceptual model



# Data Collected

- 14 soil borings and 9 piezometers installed
  - Logs complete, as-built drawings complete
- 183 soil samples (by depth)
  - Weighed for water content and sub-sample sent to lab
  - Roots sieved in the field, post-processed in the office
  - Collected bulk density samples
  - Lab: texture, SP, E<sub>Ce</sub>, pH, CEC, TN, TOC, water holding capacity
- 79 tissue samples
  - N, P, K, Ca, Mg, Na, Cl, B, Fe, Mn, Zn, Cu,  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$
- Several km of geophysical transects and 16 profile logs

FORMATION ENVIRONMENTAL		Log of Boring and Well Completion: VDA01-PZ2		Page: 1 of 2	
LADWP Vegetated Dune Area Workplan Implementation	Drilling Company: LADWP	Logged By: D. Carlson	Latitude: 36.53812		
	Drilling Method: Auger	Borehole Diameter (inches): Variable 6"-8"	Longitude: -118.61771		
	Sampling Method: Terzaghi Spill Spoon	Ground Elevation (FASL): -3629	Total Depth (ft bgs): 26.5		
Project Number: Task Order 7-T07-7.1-P1	Top of Casing Elevation (FASL): -3630	Date Started: 10/14/2020	Date Completed: 10/14/2020		
Depth (feet)	Description	USCS	Unit	Sample Number and Depth Range (ft)	Well Construction VDA01-PZ2
0	POORLY GRADED SAND, very pale brown (10YR 7/3), dry, ~85% fine sand, ~5% subrounded medium sand, ~5% subrounded coarse sand, loose			248 (0-1.5)	
1				249 (1.5-3)	
2		SP			
3					
4	WELL GRADED SAND, pale brown (10YR 6/3), ~60% coarse grained subrounded sand, ~30% fine grained sand, ~10% medium grained subrounded sand, loose	SW		(0% recovery) (3-5)	
5	POORLY GRADED SAND, very pale brown (10YR 7/3), ~85% fine grained sand, ~5% medium grained subrounded sand, ~10% coarse grained subrounded sand, loose		Asiatic Lateraline	250 (5-6.5)	
6	light brownish gray (10YR 6/2), ~90% medium grained subrounded sand, ~10% fine sand			251 (6.5-8)	
7		SP			
8				252 (8-10)	
9					
10	SILTY SAND, dark grayish brown (10YR 4/2), ~80% subrounded medium grained sand, ~15% silt, ~5% subrounded coarse grained sand	SM		253 (10-11.5)	
11					
12	POORLY GRADED SAND, brown (10YR 5/3), ~95% subrounded medium grained sand, ~5% subrounded coarse grained sand, 1" layer with oscillating grayish and brown color (possibly variable redox conditions)			254 (11.5-13)	
13		SP			
14				255 (13-15)	
15	oscillating grayish and brown laminations (possibly variable redox conditions)	SP		256 (15-16.5)	
16	WELL GRADED SAND, brown (10YR 5/3), ~60% fine sand, ~40% subrounded very coarse sand	SW			
17	SILTY SAND, dark gray (10YR 4/1), ~85% fine sand, ~15% silt	SM		257 (16.5-18)	
18	POORLY GRADED SAND, dark gray (10YR 4/1), ~95% fine sand, ~5% subrounded coarse sand	SP			
19	SILTY SAND, dark grayish brown (10YR 4/2), very moist, ~75% subrounded medium sand, ~25% silt		Asiatic Lateraline	258 (70% recovery) (18-20)	
20					
21	oscillating grayish and brown laminations (possibly variable redox conditions)			259 (20-21.5)	
22				260 (21.5-22)	
23		SM		261 (22-23)	
24	moisture change to saturated			262 (23-25)	
25					
26				263 (25-26)	



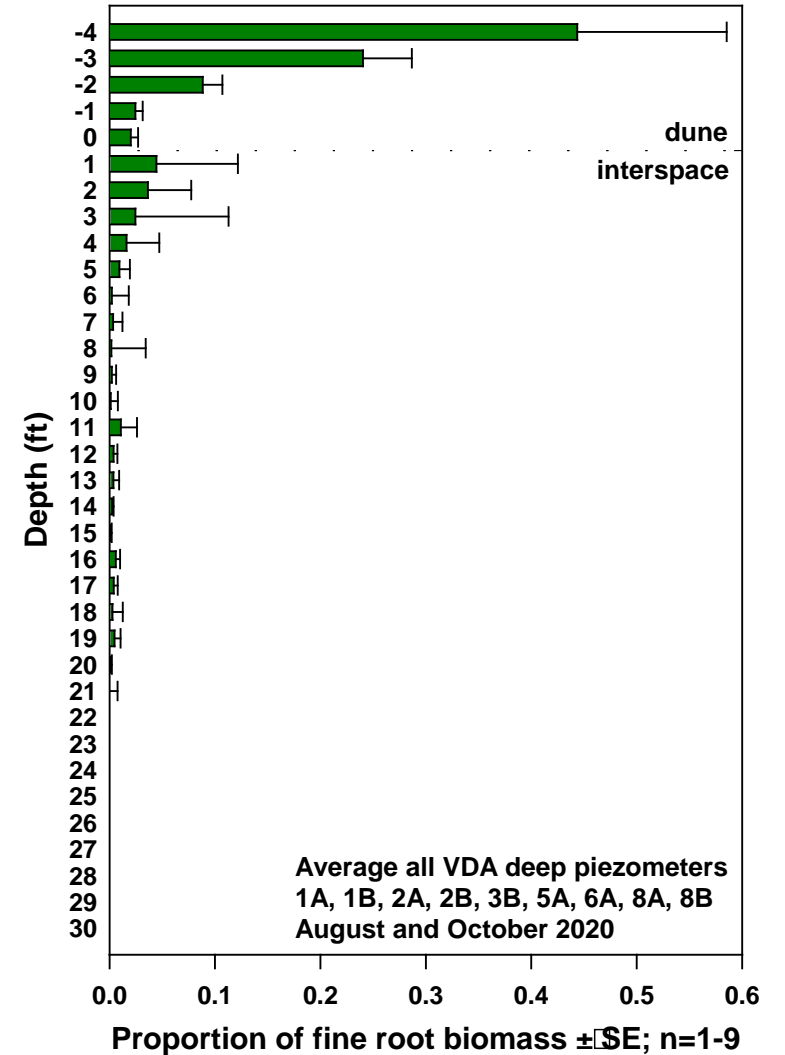
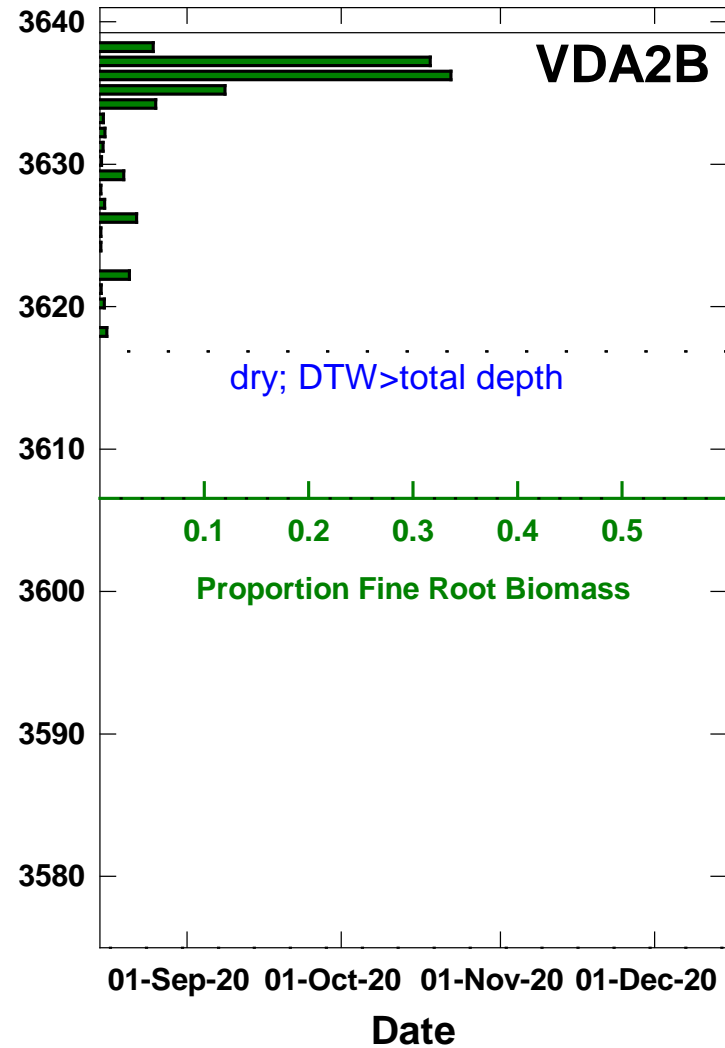
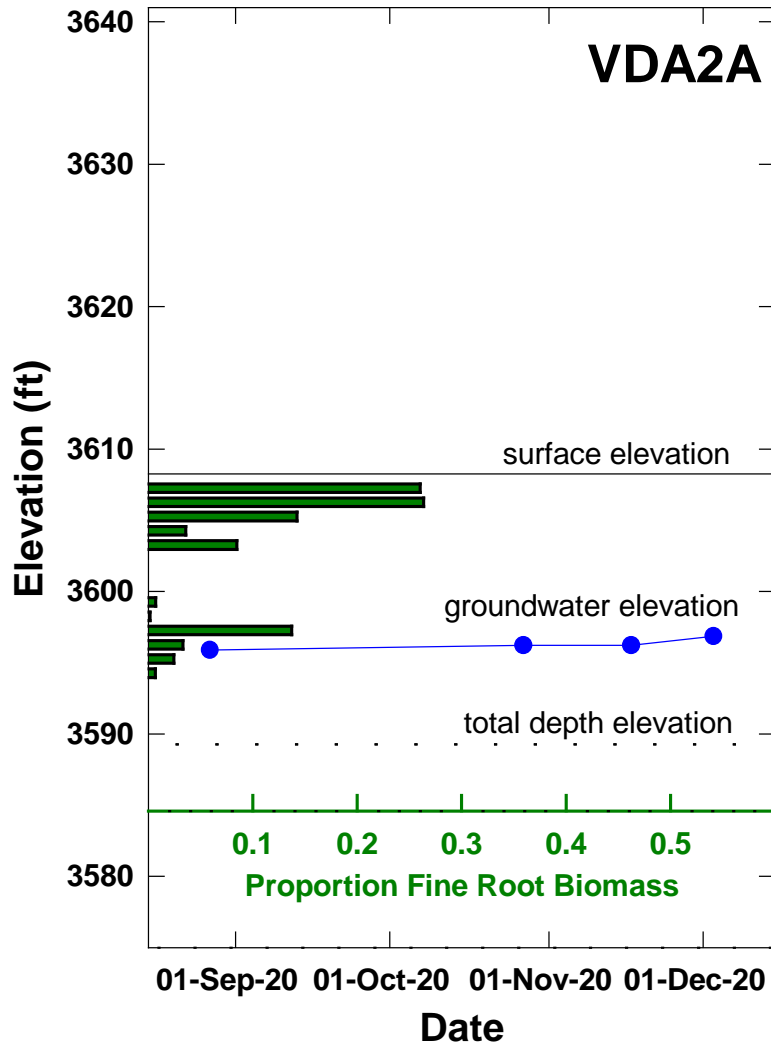




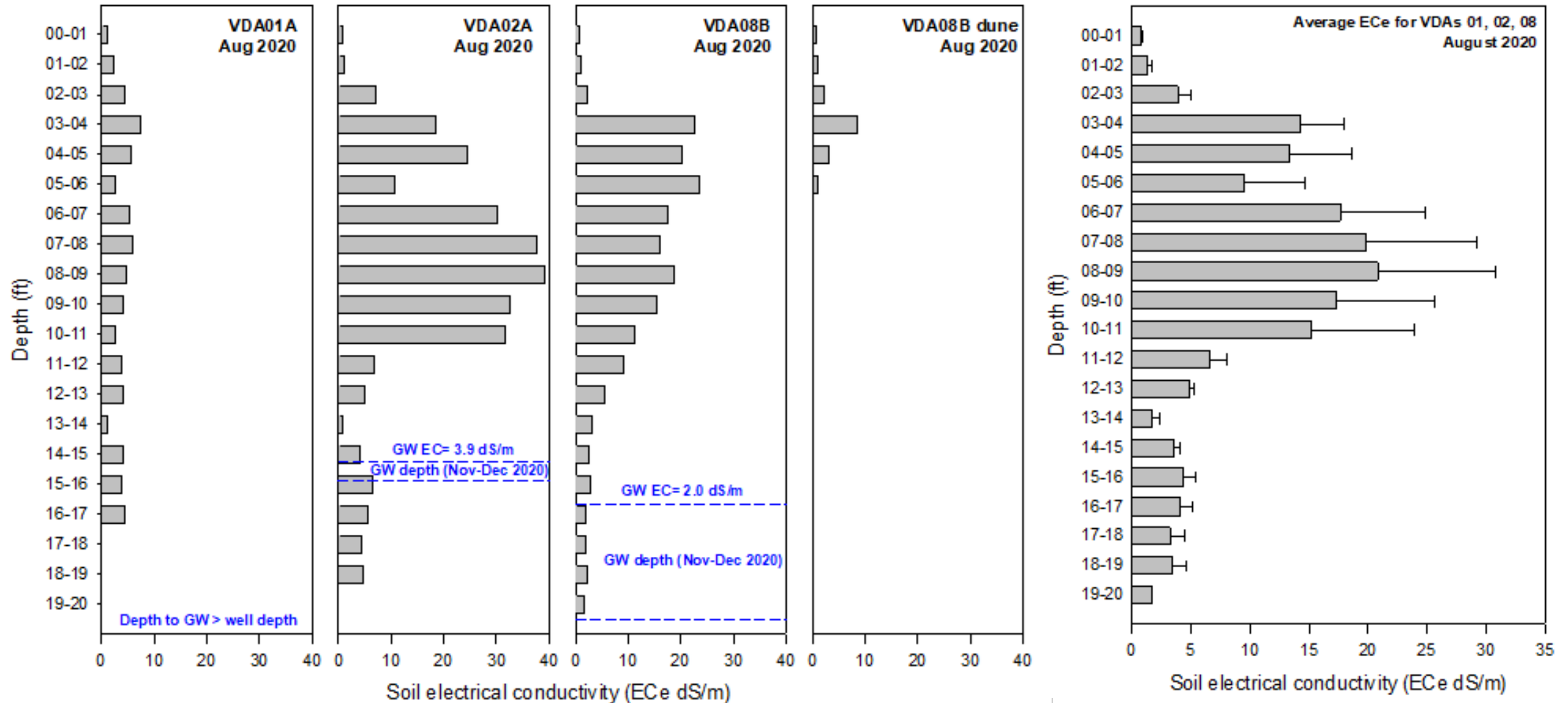
# Preliminary Findings

- Root depth distributions and groundwater depth
- Soil profile Ece and groundwater EC
- Soil water content
- Geophysical data

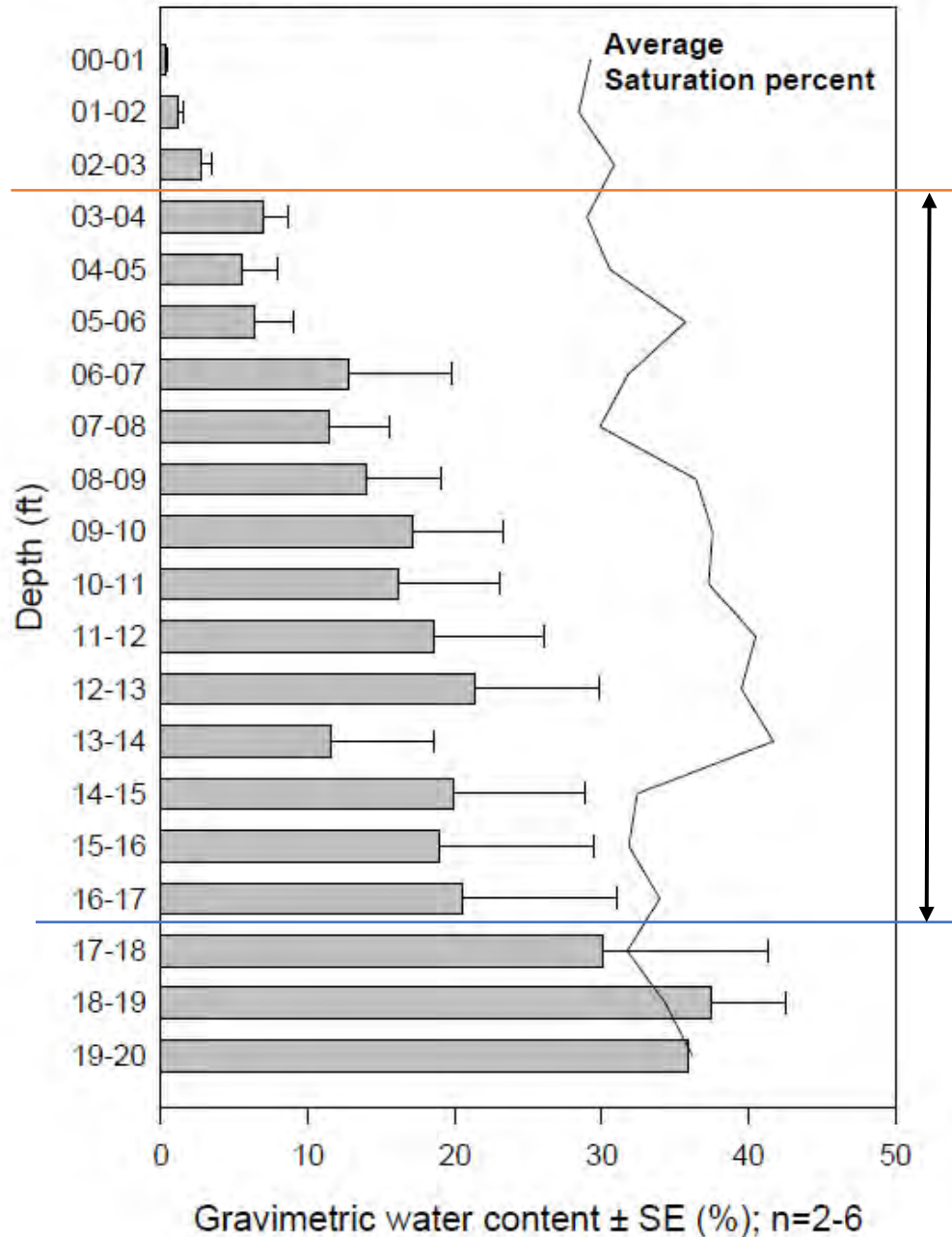
# Root distribution and groundwater depth



# Soil salinity by depth and groundwater EC

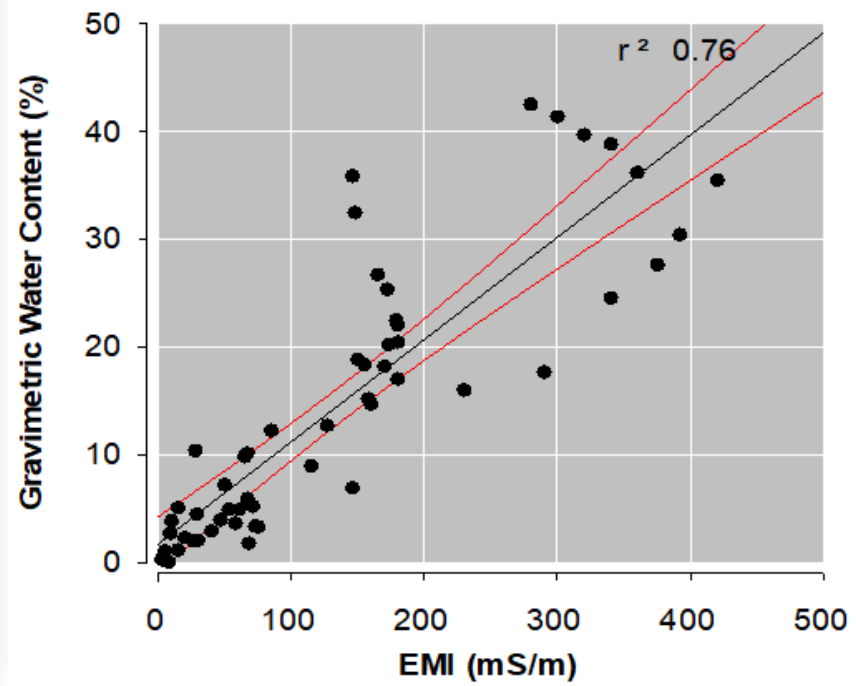
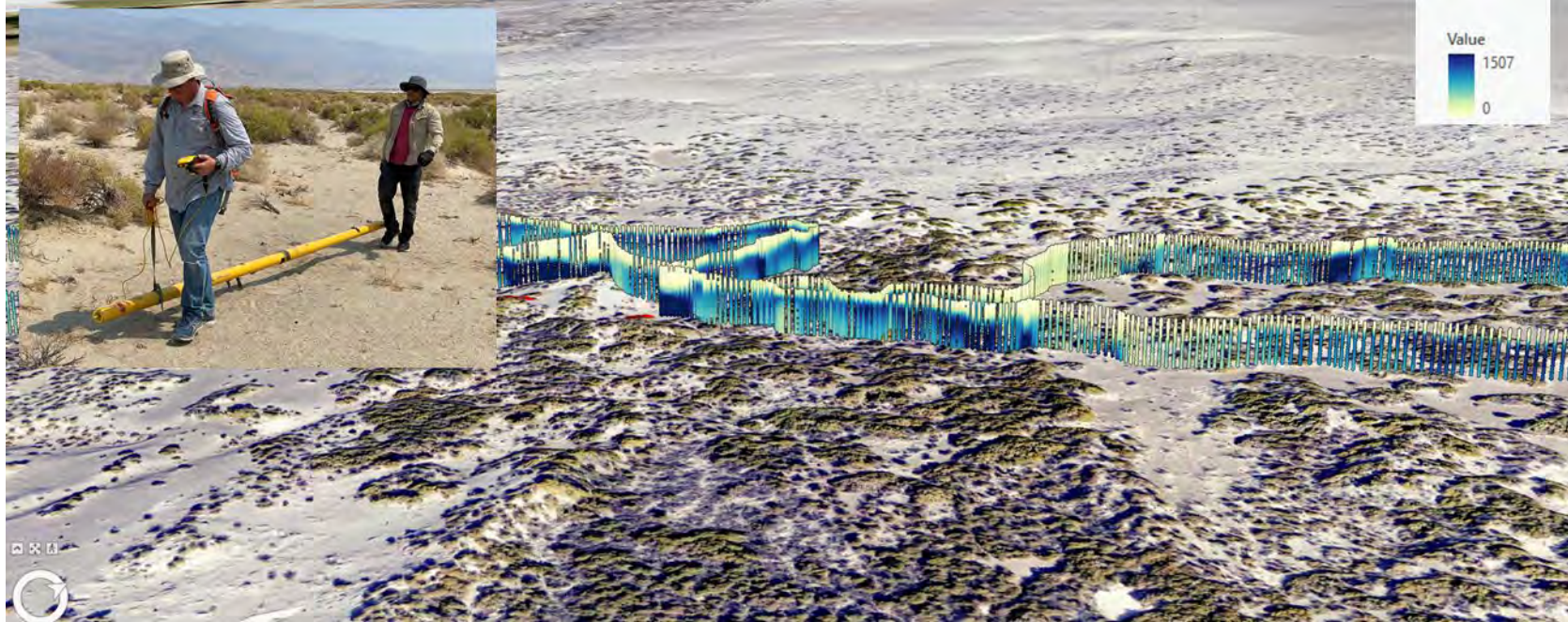


Average GWC for VDAs 01, 02, 03, 08  
August 2020



## Soil moisture by depth

- Unsaturated zone very moist for late summer
- Available water estimated to average 2.35 ac ft/ac within 3-17 ft depth interval
- Soil moisture buffer approximately 7 times annual precipitation



# Remaining Activities

## Historical Baseline

- Complete statistical analysis of historical cover variability
- Complete drivers of cover variability
- Complete 2020 LiDAR and Imagery Analysis
  - Individual shrubs
  - Shrub characteristics
    - Size, cover, etc

## Detailed Analysis and Conceptual Model Development

- Integrate field data, borelogs, hydrographs, WQ, and geophysical data spatially
- Complete remaining data analysis to support conceptual model development

Phase 2: RPP criteria, monitoring, tier development

# Phase 1 Activities

## Historical Baseline Data Development (All 15 VDAs)

**Vegetation Cover**  
Historical Cover

**Leaf Area Index and Evapotranspiration**  
Landsat 1985 to 2020

## Analysis, Drivers of Cover Variability & Early Warning Triggers

## Detailed Data Collection, Characterization & Monitoring (4 VDAs plus 3 non-invasive VDAs)

Soil and Root-zone Characteristics

Soil Geophysics

Vegetation

Groundwater

## Refine Conceptual Model

# Phase 2 Activities

Develop RPP criteria, monitoring and tiers

Insure protection of VDA resource

