

Western Burrowing Owl Workshop



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July 27-29, 2022

Workshop Topics

DAY 1 – July 27:

Ecology & Natural History

- Distribution
- Identification
- Life History
- Species Interactions
- Habitat Requirements

Day 2 – July 28:

Protection & Management

- Status & Threats
- Regulations
- Habitat Enhancement & Management
- Establishing Owls
- Future Challenges

Athene cunicularia
Burrowing Owl or “Little Miner”



An Odd Bird

- Does not hoot
- Active day and night
- Only owl that lives and nests underground
- Life revolves around the burrow
- Lines burrows with dung, collects burrow decorations
- Juveniles do a great rattlesnake mimic!



Entire Species Range 20 recognized subspecies



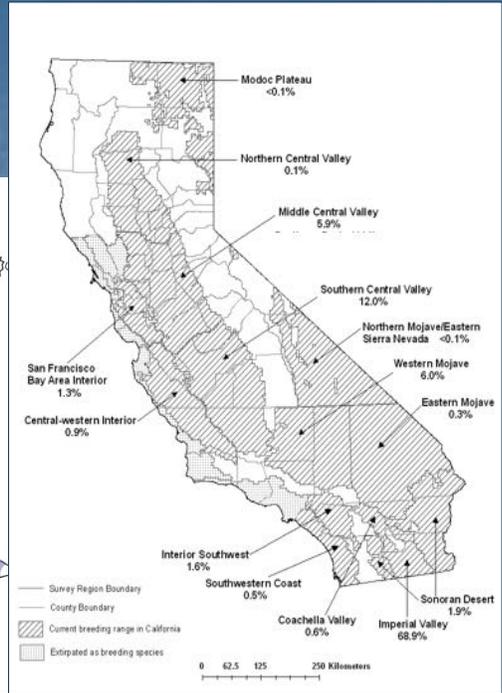
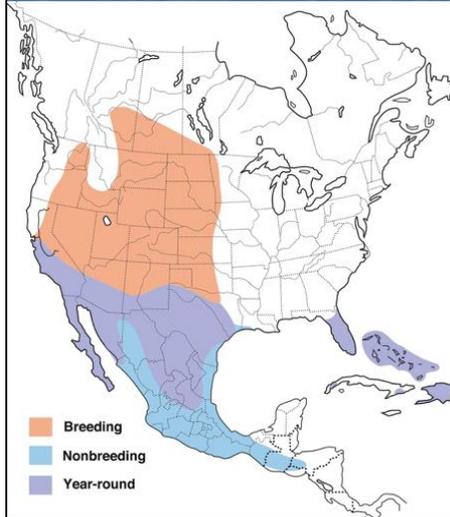
South American subspp may be physically larger than North American which may be larger than Caribbean subspp (Baladron, et al. 2015)

US Subspecies of Burrowing Owls

- Two subspecies in the US:
 - Western burrowing owl (*A. cucularia hypugaea*)
 - Florida burrowing owl (*A. cucularia floridana*)
- Very similar in appearance/behavior



Range of the Western Burrowing Owl



Migration

- Year-round residents
- Migrants – coastal, bay edges, hill sides
- Breed in more interior, flat areas
- Focus is on the breeding season...
- ...but the winter season is also vital



Identification - Adults

- Ht ~7.5-9.5 inches
- Wt ~5-6 ounces
- Wing span ~22 inches
- Long legs, few feathers
- Mottled brown and cream
- Designed for camouflage!
- Bright lemon yellow eyes
- No ear tufts
- Active day and night
- On ground or low perch



Identification - Adults

Male and female not sexually dimorphic, but male is slightly larger & paler in summer; behavioral differences.



Identification - Chicks

- May – September in CA
- Smaller than adults until about July
- Buffy breast, whiter eye-brow, darker collar



Steve Thurman



Chicks over the Season



Steve Thurman



Pete Bloom



Calls



- No typical owl “hoots”
- Males: “coo – coo” territorial/mating call
- All birds: “chatter” alarm call
- Females & Juveniles: “rasp” food call
- Nestlings & Juveniles: defensive call
- Listen to the calls:
http://www.allaboutbirds.org/guide/burrowing_owl/sounds

Life History Characteristics

- Inhabits open grasslands; short scrub habitat
- A raptor – although a small one
- Many predators
- Migratory in much of range, but in temperate areas some resident and some migrant
- Semi-colonial, especially with sciurids
- Semi-fossorial – inhabit burrows year round
- Monogamous during the breeding season
- Sexually mature at 1 year
- Lays 2-12 eggs; one clutch per year
- Lives ~3-5 years, but up to ~8 years

Bird of Open Grasslands: Prairies, Ag Lands, Bases, Golf Courses, Open Fields, Natural Grasslands and Urban Sites

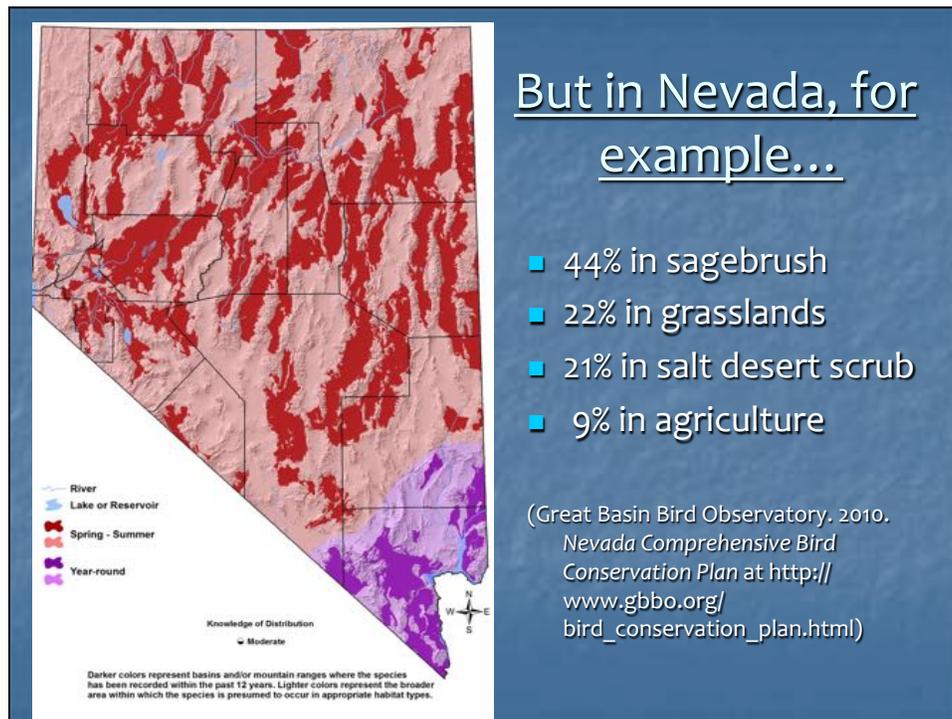


Habitat Types - Statewide in CA (Wilkerson & Siegel, 2010)

~30%=irrigation canals	~10%=urban
~16%=natural grassland	~ 8%=pasture
~10%=idle/fallow field	~ 6%=brushland
~10%=field crop	~ 3%=grain/row



J. A. Gervais



Nesting Habitat Requirements

Flexible requirements... within limits



Nesting owls are found...

- At lower elevations in much of California (often <200 ft)
- In open areas, typically with few trees
- Short grass (<6") around burrows
- Structural heterogeneity elsewhere - long grass, shrubs, rock + brush piles
- Associated with ground squirrels
- Some level of soil disturbance, esp. from ground squirrels

Predators? Just about everything!

- Primary: hawks, larger owls, skunks, foxes, coyotes, snakes
- Others: crows & ravens (a growing concern), dogs, cats, badgers



STEALTH CAM

07:43 06/29/18 69F ALV32

Scott Thurman

Burrows are key,
natural and artificial



California Ground Squirrels



Ground Squirrel Importance

- Colonial & semi-fossorial
- Provide burrows for burrowing owls
- Natural landscape maintenance
- Share many predators— Aerial & Terrestrial



Early Warning System!



Owls responded at least 75% of the time squirrels called first

Henderson & Trulio. 2019 Can California ground squirrels reduce predation risk to burrowing owls? *J. Raptor Research* 53:172-179.



Many burrows are needed:
Per pair: primary + satellite
Overall: a high density of burrows



Breeding Season Territory & Home Range

- Site tenacity – during season
- Some site fidelity – 32% - 57%
- 80% of foraging within 600m of burrow, but as far as 2 miles away
- Home range size varies widely, based on prey availability and quality

Wintering Season in CA: Many resident birds but...



- Saskatchewan Study using geolocators showed:
 - 9/10 females to CA
 - 10/15 males to OR/WA
- CA = important winter habitat for birds
- Males nearer breeding sites than females

<http://usfwspacific.tumblr.com/post/54113535534/wintering-habits-of-burrowing-owls-come-as-a-surprise>

Recent research using satellite telemetry conducted by a number of researchers (Conroy, Johnson, Holroyd, Trefry) ...

Burrowing Owl Migration - Fall 2014



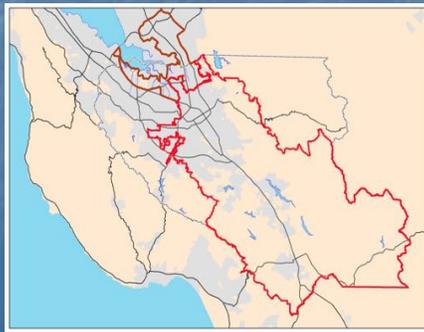
... shows amazing migratory travels!

Bend, Oregon
to
Salinas, California



Wintering BUOWs in Santa Clara County

- What is the relationship between wintering and breeding owls?
- What is the migratory pattern in our population?
- Research on migratory strategies needed
(Lincer, et al. 2018)

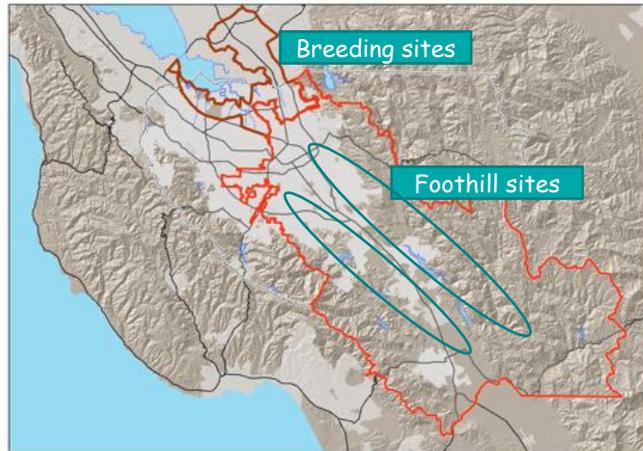


Santa Clara Valley Habitat Plan (HCP/ NCCP)

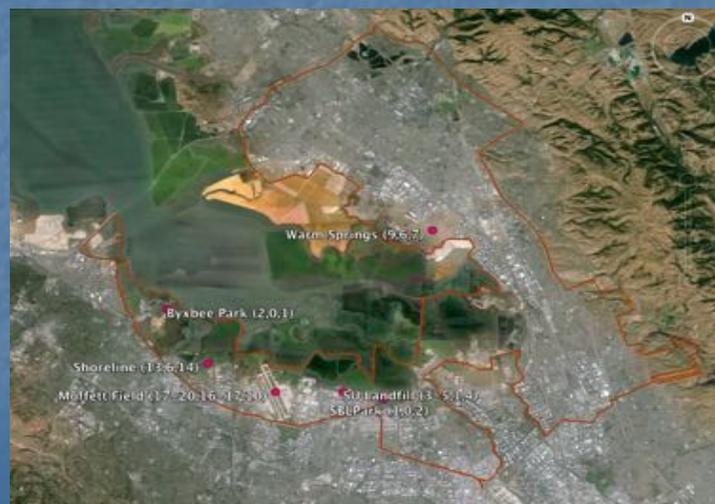
Burrowing owls - a covered species
Seeking ways to protect & recover



Santa Clara Valley Habitat Plan Area focus on protected open space--



Long-term breeding sites



Winter Study Methods

- CBC locations, local experts, eBird
- Bow trap and MP3 player
- Capture and band



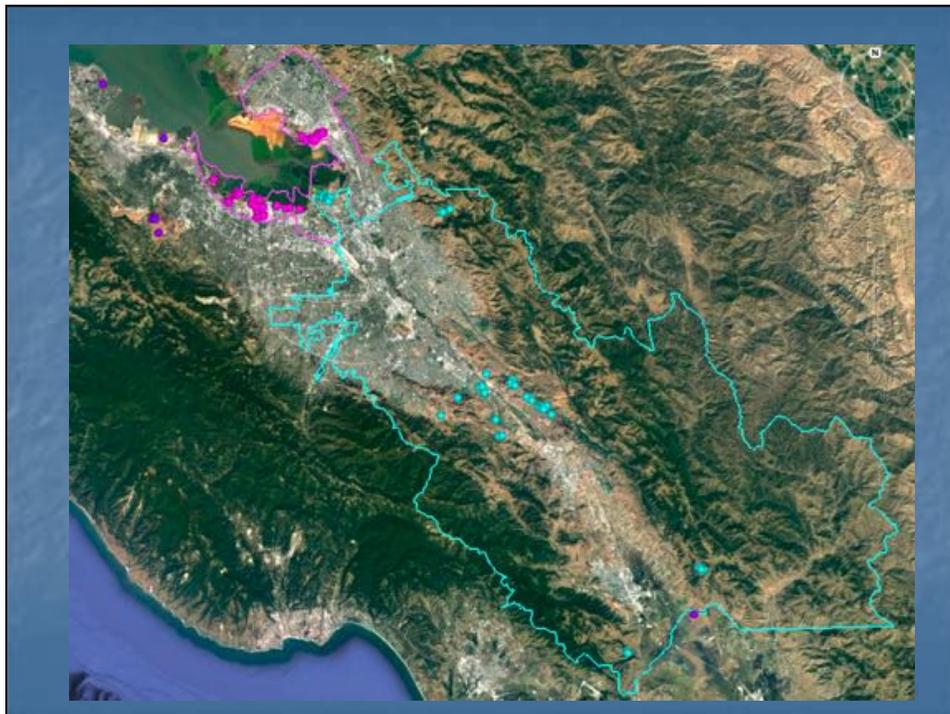
Summer Study Methods

- Surveys and banding at:
 - a) Typical breeding sites and
 - b) Foothill locations of wintering owls



4 Winter-Summer field seasons – 2014-15 to 2017-18

- Overall in winter:
 - 23-28 newly banded birds
 - Up to 700m in elevation
- Winter returns:
 - 2-3 birds from previous winters that were not seen in the summer
- Resident birds:
 - At typical breeding sites
 - No previously banded breeding owls in foothills

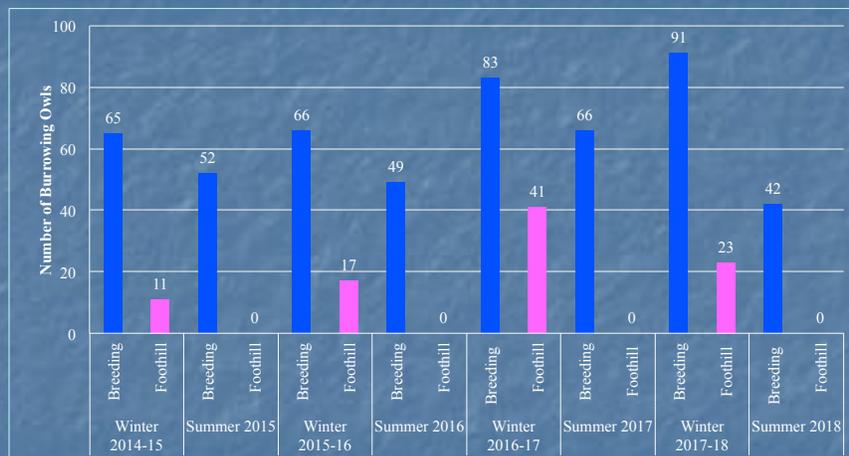


Summers 2015 - 2018

- Birds bred *only* in known breeding areas—no birds bred (or found) at foothill sites
- No winter birds from foothill sites seen at breeding areas in the summer
- Saw 12-20 summer resights per year from previous summers
- Unbanded birds seen in winter at breeding sites disappeared by summer



Results - 2014-2018



True Migrants—
from other parts of the Western range!

What they seek in winter habitat

- Higher elevation, slopes are fine
- No trees; typically grassland or low shrubs
- Still need burrows, but simpler ones OK
- Fewer burrows, perhaps
- Single birds, perhaps
- Widely-distributed
- Low profile/cryptic



Valuing and Protecting all Habitat



Can we get winter owls to stay??

- Better to be a resident than a migrant!
- Sometimes migrants do stay and breed!
- How to get them to settle down?
 - Existing breeding owls
 - Lots of burrows for refuge
 - Attractants - Calls, sign, food? Need to be tested

Gr-over-Bk X85; Dec 2019
Coyote Hills, Fremont, CA

A juvenile from BC
Photo: Anonymous



A Year in the Life of a BUOW:



Birds pair up starting in February

Aggressive/Defensive

Typically males and typically seen when defending burrow



Females lay up to 12 eggs

Chicks stay below ground for several weeks



Chicks start emerging in May –
stay with parents all summer



By September...

... juveniles molt and disperse to seek their own burrows and adults typically migrate or move to other local burrows for the winter



Year-round Timeline



Opportunistic predators

- * insects and small rodents dominate the diet
- * also eat amphibians, reptiles, crustaceans, birds



Diet in Santa Clara County, CA



Trulio, L. and P. Higgins. 2012. The diet of western burrowing owls in an urban landscape. *Western North American Naturalist* 72:348-356.

5 Study Sites: Total ~1450 ha (Site sizes: 62 to 722 ha)



Key Findings

- Year-round prey - rodents and insects
- Composition and species, especially insect taxa, similar to other habitats
- CA vole and Botta's pocket gophers - do well in urban settings

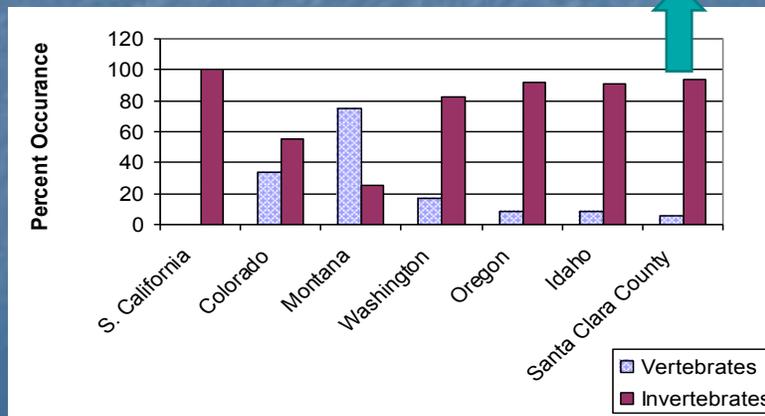
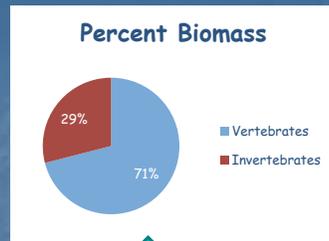


Avg. mass = 53 g



Avg. mass = 155 g

Diet differs over the range based on prey availability



Population Dynamics

- Adult survivorship: ~30-60% or more
- Juvenile survivorship: ~12-30%
- Nest success rates: Extremely variable
- Fecundity: Quite variable (~3 chicks per successful pair)
- PVA shows adult survivorship is the key parameter in population change (Barclay et al. 2011)

Population Genomics

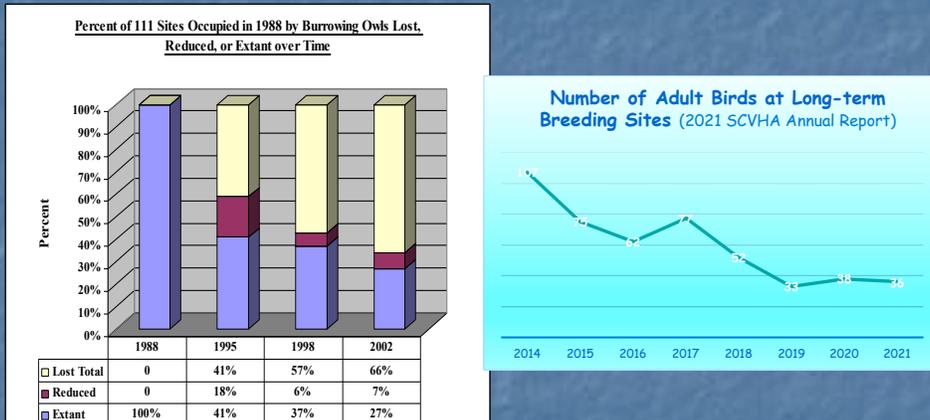
- *A. c. hypugaea* is panmictic
 - Migratory populations cannot be distinguished
 - But, resident populations differ from migratory
- New data from fine-grained DNA tests are changing our understanding
 - Isolated populations show lower genetic diversity and can show inbreeding effects
 - Resident populations differ from migratory ones and from each other
- Many implications for species management

Landscape as a Factor in Population Persistence



Enough foraging habitat in the landscape? Ability to disperse between populations? Land use change?

Land Use Change in Santa Clara County and BUOW Populations



- From ~1980-2010 – Habitat loss impacts
- From ~2010-2022 – Small population impacts

Small Group Exercise Could they be here?

As a burrowing owl biologist, you are given information on a site. The owner wants to know, just based on these features, do you think there might be burrowing owls here?

Looking at these, what would you want to know about the site in order to say that owls might be there? What aspects of the site do you think would constrain or promote the presence of owls?

Burrowing Owls In Action!

Angela Farms Burrowing Owls in Montana:

<https://www.youtube.com/watch?v=wmqVzcltLPo>



Day 2 - Protection and Management

- Status & Threats & Regulations
- Habitat Enhancement Methods
- Establishing Owls on Sites
- Management for Population Persistence
- Future Challenges

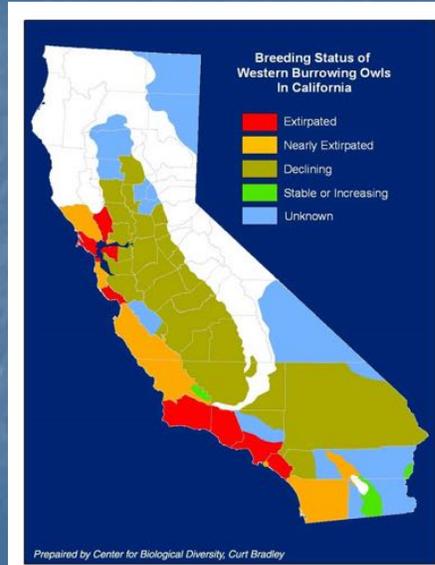


Status

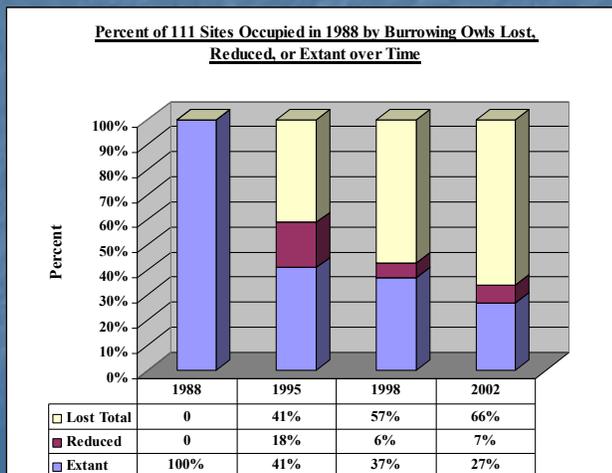
- Endangered in Canada
- Threatened in Mexico
- Bird of Conservation Concern in US
- Endangered in Minnesota
- Threatened in Colorado
- Species of Special Concern in California, Montana, Oklahoma, Oregon, Utah, Washington, and Wyoming

Owls are declining in California

- 60% of breeding groups found in the 1980s disappeared by the 1990s
- A species of special concern in California



Example: Santa Clara County



Between 1988 and 2002, 66% of locations lost

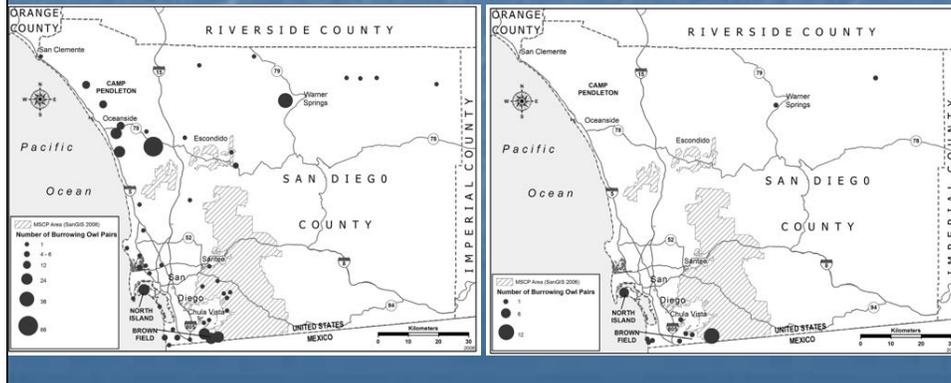
Fewer than 50 pairs of birds remain in all of Santa Clara County

Santa Clara Valley Habitat Plan

Example: San Diego County Status

- Population Status – 1970s/1980s, ~250-300 pr; 2003, 25-30 pr
- Protection Efforts & Recovery Efforts

Lincer and Bloom, 2007



Threats

- **Urbanization of grasslands.** Urban sites are subject to disturbance, habitat loss, and poor habitat conditions.
 - Development
 - Auto strikes
 - Exterminating rodents
 - Secondary poisoning
 - More mesopredators & corvids
 - Weed abatement & Tall grass
 - Recreationists & Dogs
 - Surface/soil disturbance





Threats

- **Loss of agricultural land**
 - ~90% of pairs found in agricultural landscapes, especially with irrigation canals
 - One of the only California raptors that does well in such agricultural areas
 - Significant areas likely to be converted to developed uses



Threats

- **Agricultural Practices**
 - Conversion to vineyards
 - Lining irrigation ditches
 - Discing to eliminate weeds
 - Exterminating rodents
 - Secondary poisoning
- **Solar/wind Farms**
 - Loss of agricultural lands
 - Loss of habitat
 - Direct mortality
- **Global Climate Change** – already harming BUOWs



Sustainable Energy Sources

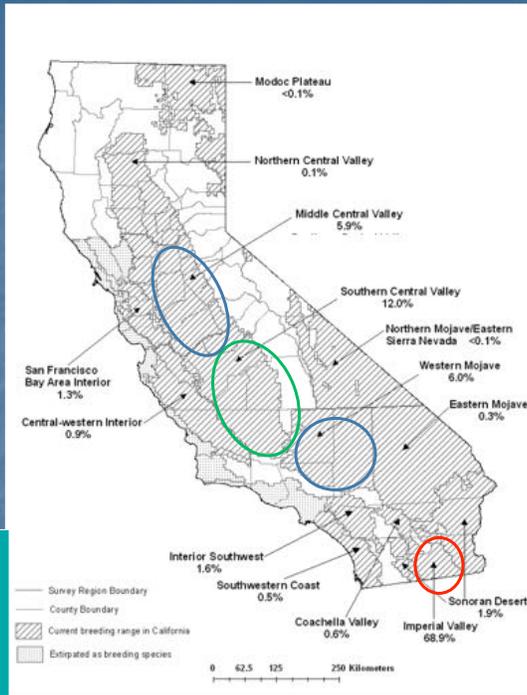
- Wind turbines – Significant source of local BUOW mortality; Altamont pass; See:
 - Smallwood, K.S., L. Neher, and D.A. Bell. 2009. Map-based repowering and reorganization of a wind resource area to minimize burrowing owl and other bird fatalities. *Energies* 2:915-943.
- Solar Farms - Could be ~500,000 acres; Sites are graded flat and vegetation removed; Significant loss of habitat & mortality; See:
 - Smallwood, K.S. 2022. Utility-scale solar impacts to volant wildlife. *Journal of Wildlife Management* 86:e22216 <https://doi.org/10.1002/jwmg.22216>

CA Burrowing Owl Distribution

2006-07 estimate = 9,187 (SE=2,346) pairs statewide

Very similar to statewide estimate of ~10 years before

Wilkerson, R.L. and R. B. Siegel. 2010. Assessing changes in the distribution and abundance of burrowing owls in California, 1993-2007. *Bird Populations* 10:1-36.



Human Population Growth Expected:

- * Middle Central Valley
- * Southern Central Valley
- * Western Mohave
- * Imperial Valley



Regulatory Framework

- Federal: Migratory Bird Treaty Act - prohibits the "take" of any migratory bird or body parts, nests, eggs or products
- Federal: Fish and Wildlife Conservation Act - Bird of Conservation Concern
- Federal: Endangered Species Act, Section 10 - Habitat Conservation Plans
- State: California Fish and Wildlife Code Section 3503.5 - prohibits the taking, possession or destruction of birds of prey, their nests or eggs. For this reason, any impacts to burrowing owls during the breeding season (February 1 to August 31) are in violation of this code, unless approved by the CDFW

Regulatory Framework

- State: ESA – California Species of Special Concern
- State: Natural Community Conservation Planning Act (1991) - takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity
- State: California Environmental Quality Act (CEQA) - requires evaluation of project impacts to Species of Special Concern; requires a "mandatory finding of significance" if impacts to rare, threatened or endangered species are likely to occur
- State: CDFW Staff Report on Burrowing Owl Mitigation (2012) – guide for determining owl presence and avoiding impacts to owls and their habitat

Staff Report on Burrowing Owl Mitigation (CDFG, 2012)

- Seek landscape-based planning
- Steps in developing mitigation include:
 1. Habitat Assessment (Appendix C)
 2. Surveys - impact assessment & preconstruction site surveys (Appendix D)
 3. Impact Assessment (pg 6-8)
 4. Mitigation Approaches (pg 9-15)
- Get to know your CDFW contact & work with them on avoidance/mitigation

Determining Presence/Absence

- Employ only qualified biologists (species-specific experience, education, & field training)
- Survey all suitable habitat areas an adequate time before disturbance (breeding or wintering)
- Observe at sunrise or sunset for at least 3 hr
- Observe at least 3 days
- Survey entire site on foot for burrows/birds
- If burrowing owls are found, contact California Department of Fish and Wildlife

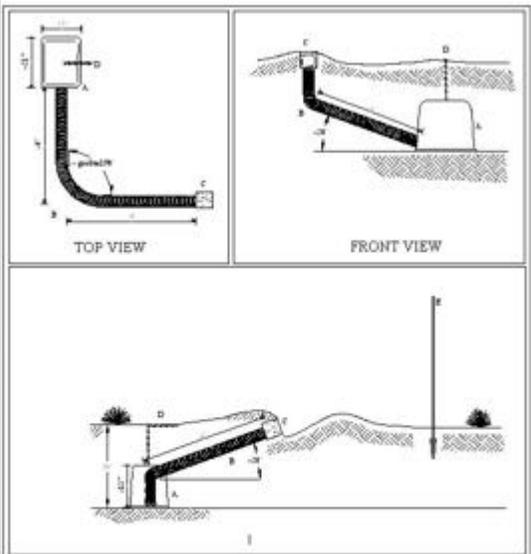


Line Transect Surveys – Very effective for smaller areas

Mitigation Methods

- Avoid or Minimize to less than significant
 - use appropriate buffer distances & protective screening
 - restore habitat if impact is temporary
- Burrow Exclusion/Eviction (Passive relocation) - may be permitted, as appropriate
 - effective only if alternative burrows and habitat exist within ~100m of the effected burrow
 - provide artificial burrows ~1 mo pre-eviction
- Translocation (Active relocation) – typically, only in the context of scientific research or NCCP

Artificial Burrows



A - plastic irrigation valve box
 B - 4" diameter perforated corrugated plastic pipe
 C - 6" square hollow concrete block
 D - chain or plastic rope marking location of nesting chamber on ground surface
 E - 5' - 6' perch post (optional)



What about moving owls?

For mitigation, *maintain* owls in place

Translocate only when absolutely necessary



Steve Blackmon, WildCare

First, a few definitions

- Translocation – actively moving animals from one site to another
- Relocation – actively moving animals to sites that they had once occupied
- Displacement or Eviction or Passive Relocation – excluding BUOWs from existing burrows with the hope they will find a new burrow to occupy

Translocation is difficult

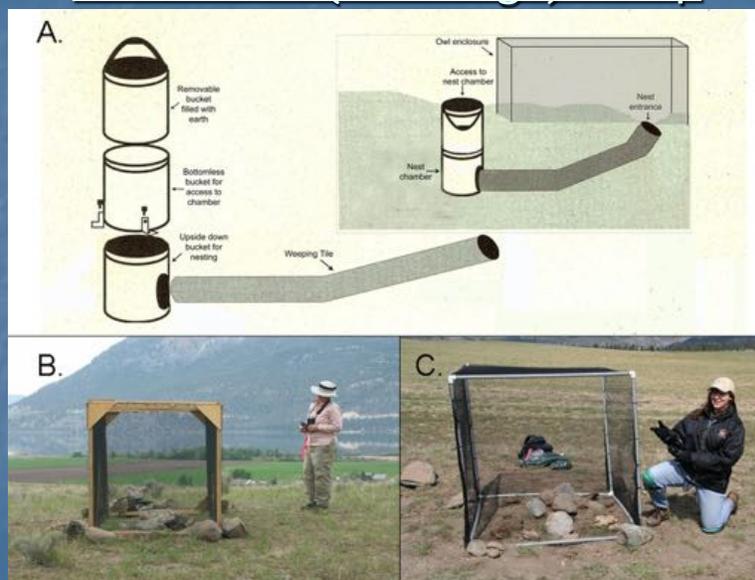
- 105 wild, preflight juveniles soft-released at burrows in Minnesota 1986-1989 (Martell et al., 2001):
 - No birds ever found after release.
- 106 captive-raised, 10 mo juveniles hard-released at burrows in British Columbia 1992-1997 (Leupin and Low, 2001):
 - 34% killed by predators
- 27 adult birds moved from construction sites, soft-released in Santa Clara County, CA in early 1990s (Trulio, 1995):
 - 17 disappeared (63%) within a year of release
- Large-scale translocation (100s of birds) in Arizona in 2017-2018 (Doublet, et al., 2022):
 - Releasing in groups of 6-10 – poor survivorship and site fidelity

More Successful Results

- Passively relocated (displaced birds) can allow birds to move to new burrows (Trulio, 1995):
 - Provide artificial burrows for birds within the home range
 - Allow birds time to investigate new burrows before eviction

- Researchers compare hard- vs. soft-release of captive-bred owls (2001-04) (Mitchell et al., 2011):
 - Soft-release results in greater survivorship and reproduction

Soft-release (“hacking”) Set up



Recent Advances on Translocation and Mitigation Methods

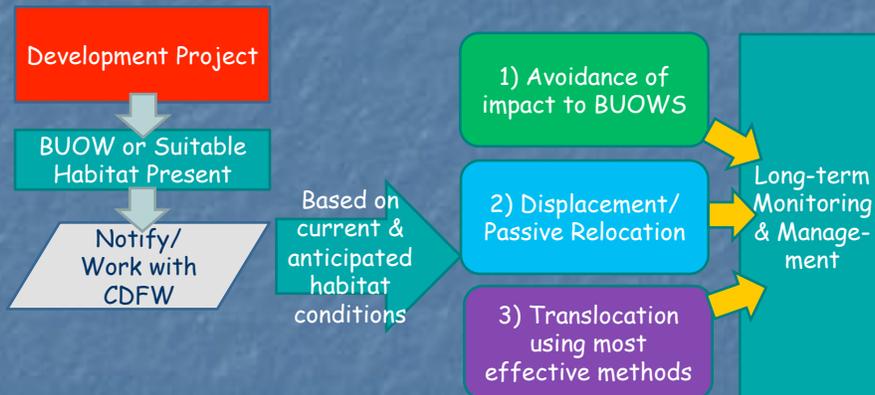
New research by Hennessy, et al. (2022):

- Displacing owls is best when refuge available in home range
- Translocation is best when displacement not possible
 - Move birds to existing habitat with owls
 - Move birds to high quality habitat and use conspecific cues – pellets, whitewash, calls

Recommended Release Conditions

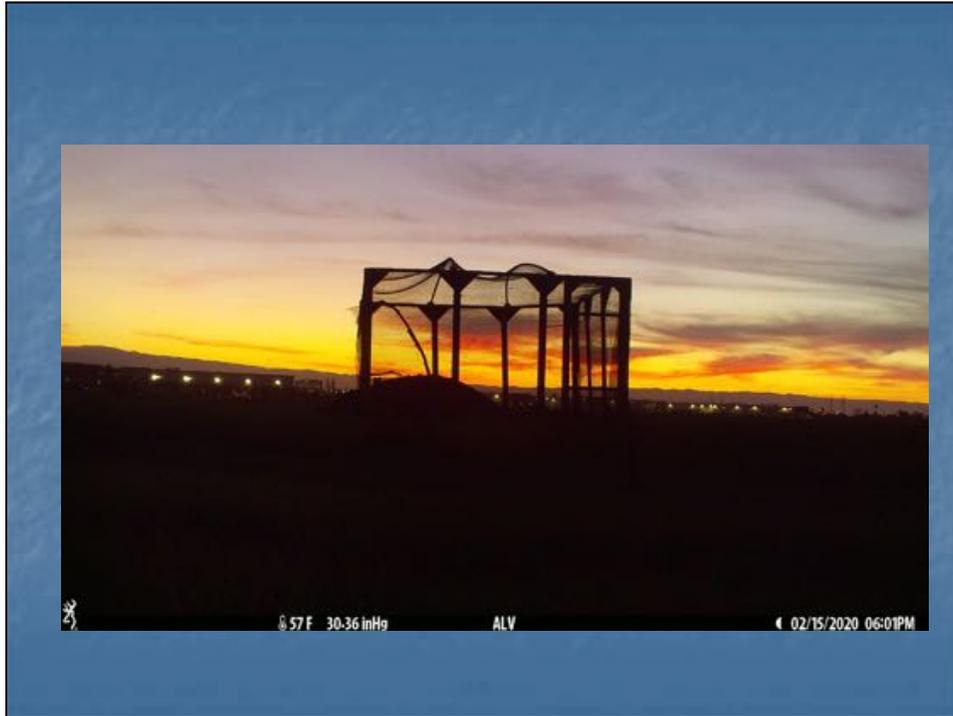
- Soft-release - birds in enclosures 14+ days
- Use social cues - calls, pellets and whitewash
- Non-breeding season (such as mitigation actions):
 - 1 adult or pair per aviary
 - Move to a new site >17.5km from original site
 - Supplemental feeding
- At start of breeding season:
 - One pair per aviary
 - Keep in aviary until lay eggs
 - Supplemental feeding over the breeding season

Decision Process for BUOW Mitigation Actions (Hennessy, et al., 2022)



Some final notes on Tranlocation

- Expensive
- Time-consuming
- Labor-intensive
- Specialized materials/equipment
- BUOW experts
- Easy to do wrong
- EXPENSIVE
- But, can be the right approach for BUOW conservation



Small Group Exercise

What are your thoughts on ensuring the lowest impact to BUOWs?
Consider habitat, surveying, impact avoidance, other possible mitigations



Project Scenarios:

Recommendations for lowest impacts to BUOWs

- 1 Adding another water tank
- 2 Upgrading the power towers
- 3 Putting in a pipeline along the road
- 4 Placing a trail and picnic tables
- 5 Townhouses on 8.97 acres
- 6 Horse Center on 5 acres
- 7 Commercial development on 20 acres
- 8 Additional housing
- 9 New vineyard on 50 acres

How to Manage Habitat to Preserve Burrowing Owls

- Habitat Features (owls present)
- Principles for Establishing Sites
(owls not present)

Habitat Features for Enhancing Areas for Owls (owls present)

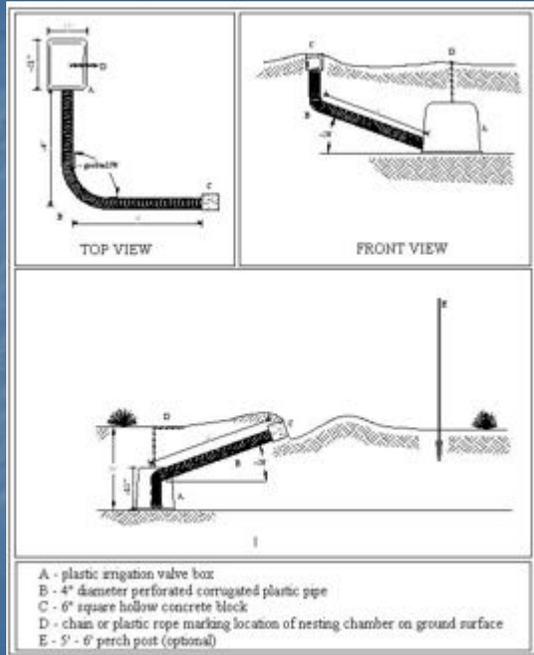
- Shoreline Burrowing Owl Preservation Plan
- San Jose/Santa Clara Water Pollution Control Plant Interim Plan

Principle 1:

Develop a **long-term plan** that sets aside adequate areas for burrowing owl protection and management; exclude disturbance activities, such as recreational trails, picnic sites or camp sites.



Principle 2: Enhance sites for nesting with **artificial burrows**.



Principle 3: Enhance the site for **ground squirrels** by bringing in mounds of dirt (don't use good soil!) and encourage healthy ground squirrel populations.



Principle 4: **Keep grass short** (<6 inches) around nesting burrows and remove trees.



Principle 5: Enhance foraging opportunities by creating a structurally heterogeneous prey habitat, providing features designed to attract prey and never using pesticides or poisons.

<https://www.flickr.com/photos/123882326@N04/>



Principle 6: Prevent human traffic or use, such as recreational uses or informal uses such as dog-walking or photography



Recap - Key Habitat Features

- Open grassland habitat, few to no trees or other obvious raptor-perching sites
- As large as possible – viable site size will vary depending habitat quality and qualities of the surrounding landscape
- Healthy, breeding ground squirrel population
- Lots of burrows
- Short grass (<6”) around burrows
- Structurally heterogeneous habitat—longer grass, foraging areas--for strong prey base
- Prevent human traffic or use

Management & Protection

Owls can do well in developed, urban, & agricultural areas if...

- Nests are protected from excessive disturbance
- And there is enough foraging habitat

They don't need “pristine habitat”



Principles for Establishing Habitat - owls not present

- GOAL: Attract nesting owls to a site where they are not currently found
 - Translocation may also be an approach
- NOTE: Once owls are extirpated from an area, reestablishing them is *very difficult*

Establishing Habitat

- Sites with the best chance of *attracting* nesting burrowing owls:
 - Add to adjacent, owl-occupied nesting habitat or within 300m of occupied habitat
 - Nesting owls recently on the site
 - Relatively large (~30-140 acres/owl pair??)
 - Not fragmented with roads or paths
 - Low elevation and flat
 - Habitat features as noted previously
 - Large, healthy colonial rodent population

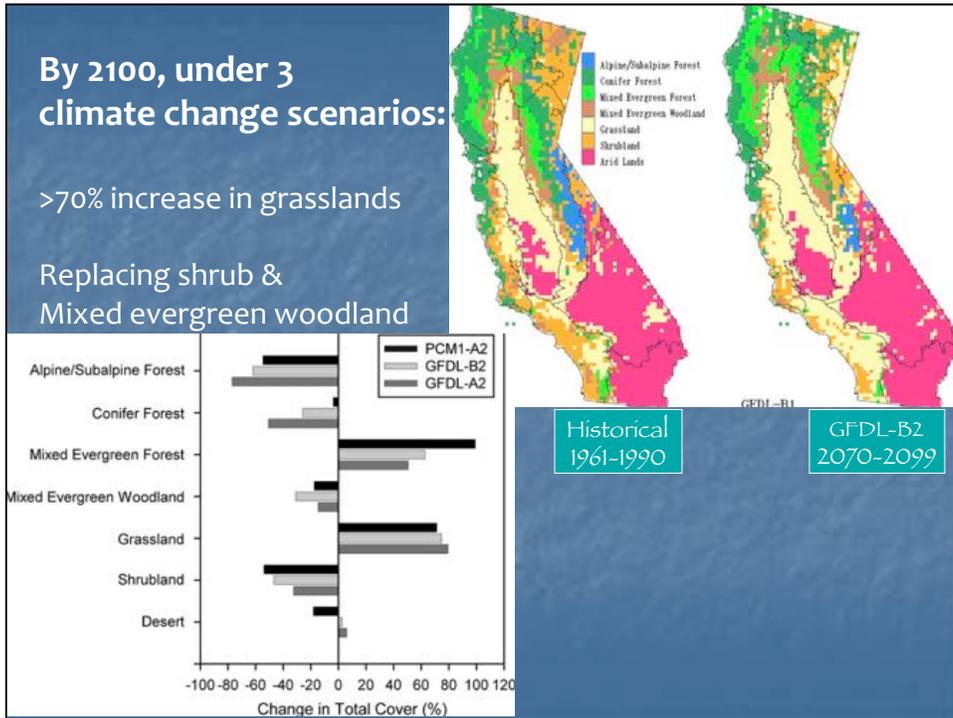
Monitoring for Success

- Stable population over the years
- >50% of nests per year produce chicks
- Average of 3 chicks fledged per nest
- >30% of birds show year-to-year site fidelity
- Acceptable levels of predation
- Successful habitat management for grass height and heterogeneity
- Strong prey base
- Little to no on-site human disturbance

The Long View for Burrowing Owls: Climate Change

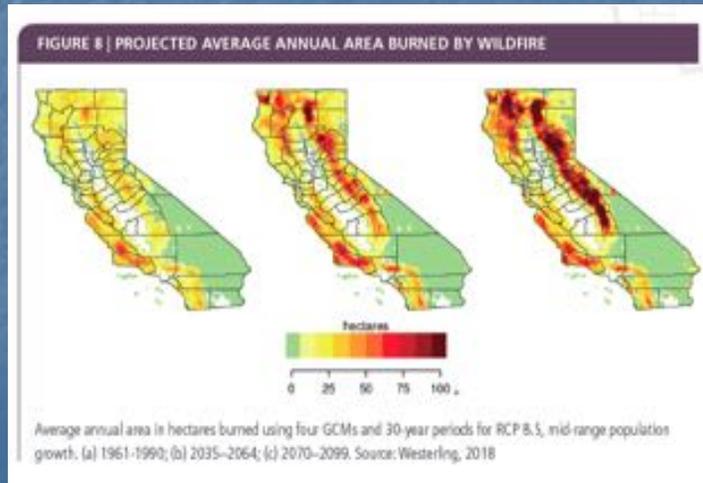
How will the burrowing owl fare in an era
of climate change?

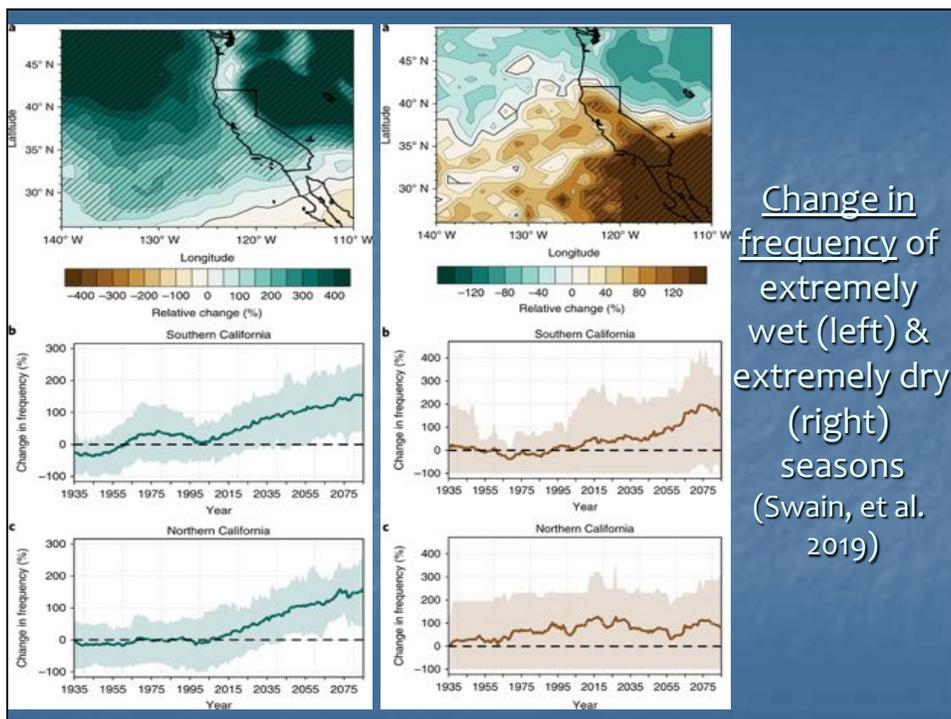




Climate Change – Fire!

- ~77% increase in mean area burned under current CO₂ conditions





Big Questions...

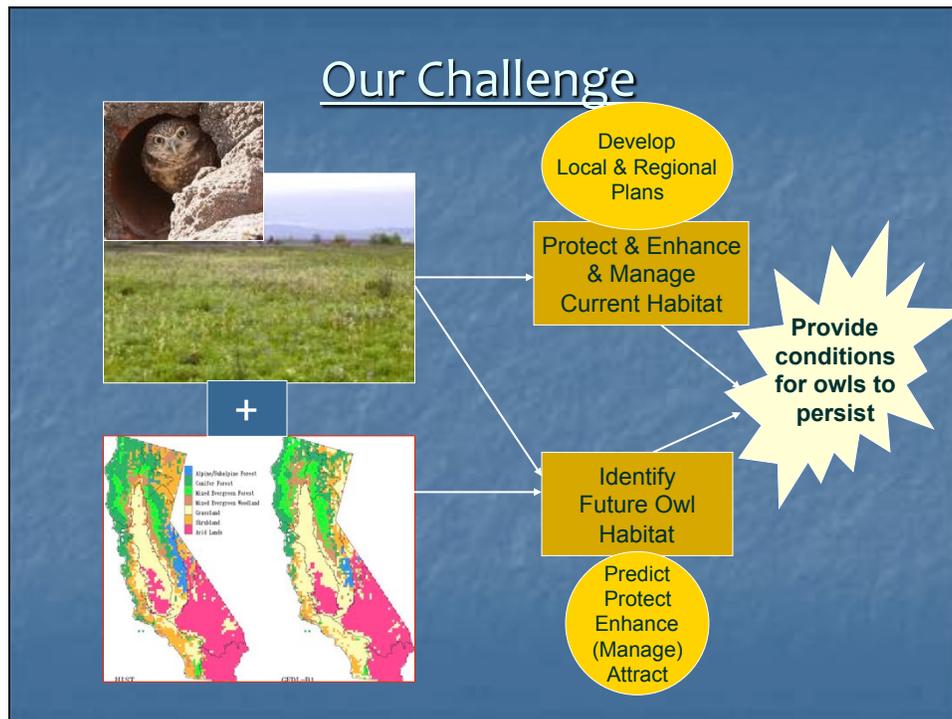
- Fire + Drought + Habitat Change
 - Too much, too often?
 - Destroy food base?
 - Squeeze owls into less suitable conditions?
- And what about the intersection of human activities, population growth & climate change?
- National Audubon Climate Report states:

“By 2080, this diurnal owl species could lose 77 percent of its current breeding range. Climate change will disrupt its winter range as well, leaving only 33 percent intact...”



Dave Taylor, WildCare

(<http://climate.audubon.org/birds/burowl/burrowing-owl>)



Thanks to colleagues & supporters

Especially...

- Phil Higgins, Debra Chromczak, Sandra Menzel
- Edmund Sullivan, Santa Clara Valley Habitat Agency
- City of Mountain View, Shoreline at Mountain View
- City of San Jose, WPCP
- NASA Ames Research – Moffett Federal Airfield
- US Fish & Wildlife Service & Don Edwards SFBNWR
- California Department of Fish and Wildlife
- Santa Clara Valley Open Space Authority
- Santa Clara County Parks & Recreation, Santa Clara Valley Water District, and VTA

...and many tireless, enthusiastic field & lab assistants!

And thank you...

- Elkhorn Slough Coastal Training Program
- All the biologists, advocates, agency experts working to protect burrowing owls
- And, you for your attending this workshop to learn about this wonderful animal!



Directions to the Field Site

- We will meet at the end of Nortech Parkway in Alviso.
- Take Route 237 and exit onto North First Street.
- Turn right onto Nortech Parkway and park at the end of the street. The star is our meeting point. (GPS: 150 Nortech)

