2024 Dune Restoration Meeting

Thursday January 11, 2024

9am to 3pm

Dickenson Auditorium Zoo Drive 2920, 92101 San Diego, CA

Virtual: https://ucsd.zoom.us/j/94969948844

Welcome, Introductions, and Overviews

9:00	Welcome and Introductions
9:10	SOUTH CARLSBAD STATE BEACH (PONTO) COASTAL DUNE RESTORATION PROJECT *Carolyn Lieberman*, Frederico Scarelli, James Peeler, Darren Smith, Carrie Benner*
9:30	KNOWLEDGE GAINED FROM MONITORING AT TWO SEPARATE DUNE RESTORATION SITES IN SAN DIEGO COUNTY *Hany Elwany*, James Peeler*, Frederico Scarelli*
9:50	INVASION ECOLOGY AND RESTORATION OF YELLOW BUSH LUPINE-DOMINATED DUNES AT HUMBOLDT BAY NATIONAL WILDLIFE REFUGE *Andrea Pickart*
10:10	PLANT COMMUNITY SIMILARITY CHANGES ALONG THE INTENSE STRESS GRADIENT OF COASTAL DUNES *Ben J. Rivera*
10:30	Break
10:50	USING ADAPTIVE RESTORATION TO ENHANCE THE SUCCESS OF COASTAL DUNE RESTORATION EFFORTS? *Lorraine S. Parsons*, Rachel Hendrickson, Miriam Golding, Wende Rehlaender, Gregory Jones*
11:10	THE BEACH ECOLOGY COALITION: INFORMAL EDUCTION FOR BEACH PROFESSIONALS *Karen Martin*, Dennis Simmons, and Melissa Studer*
11:30	OREGON NATIVE COASTAL DUNE PLANT PROPAGATION *Gabriel Campbell-Martínez*, Roxy Olsson, Kathryn Ketel, Kristen Malacara*
11:50	UTILIZING DUNES AS NATURE-BASED SOLUTIONS FOR CLIMATE CHANGE IMPACTS THROUGH THE CALIFORNIA DUNE SCIENCE NETWORK *Jenna Wisniewski*, Laura Engeman*
12:10	PROTECTING HABITAT AND SPECIES DISTRIBUTIONS IN BEACH ECOSYSTEMS UNDER CURRENT AND FUTURE CLIMATE

Michelle Marraffini, Kriss Neuman

12:20 RESTORING FORM AND FUNCTION AT THE OCEAN RANCH DUNES – EARLY OBSERVATIONS
James Ray, Kelsey McDonald, and Michael van Hattem*

12:40 Lunch

Discussion Topics

1:40 Experiences and challenges in addressing conflicts between recovery goals for dunes and birds
Panel and discussion

2:40 Group discussion share

3:10 Closing Remarks

Informal happy hour at Panama 66 in Balboa after

Abstracts:

SOUTH CARLSBAD STATE BEACH (PONTO) COASTAL DUNE RESTORATION PROJECT

Carolyn Lieberman[*1], *Frederico Scarelli*[2], *James Peeler*[3], *Darren Smith*[4], *Carrie Benner*[4] [1]U.S. Fish and Wildlife Service, 2177 Salk Avenue, Suite 250, Carlsbad, CA 92008 Carolyn_Lieberman@fws.gov [2]Rincon Consultants, Inc, 2215 Faraday Avenue, Suite A, Carlsbad, CA 92008, [3]Coastal Environments, 2166 Avenida de la Playa, Suite E, La Jolla, CA 92037, [4]California State Parks, South Coast District, 4477 Pacific Highway, San Diego, CA 92110

The purpose of the South Carlsbad State Beach (Ponto) Coastal Dune Restoration Project (Project) was to experimentally determine whether biomimicry techniques facilitate deposition of sand and establishment of dune habitat on the beach and can reduce movement of sand onto the adjacent Pacific Coast Highway. We installed the experiment October 2022 as part of a randomized block design. Each block contained three 15 by 15-meter treatment plots and one 15 x 15-meter control plot. Biomimicry treatments include (1) three rows of 4-foot sand fencing, (2) eighteen groupings of forty-eight18-inch shims and one row of sand fencing, and (3) six groupings of forty-eight shims and three rows of sand fencing. We installed symbolic fencing around the treatment plots and placed native dune plant seeds and cut vegetation harvested from Batiquitos Lagoon inside the treatment plots. We lift shims up as sand accumulates around them.

We have completed the first year of monitoring and are finding the treatments on track to meet success criteria for topography, vegetation, and sand retention. Results from the first 6 months of monitoring documented treatment plots accumulating up to 2 feet of sand whereas control treatments lost sand. We observed that more sand accumulated in treatment plots north of the Batiquitos Lagoon jetty compared to south of the jetty. Interestingly, the area of vegetative cover appeared inversely related to sand accumulation with lower cover north of the jetty compared to south of the jetty. Most plants were native and consisted of red sand verbena (*Abronia maritima*), beach evening primrose (*Camissonia cheiranthifolia*), and coast woolly-heads (*Nemacaulis*

denudatae var. *denudata*). Nonnative species consisted of sea rocket (*Cakile maritima*), freeway iceplant (*Carpobrotus endulis*), and crystalline iceplant (*Mesembryanthemum crystallinum*).

Based on the experimental results, California State Parks will be expanding the project into adjacent areas.

KNOWLEDGE GAINED FROM MONITORING AT TWO SEPARATE DUNE RESTORATION SITES IN SAN DIEGO COUNTY

*Hany Elwany**1, *James Peeler**, *Frederico Scarelli*, Coastal Environments Inc., 2166 Avenida De La Playa, CA 92037, hany@coastalenvironments.com

Coastal EnvironmentsInc., with the help of many others, hasdesigned andinstalled two "living shoreline" dune restoration projects in the last four years;one at Border Field State Park -next to the US-Mexico border and one at South Ponto State Beach in Carlsbad, California. Both projects involved the installation of both wooden shims and sand fence in various alignmentsto test their functionality in trapping sand and creating sand dunes. Both projects also involved collecting and spreading *Abronia maritima, Ambrosia chamissonis, and Camissoniopsis cheiranthifolia*native dune plant seeds on the embryonic dunes. The Border Field SP project has now been monitored for approximately four years and the South Ponto Beach SP project for approximately one year both visually and using a drone and real time kinematic ground control points to create very precise digital elevation models(DEM's)for both sites. The DEM's are updated with each drone flight. The two sites vary in elevation and topography, available sand supply, weather conditions, and usage. Both the wooden shims and sand fence have been quite effective at trapping sand and creating sand dunes. Thewooden shims create a more natural looking dune shape but are much more maintenance intensive. The elevation of the embryonic dunes in relation to tidal elevation has also proved to be a very important factor. Other important factors include site usage and accompanying disturbance, both sand supply and wind conditions, as well as the site usage by both endangered or threatened shorebird species (*Charadrius nivosus and Sterna antellarum browni*) and various raptor species. The data and knowledge that have been collected over these last four years of monitoring have been invaluable and many important lessons have been learned that can be shared with the wider dune restoration community.

INVASION ECOLOGY AND RESTORATION OF YELLOW BUSH LUPINE-DOMINATED DUNES AT HUMBOLDT BAY NATIONAL WILDLIFE REFUGE

Andrea Pickart, US Fish and Wildlife Service, 6800 Lanphere Rd, Arcata CA 95521 *andrea_pickart@fws.gov*

Yellow bush lupine (*Lupinus arboreus*) is a short-lived, fast-growing woody shrub that is native to dune scrub in central and southern California. In the 1960s it was planted on a private dune parcel that is now part of the Wadulh Unit of Humboldt Bay National Wildlife Refuge. It now comprises 120 acres (73% of the non-forested dunes on the Unit). Yellow bush lupine is an ecosystem engineer which alters soil chemistry and dune processes. It has an abundant and long-lived seedbank (over 20 years). The native dune mat community is characterized by low to moderate cover and its constituent species are adapted to low nutrients and summer drought. Yellow bush lupine has nodulating bacteria in its root system that fix atmospheric nitrogen, enriching dune soils. Dead shrubs provide additional nitrogen and a build-up of litter/duff, which increases moisture holding capacity. These conditions favor secondary invasions, especially the invasive annual grasses ripgut brome (*Bromus diandrus*) and rattlesnake grass (*Briza maxima*). Restoration is in progress at the Wadulh Unit and requires removal of lupine and associated species and exposure of the mineral soil. This is being accomplished by a combination of manual removal and heavy equipment. In the manual treatment, shrubs are chopped down and the duff layer is removed and deposited in trenches created by an excavator. In the heavy equipment treatment, an excavator will be used to scrape off lupine and duff and bury organic material a meter below the surface. This also serves to remove much of the seedbank. The heavy equipment treatment leaves a

bare, infertile surface lacking microorganisms that promote dune mat recovery. Revegetation with native species is planned using nursery grown plants with mycorrhizal inoculum. The Wadulh restoration is the first large scale attempt at restoration of lupine-dominated dunes. Adaptive management will be an important component of the restoration.

PLANT COMMUNITY SIMILARITY CHANGES ALONG THE INTENSE STRESS GRADIENT OF COASTAL DUNES

*Ben J. Rivera**[1], [1]UC Davis Graduate Group Ecology 387 N Quad, Davis, CA 95616 benrivera@ucdavis.edu

Coastal dune plant communities are the perfect system to study how community assembly rules change due to their very short, but intense, environmental gradients. In addition, dune plant communities play key roles in the ecosystem services and functions of these ecosystems, and yet, coastal dunes are understudied within theoretical frameworks such as the Stress Gradient Hypothesis. I surveyed plant species abundances and their functional traits along with their stressful microclimates in these dune ecosystems to better understand how community assembly rules change in these vulnerable plant communities along stark environmental gradients. Within plots, I used nested quadrats (1x1m inside of a 2x2m) to test if focal communities are similar in both plant composition and functional traits to their immediate surroundings and if their relative similarities correlate with environmental stressors such as salinity, elevation, relative soil temperature, and more. Between plots, I compared the relative effect of spatial autocorrelation to how similar the plots were environmentally. Preliminarily, generalized linear mixed models indicate that there are predictable changes in how community similarity changes along specific stress gradients both within and between plots. Two one sided tests estimate that across the total range of relative soil temperatures, community dissimilarity with plots can increase between 13.6% and 23.8% with 90% confidence ($\alpha = 0.05$, $m = 10\%$). Between plots, a 90% confidence interval shows that across the range of environmental similarities, community dissimilarity increased between 14.5% and 23.5% ($\alpha = 0.05$, $m = 10\%$). Both are significant (intervals do not overlap with 0) and substantial (no overlap with m). While community dissimilarity correlating with environmental dissimilarity is expected under the Stress Gradient Hypothesis, increases to soil temperature increasing dissimilarity within plots is surprising. While further analysis is forthcoming (interactions, functional traits, site effects, etc.), this theoretical framework could help guide future dune restorations.

USE OF PRESCRIBED BURNING TO ACCELERATE RESTORATION OF NATIVE COASTAL DUNE COMMUNITIES FOLLOWING INITIAL TREATMENT

Lorraine S. Parsons[1*], *Rachel Hendrickson*[1], *Miriam Golding*[1], *Wende Rehlaender*[1], *Gregory Jones*[1], [1]Point Reyes National Seashore, 1 Bear Valley Road, Point Reyes Station, CA 94956, Lorraine_Parsons@nps.gov

Point Reyes National Seashore (Seashore) removed highly invasive European beachgrass (*Ammophila arenaria*) and, to a lesser extent, iceplant (*Carpobrotus edulis*) at AT&T Coastal Dunes between 2015 and 2018. These primary invaders were largely removed using herbicide treatment, with annual retreatment conducted through 2023. While eradication efforts have been highly successful, evolution of the restored backdunes into native vegetation communities similar to those found in uninvaded dunes (e.g., native Dune Mat, Dune Scrub) has been hampered by delayed decomposition of the standing dead biomass and litter of European beachgrass, particularly in backdune areas. Based on monitoring results from an adjacent older restoration site, it takes at least 10 years for dead biomass to decompose to levels below 1% cover. Previous mechanical efforts to break up dead biomass through mowing or scraping with a dozer weren't very effective,

because while necromass was broken up, thatch (fallen beachgrass stems >10 cm in length) and detritus (finer organic matter <10 cm) persisted, and ground disturbance caused a flush of secondary invaders or new weeds. The Seashore is now attempting a different approach to speeding up decomposition of dead beachgrass by conducting a pilot project at AT&T South using prescribed burning. In October 2023, strip firing was used to burn approximately 12.8 acres in backdune areas. Following the burn, an average of 71% of the burn area showed evidence of burn as determined by percent cover of char, ash, or scorched vegetation/detritus in monitoring plots. Cover of standing dead beachgrass and thatch plummeted in plots from 35% and 29% pre-burn to 0.2% and 3% post-burn, respectively. Detritus cover dropped from 69% to 27%. Moving forward, the Seashore will monitor and treat establishment of post-fire weeds, as well as evaluate trajectories of recovery and establishment of native dune plant species in both burned and unburned plots.

THE BEACH ECOLOGY COALITION: INFORMAL EDUCTION FOR BEACH PROFESSIONALS

*Karen Martin**[1], Dennis Simmons[2], and Melissa Studer[2], [1]Pepperdine University, 24255 Pacific Coast Highway, Malibu, CA 90263-4321 karen.martin@pepperdine.edu [2]Beach Ecology Coalition, Malibu, CA

Beaches are among the world's most beloved and heavily visited coastal ecosystems. Along developed coastlines, management of sandy beaches typically emphasizes human recreation and safety, economic benefits and tourism. However, sustainable practices that protect and enhance critical habitats for wildlife and shoreline protection are essential in a time of changing climate and shrinking beaches. First meeting in 2004, a non-profit educational organization has grown in California that soon was incorporated as the Beach Ecology Coalition. From the start, beach managers and maintenance staff were involved, along with coastal ecologists, park supervisors, lifeguards, coastal engineers, aquarium staff, marine biologists, surfers, environmental advocacy organizations, and resource managers. Representatives from local, state, and federal government agencies participate in this organization. Our mission is "to enhance ecosystem conservation and beach management to balance natural resource protection and recreational use." The group shares the latest scientific research to apply practical approaches to issues including adaptation for sea level rise, protection of native species on beaches, mediating conflicts between users, and other issues of common interest. Semi-annual meetings are characterized by a collegial atmosphere; groups that sometimes are in conflict often find new approaches to working together. Within this coalition, we have developed Best Management Practices guidelines on the basics of beach ecology, and are working to expand outreach to include certification for introductory basic beach ecology. This organization welcomes anyone who works on beaches and is willing to collaborate across groups of people with different expertise. Our goal is to increase appreciation of the role of beach ecosystems, and to find more ways to balance human uses and natural resource protection on sandy shores. Please see www.BeachEcologyCoalition.org for more information.

OREGON NATIVE COASTAL DUNE PLANT PROPAGATION

*Gabriel Campbell-Martínez**[1], *Roxy Olsson*[1], *Kathryn Ketel*[1], *Kristen Malacara*[1], [1] Rae Selling Berry Seed Bank, Portland State University, 111719 SW 10th Ave, Rm B1-81, Portland, OR 97201, gec2@pdx.edu

Coastal dunes protect urban infrastructure and provide critical habitat for rare and endangered species. Coastal dunes are threatened by development, climate change, and invasive species. They require active restoration activities including seeding and planting to maintain the ecosystem services they provide. Propagation protocols are lacking for most coastal dune species, limiting their successful use in restoration projects. We propagated several coastal dune species native to the west coast of North America from seeds, cuttings, and divisions in Portland, Oregon using standard greenhouse and nursery techniques. We recorded propagation success and plant development through production in 48-cell plug liners and 4-inch pots to develop a timeline of plant production and photographed the process over time. The majority of plants tested were easily propagated using standard greenhouse and nursery techniques and were ready for planting within one growing season. Some

species were not easily propagated and may require specialized cultivation techniques. Plants grown during this project were distributed to partners for use in restoration projects and photographs were provided to OregonFlora and are available for public view.

UTILIZING DUNES AS NATURE-BASED SOLUTIONS FOR CLIMATE CHANGE IMPACTS THROUGH THE CALIFORNIA DUNE SCIENCE NETWORK

Jenna Wisniewski, Laura Engeman*, California Sea Grant, 9500 Gilman Dr, La Jolla, CA 92093, jwisniewski@ucsd.edu

Increased winter wave action and storm events in recent years have amplified concerns for sandy beach ecosystems and coastal communities. California's dune systems have high potential to act as a natural buffer to coastal flooding and climate change impacts, increasing coastal resilience and protecting infrastructure. The California Dune Science Network facilitates partner-based coastal dune restoration efforts statewide, identifies science-based indicators of coastal resilience, and synthesizes best management practices. In partnership with 17 other collaborators and end-users, the Network recently received a California Climate Action Seed Grant to study the functionality of dunes as nature-based solutions (NbS) to climate change impacts. Using these funds, the Network will: **1)** conduct the first comprehensive state-wide dune inventory detailing the extent of current dunes and historical presence including current monitoring programs and restoration efforts to identify best restoration practices for multiple dune types. **2)** complete modeling and observations at 17 pilot sites across the state to advance understanding of adaptive management approaches including proper dune engineering, restoration, and monitoring methodology. **3)** synthesize findings from Obj. 1 & 2 to develop site suitability, restoration and performance assessment frameworks to identify opportunities for restored dunes to improve shoreline resilience. The findings from this project will be used to inform other Nbs dune projects and to develop state-wide guidance for dune monitoring, implementation, and maintenance.

RESTORING FORM AND FUNCTION AT THE OCEAN RANCH DUNES – EARLY OBSERVATIONS

James Ray*, Kelsey McDonald, and Michael van Hattem, California Department of Fish and Wildlife, 619 Second Street, Eureka, CA 95501 James.Ray@wildlife.ca.gov

The Ocean Ranch Restoration Project (ORRP) is a collaborative 850-acre coastal dune and estuary ecosystem restoration effort located in the Ocean Ranch Unit of the Eel River Wildlife Area in Humboldt County, owned and managed by the California Department of Fish and Wildlife. The coastal dunes encompass approximately 279 acres and are dominated by invasive European beachgrass (Ammophila arenaria), which has significantly degraded the natural communities and ecological functions of this important coastal habitat. Through eradication of European beachgrass, the ORRP aims to restore natural dune ecological and geomorphological processes to promote the recovery and enhancement of native biodiversity, State and Federally listed plants, such as Beach layia (Layia carnosa), and increase the resiliency of coastal dune habitat to sea level rise. To achieve this, the ORRP is applying a spatially and temporally phased Integrated Pest Management approach combining prescribed fire and herbicide, with the auxiliary use of hand pulling. Beginning in 2022, a total of approximately 41 acres have been treated with combinations of herbicide-then-fire and vice versa. Efficacy of these treatment sequences is being evaluated to inform future restoration efforts. Although it is too soon to identify differences in effectiveness of treatment types, results show immediate significant reductions in European beachgrass. After the first year of treatment, mean absolute percent cover of European beachgrass was significantly lower in burn-only areas (10.61 ± 6.58 95%CI) and the herbicide-then-burn area (0.13 ± 0.11) compared to untreated control areas (48.44 ± 6.30). The herbicide-then-burn treatment area had European

beachgrass cover of less than 1 percent, equivalent to the native reference site (0.56 ± 0.50). Results also indicate efficiency differences between herbicide application methods, with a mean effort of 9.1 person hours per acre for ATV application versus 15.4 for backpack sprayer application.