Oceano Dunes Particulate Matter Reduction Plan Scientific Advisory Group (SAG) update – May 2020

ASU Arizona State University

SAG members: Raleigh Martin, PhD
Ian Walker, PhD

2019-2020 Progress

- Several (8) SAG meetings with CalParks OHMVR Division & APCD

- PMRP revised May 2019

- First Annual Report & Work Plan (ARWP) developed May-Oct 2019

- APCD Hearing Nov 2019 -> Update of SOA

- OHV Commission Meeting Dec 2019

- Develop 2020 ARWP

- Extensive mitigation efforts, >90 acres including 48-acre foredune

- Expand monitoring efforts
  - 21 meteorology/air quality stations within ODSVRA, SODAR upper air data
  - 2019 and 2020 updated PiSWERL dust emissions surveys
  - Sediment traps, seasonal drone-based land surveying

- Update DRI dust emissions modelling (2019 emissions, local SODAR data)

- March 2020 closure of ODSVRA due to covid-19 pandemic…
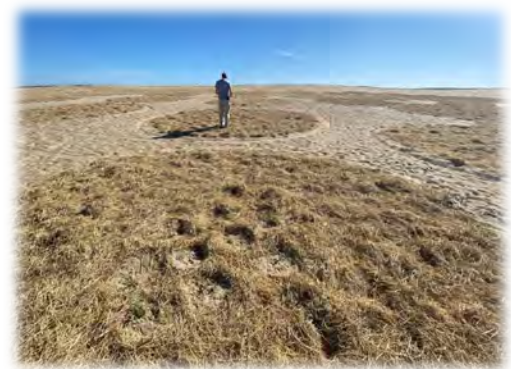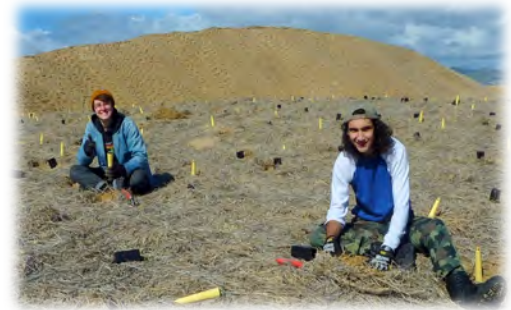
2019-20 Dust Mitigation Efforts

- 2020 dust control treatments:
  - 48-acre foredune (6 treatment areas, adaptive management)
  - 40 acres seasonal wind fence + 4.4 acres permanent treatment
  - installed 89,433 plants + 677 lbs native seed into treatment areas

- Increased monitoring within ODSVRA
  - installed network of 21 meteorological stations (6 in foredune + 15 in park)
  - installed BAM instrument within dune field to assess onsite dust measurements
  - Completing additional PISWERL tests with DRI

- Assessing other sources of PM dust (Scripps and DRI)

- Focused research to assess impacts on dust levels and emissivity since Covid-19 closure

- Updating DRI model and apply results to dust control planning and implementation

2020 Dust Control Activities
Oceano Dunes SVRA 2020
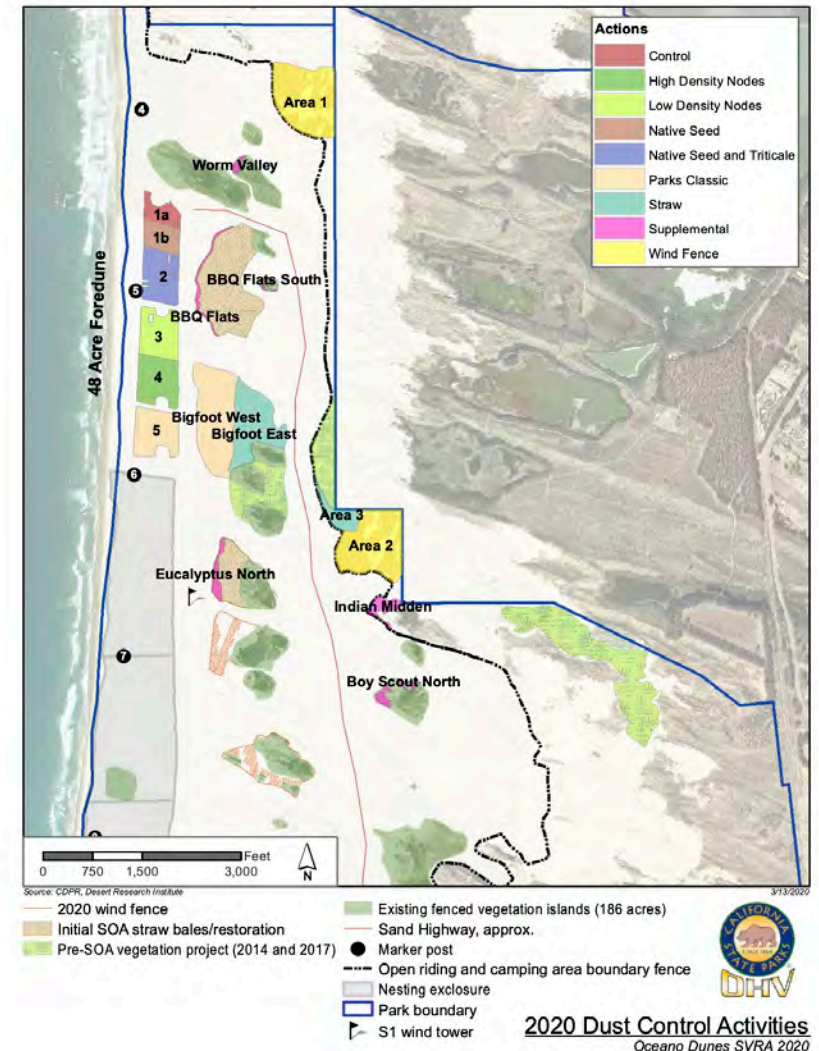
BBQ Flats 2019 Project (~27 acres)
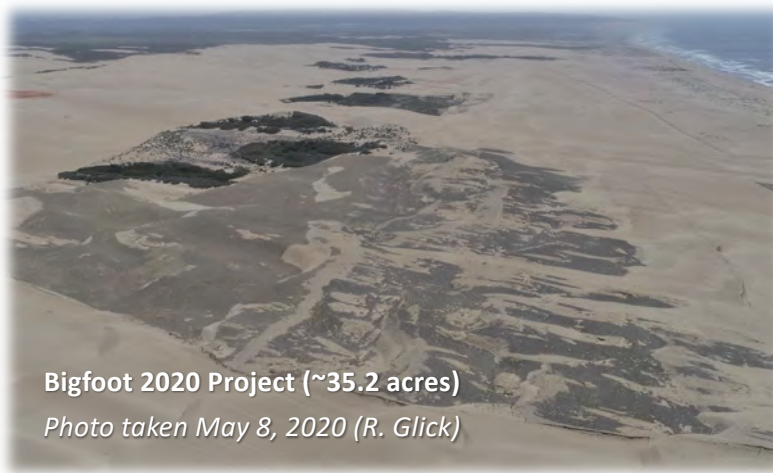*Photo taken May 5, 2020 (R. Glick)*

Foredune straw planting node installation Feb 2020
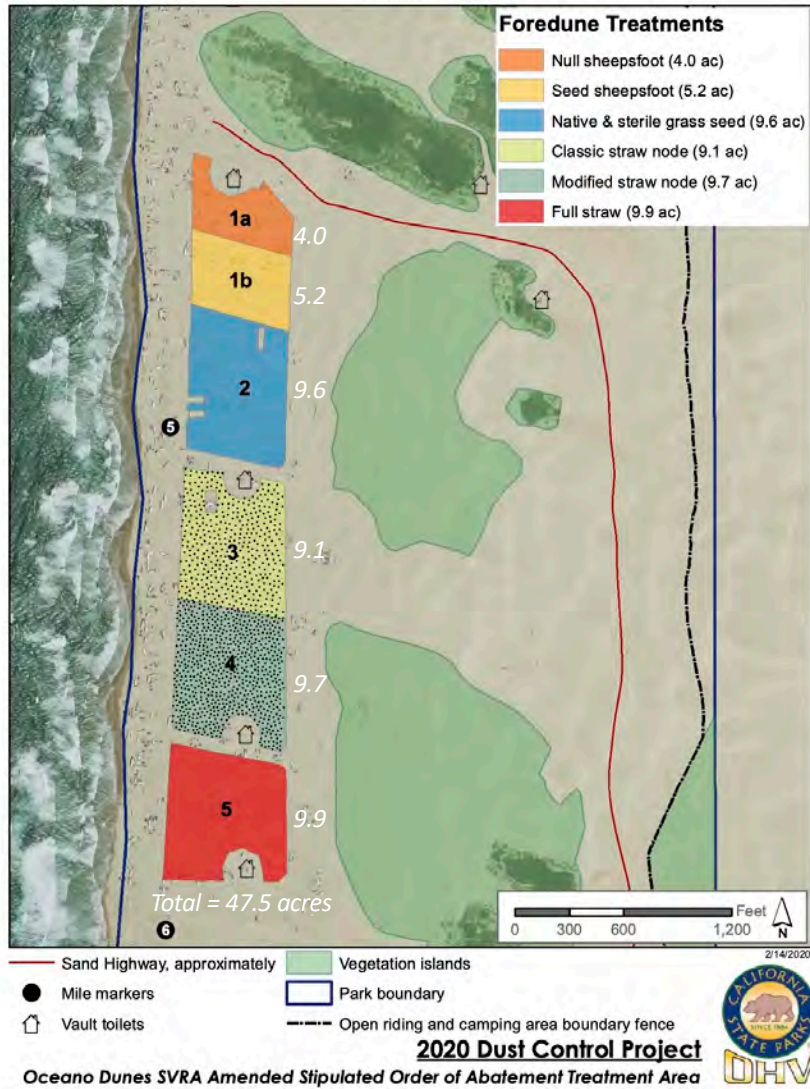
ASU SODAR system
Installed May 2019

Bigfoot 2020 Project (~35.2 acres)
Photo taken May 8, 2020 (R. Glick)

One of 21 monitoring stations

Exhibit 2

Foredune Treatments

- Null sheepsfoot (4.0 ac)
- Seed sheepsfoot (5.2 ac)
- Native & sterile grass seed (9.6 ac)
- Classic straw node (9.1 ac)
- Modified straw node (9.7 ac)
- Full straw (9.9 ac)

1a — 4.0
1b — 5.2
2 — 9.6
3 — 9.1
4 — 9.7
5 — 9.9

Total = 47.5 acres

- Sand Highway, approximately
- Mile markers
- Vault toilets
- Vegetation islands
- Park boundary
- Open riding and camping area boundary fence

2/14/2020

2020 Dust Control Project
Oceano Dunes SVRA Amended Stipulated Order of Abatement Treatment Area

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27,771 plants
288 lbs seed

Seasonal UAS Surveys

- Mapping campaigns in Oct 2019, Feb 2020, will continue bi-annually

- Produce high-resolution aerial photos @ 1.45 cm (0.6") resolution

- Create three-dimensional digital elevation models (DEMs)

- Quantify erosion-deposition patterns and volume changes

- Identify reductions in sand transport, link to changes in dust emissions

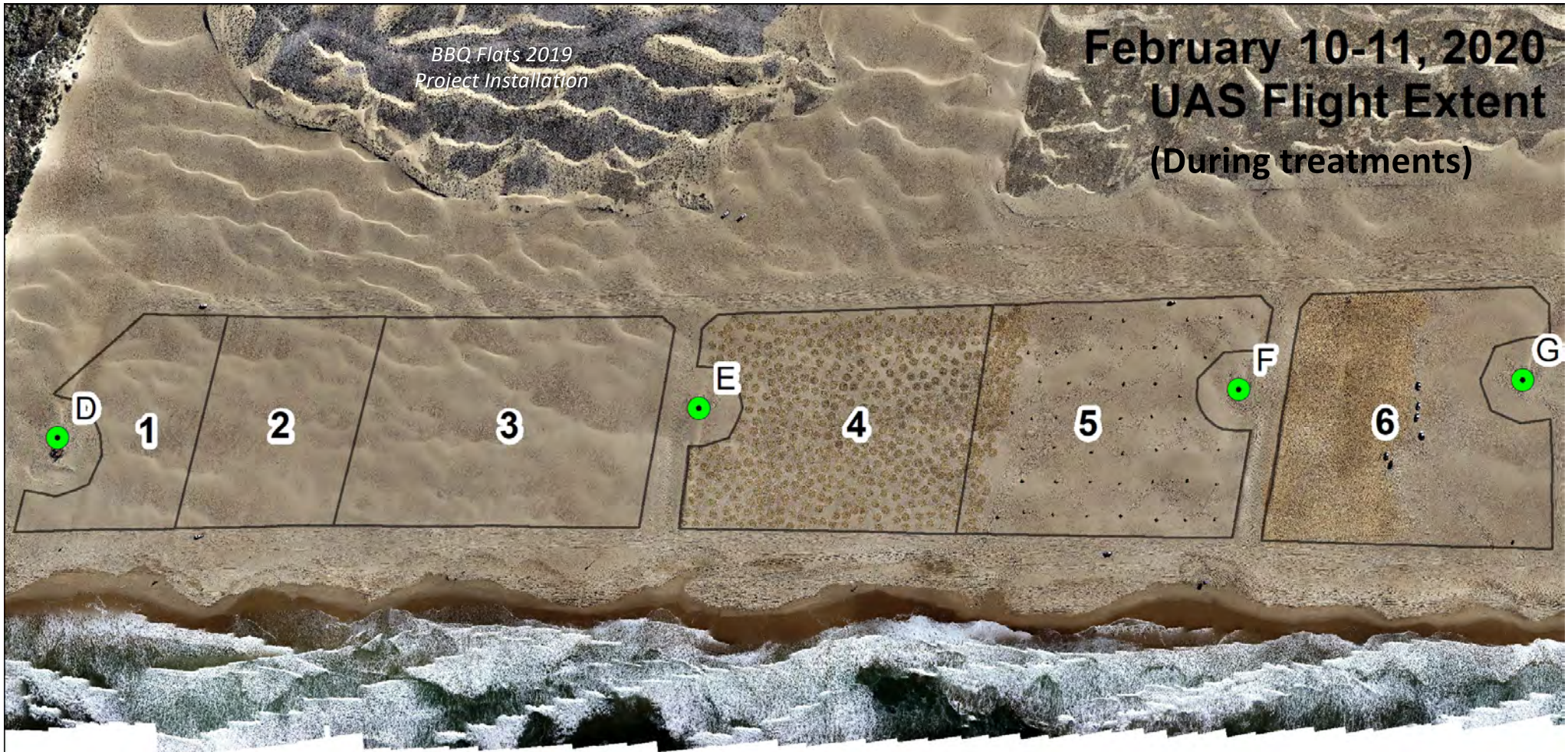- Inform adaptive management planning and implementation

525 m

February 10-11, 2020
UAS Flight Extent

Foredune restoration zone

0 250 500 1,000
Meters

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

February 10-11, 2020
UAS Flight Extent
(During treatments)

BBQ Flats 2019
Project Installation

Pre-restoration foredune zone dynamics
(Oct. 2019 – Feb. 2020 baseline)

Map Created on 16 May 2020 by Z. Hilgendorf and Dr. I. J. Walker

Disclaimer: Results are preliminary and should be considered for visualization purposes only.
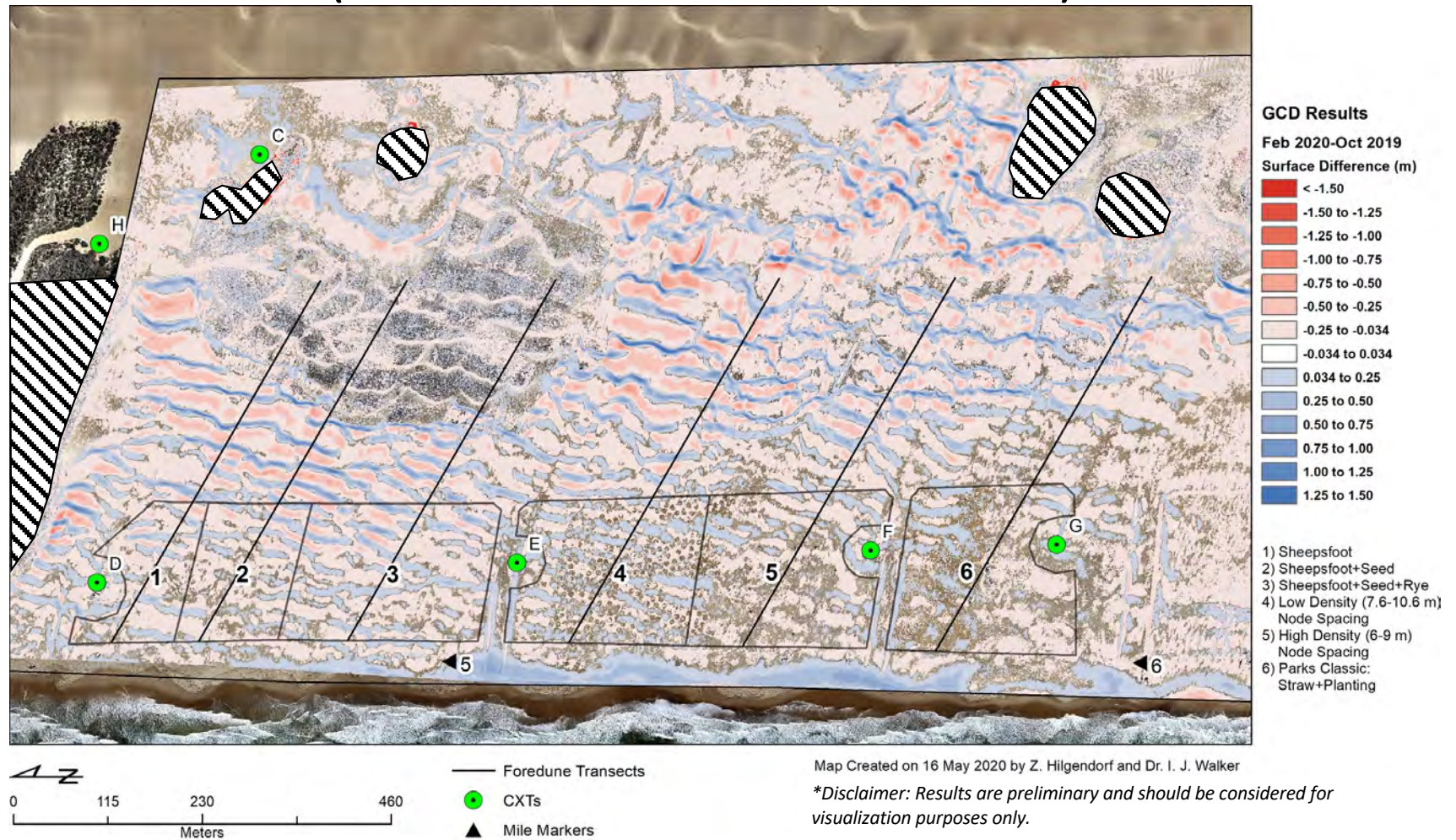
BBQ Flats 2019 Project Installation

Foredune Areas 1 - Control (sheepsfoot only) and Area 2 - Native Seed + Sheepsfoot
Photo taken May 8, 2020 (R. Glick)

Foredune Area 2 – Native Seed + Sheepsfoot
Beach bur (*Ambrosia chamissonis*) seedlings
Photo taken May 1, 2020 (R. Glick)

BBQ Flats 2019 Project Installation

Foredune Area 3 – Native Seed + Sterile Wheat/Rye + Native Seed
Photo taken May 8, 2020 (R. Glick)

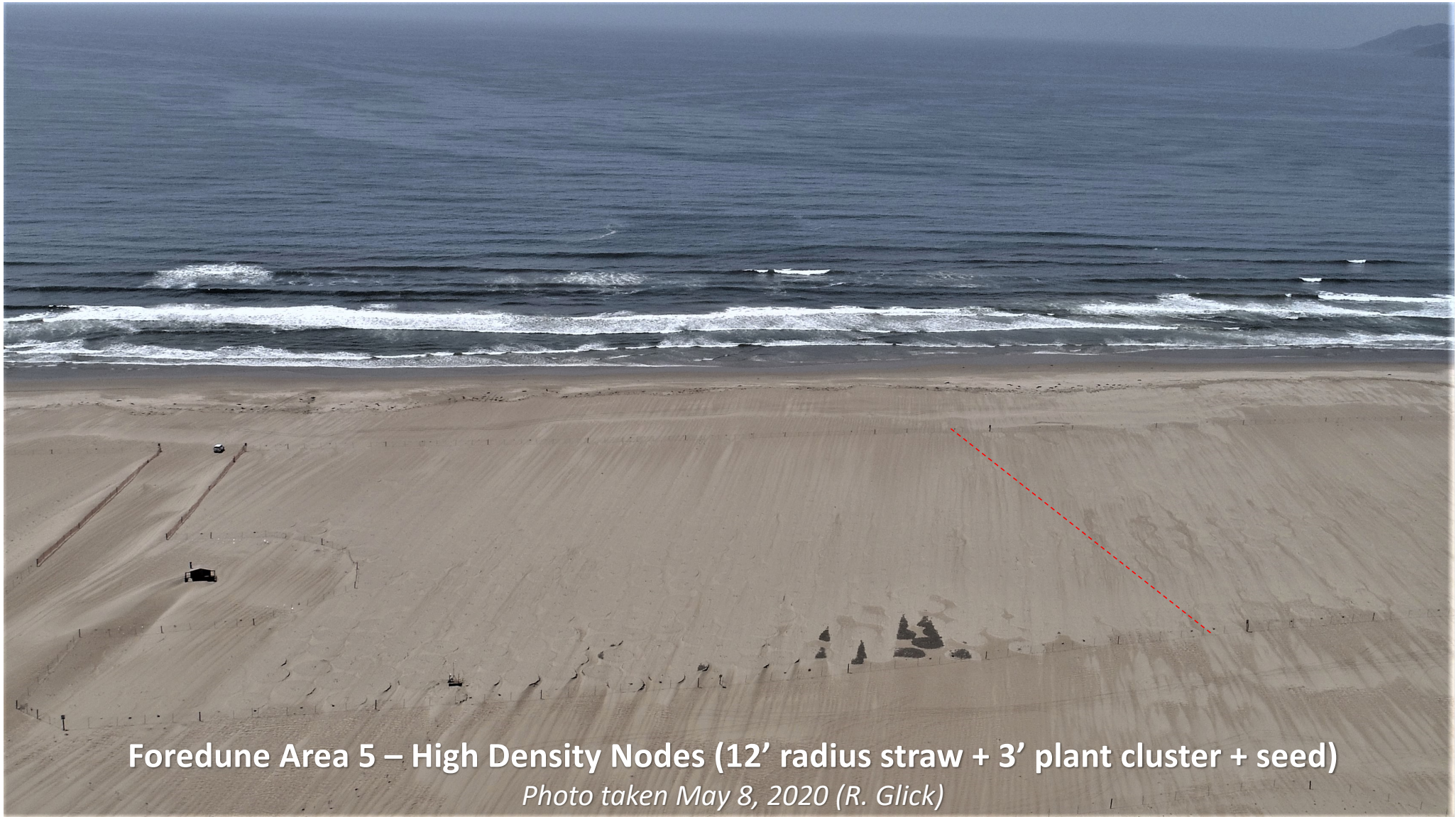Foredune Area 3 – Native Seed + Sterile Wheat/Rye
Photo taken May 7, 2020 (R. Glick)

BBQ Flats 2019 Project Installation

Bigfoot 2020 Project Installation

Foredune Area 4 – Low Density Nodes (12' radius straw + 3' plant cluster + seed)
Photo taken May 8, 2020 (R. Glick)

Foredune Area 5 – High Density Nodes (12' radius straw + 3' plant cluster + seed)
Photo taken May 8, 2020 (R. Glick)
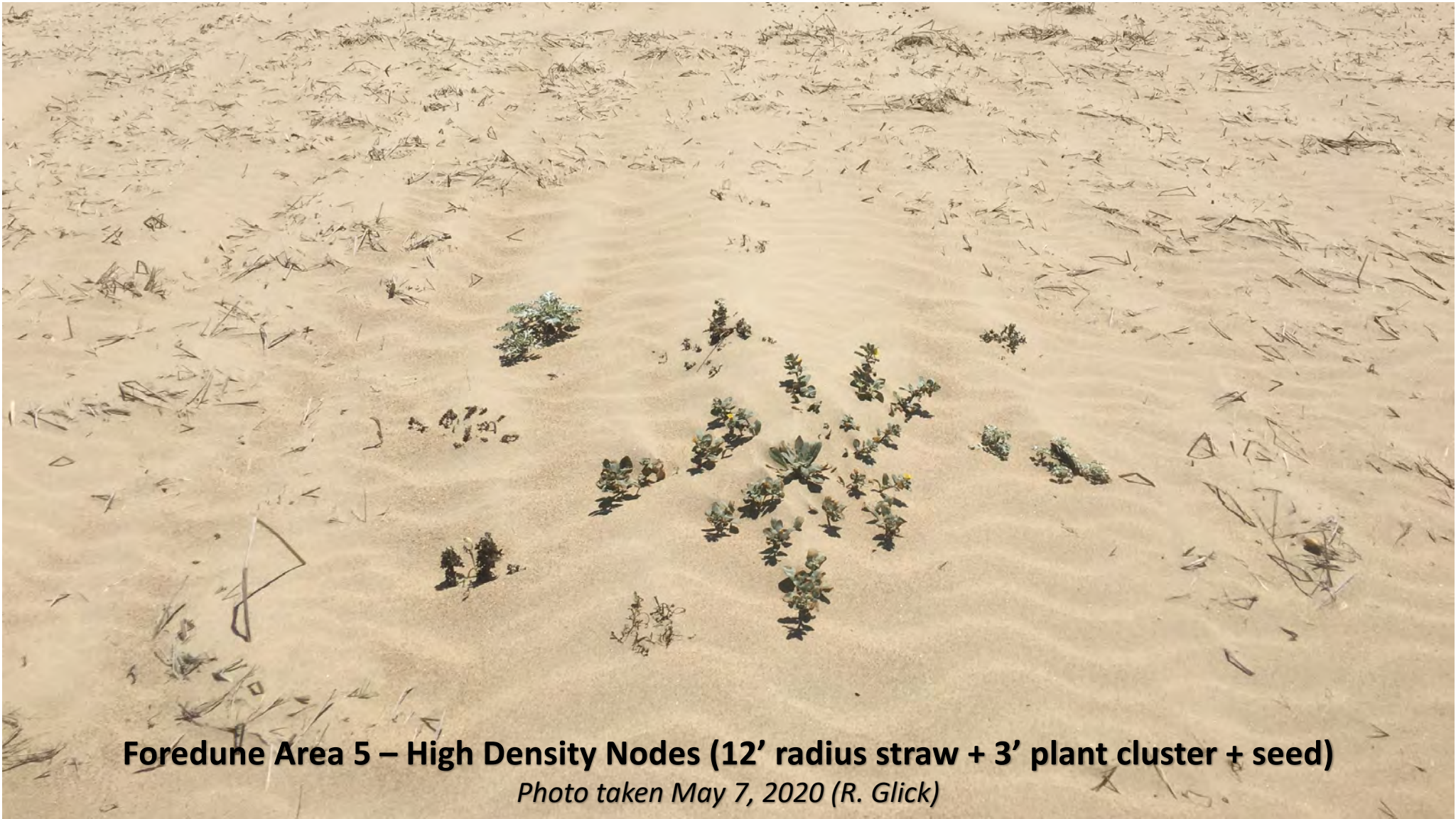
Foredune Area 5 – High Density Nodes (12' radius straw + 3' plant cluster + seed)
Photo taken May 7, 2020 (R. Glick)

Foredune Area 6 – Parks Classic (plants + native seed + sterile wheat/rye + 100% straw cover)
Photo taken May 8, 2020 (R. Glick)

Bigfoot 2020 Project Installation

Foredune Area 6 – Parks Classic (plants + native seed + sterile wheat/rye + 100% straw cover)
Photo taken May 8, 2020 (R. Glick)

Dust emissions modelling update

- According to the Stipulated Order of Abatement (SOA):
  - *Target*:
    - Achieve ambient air quality standards for 24-hr average PM_{10} dust concentration measured at CDF (150 µg/m^3 and 50 µg/m^3 for federal and CA, respectively)
  - *Initial Target*:
    - 50% reduction in PM_{10} mass emissions (metric tonnes per day) from ODSVRA modeled with DRI Model
  - *Modeling scenario*:
    - Top 10 emissions days in 2013 (pre-control "baseline")

DRI Model

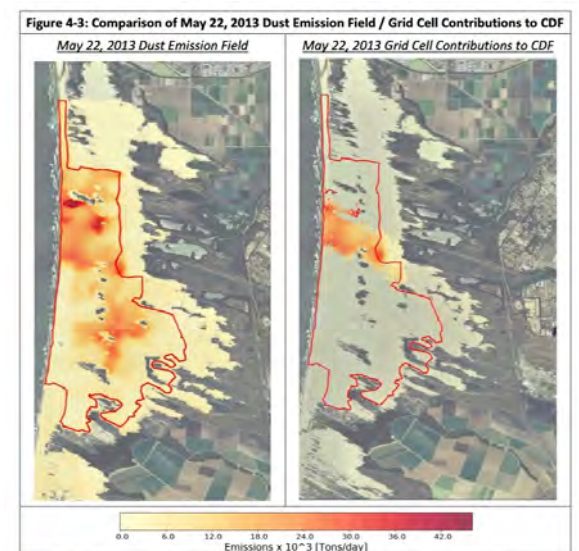**1. Wind Field (CALMET)** + **2. PM$_{10}$ Mass Emissivity (PI-SWERL)** + **3. Dust Dispersion (LSPDM)**
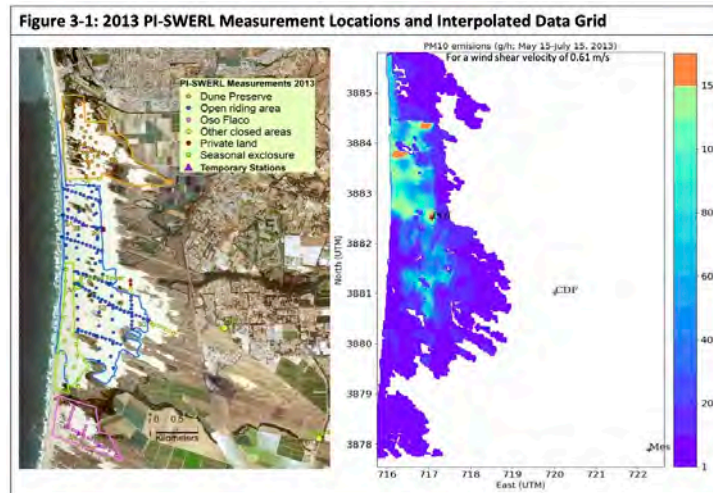
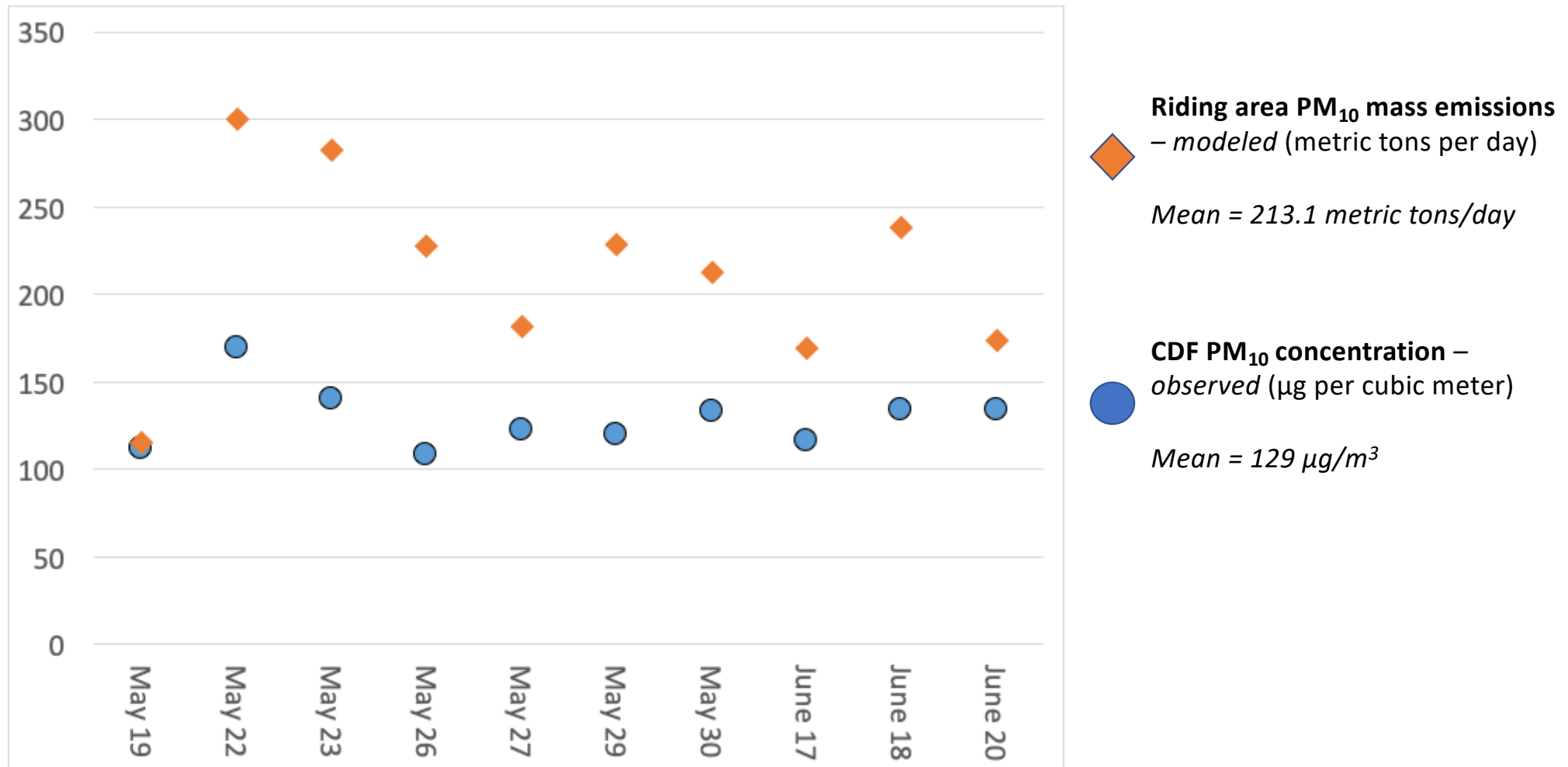PM$_{10}$ mass emissions (metric tons/day)

PM10 dust concentration (µg/m^3)
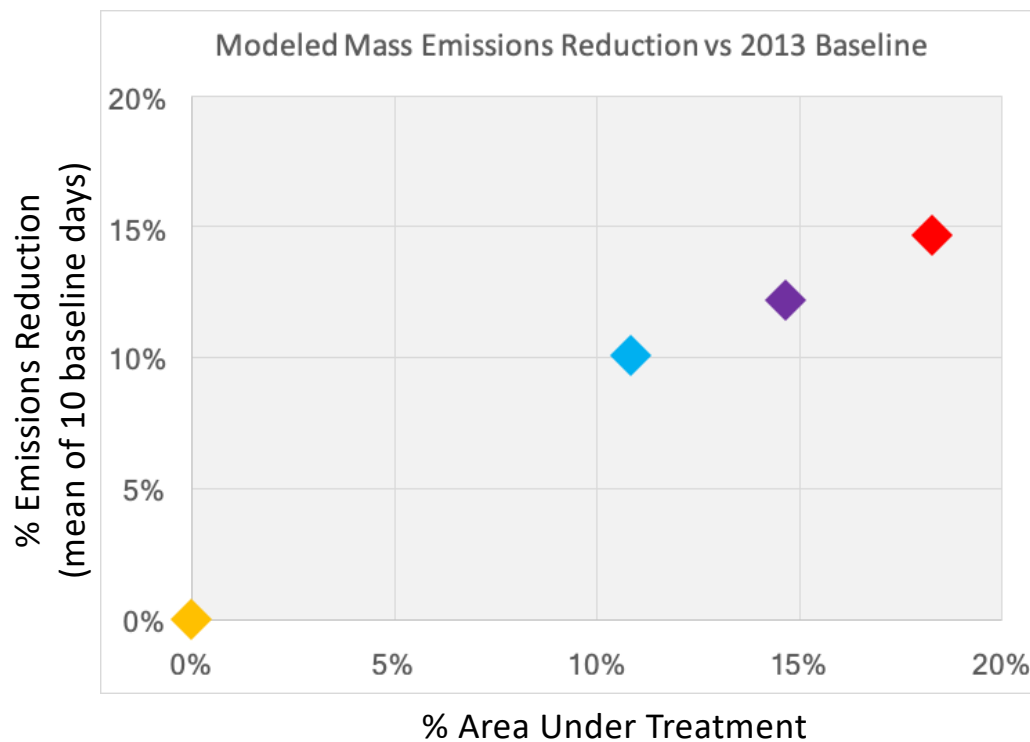
Modeling scenario: Top 10 mass emissions days in 2013

Riding area PM₁₀ mass emissions – *modeled* (metric tons per day)

Mean = 213.1 metric tons/day

CDF PM₁₀ concentration – *observed* (μg per cubic meter)

Mean = 129 μg/m³

Treatment areas in ODSVRA

Legend:
- Spring 2020 projects (44.4 acres)
- **Controls (186 acres) from:**
- Foredune Addition 2019 (48 acres)
- Controls through 2019 (138 acres)

- ● Marker post
- — Sand Highway, approx.
- –·– Open riding and camping area boundary fence
- Open Riding Area (1,264.8 acres)
- Nesting exclosure
- Existing fenced vegetation islands (186 acres)
- La Grande Tract (643.8 acres)
- Park boundary

Source: CDPR, Desert Research Institute

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
4/21/2020

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Dust Control Activities
Oceano Dunes SVRA 2020

Dust Control Effect on <u>Mass Emissions</u>

Modeled Mass Emissions Reduction vs 2013 Baseline

Y-axis: % Emissions Reduction (mean of 10 baseline days) — 0%, 5%, 10%, 15%, 20%

X-axis: % Area Under Treatment — 0%, 5%, 10%, 15%, 20%

**16.5% Reduction in Riding Area <u>Mass Emissions</u> Following Spring 2020 Projects

Dust Control Effect on PM$_{10}$ Concentration at CDF

| 10 Highest Emisison Days (2013 winds/2013 emissions)	PM$_{10}$ (μg m^{-3})
Observed	128
Modeled Baseline	123
Modeled 2020 Controls 100% Effective	57

****53.7% Reduction in CDF PM10 Concentration
Following Spring 2020 Projects**

Modeling summary

- Model shows improvements in air quality (PM_{10}) at the CDF monitoring site related to control projects installed as of 2020

- Continued efforts to examine additional needs to meet air quality objectives at sensitive receptor sites

Figure 4-3: Comparison of May 22, 2013 Dust Emission Field / Grid Cell Contributions to CDF

May 22, 2013 Dust Emission Field   May 22, 2013 Grid Cell Contributions to CDF

Emissions x 10^3 [Tons/day]
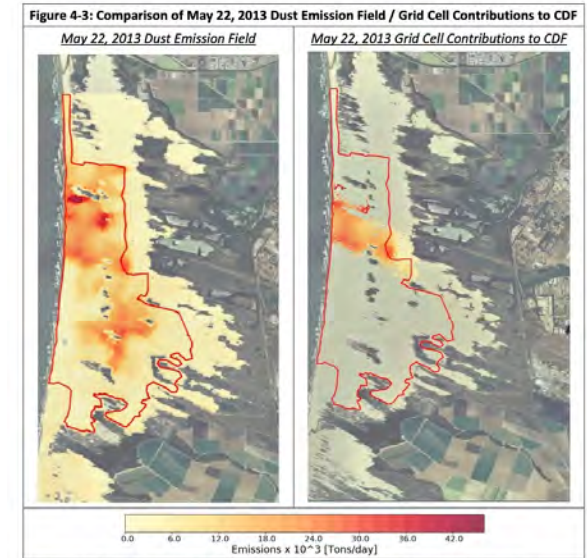
Source: DRI, 2019. Figure Notes: The red outline represents the boundary of the Oceano Dunes SVRA open riding area.

PM10 emisions (g/h; May 15-July 15, 2013)
For a wind shear velocity of 0.61 m/s
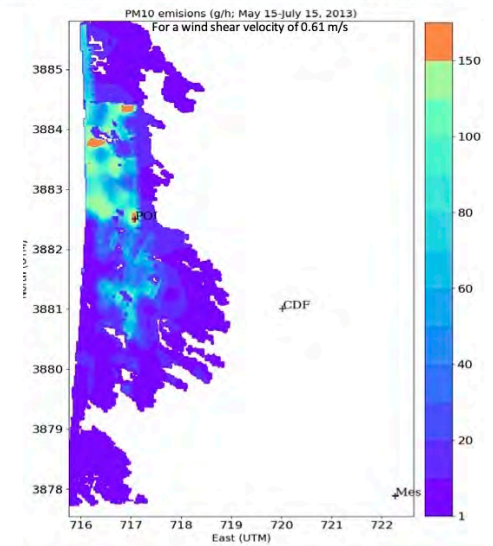
Next Steps: Dust Control Treatments

- 48-acre foredune
  - Intensively monitor evolution of the 6 treatment areas
  - Monitoring will inform adaptive management for future treatment strategies
- 44.4 acres Spring 2020 controls
  - 40 acre seasonal treatment
  - 4.4 acre permanent treatment
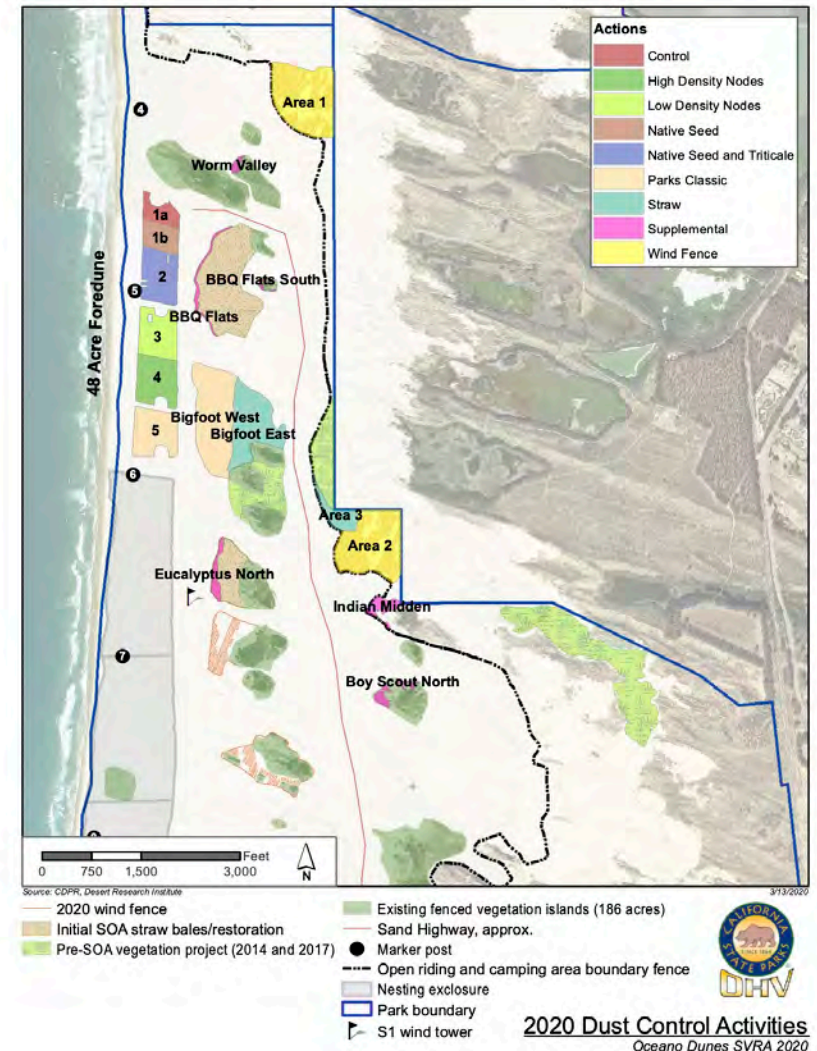
Next Steps: DRI Model Improvements

1. CALMET improvements
   - assimilation of local SODAR upper air data (vs. Vandenberg AFB)
   - high-resolution modeling to address foredune topographic feedbacks

2. PI-SWERL improvements
   - 2020 campaign ongoing

3. Dispersion model improvements
   - Filter sampling at CDF to increase understanding of PM_{10} sources

| 1. Wind Field (CALMET) | + | 2. PM_{10} Mass Emissivity (PI-SWERL) | + | 3. Dust Dispersion (LSPDM) |

Concluding thoughts

- **COVID-19 Closure Impacts**
  - Emissions will not have ceased in absence of OHV activity during COVID-19 closure
    - Decades of surface disturbance, long-term geological processes

- **Adaptive Management**
  - 2019 was a BIG push year with significant initiatives (foredune, plantings, increased monitoring, new modeling efforts, etc.),
    - ➢ *responses to these efforts will take time to yield benefits*
  - Protocols & monitoring now in place to detect responses and inform mitigations