Western Burrowing Owl Workshop

Dr. Lynne Trulio

ltrulio21@gmail.com

July 12-14, 2023

Workshop Topics

DAY 1 – July 12: *Ecology & Natural History*

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

Day 2 – July 13: *Protection & Management*

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

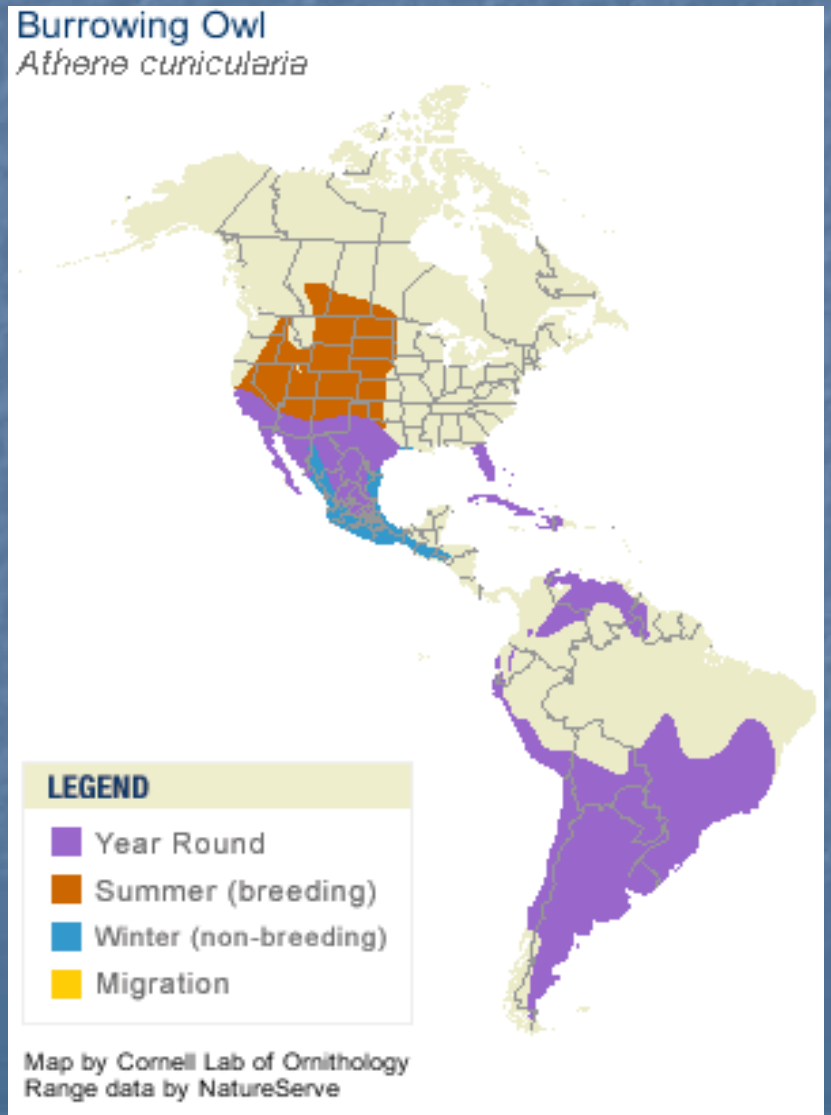
Athene cunicularia
Burrowing Owl or "Little Miner"

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

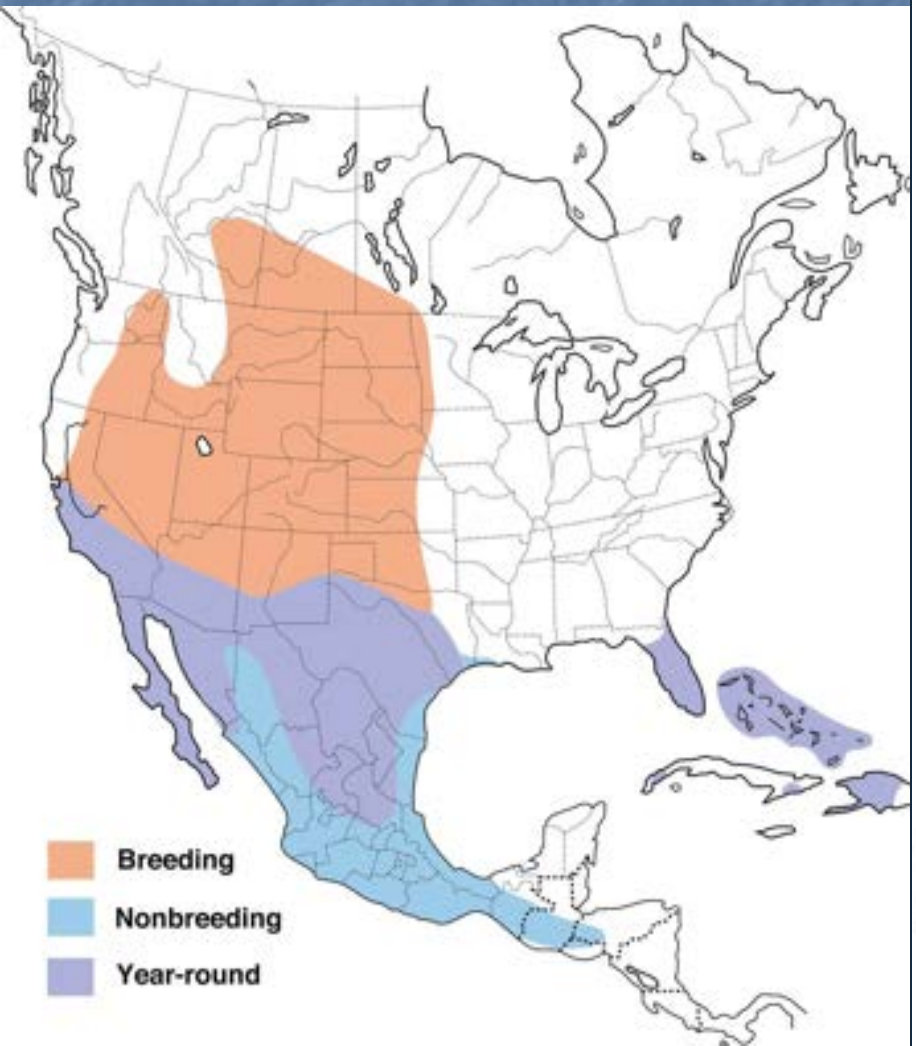


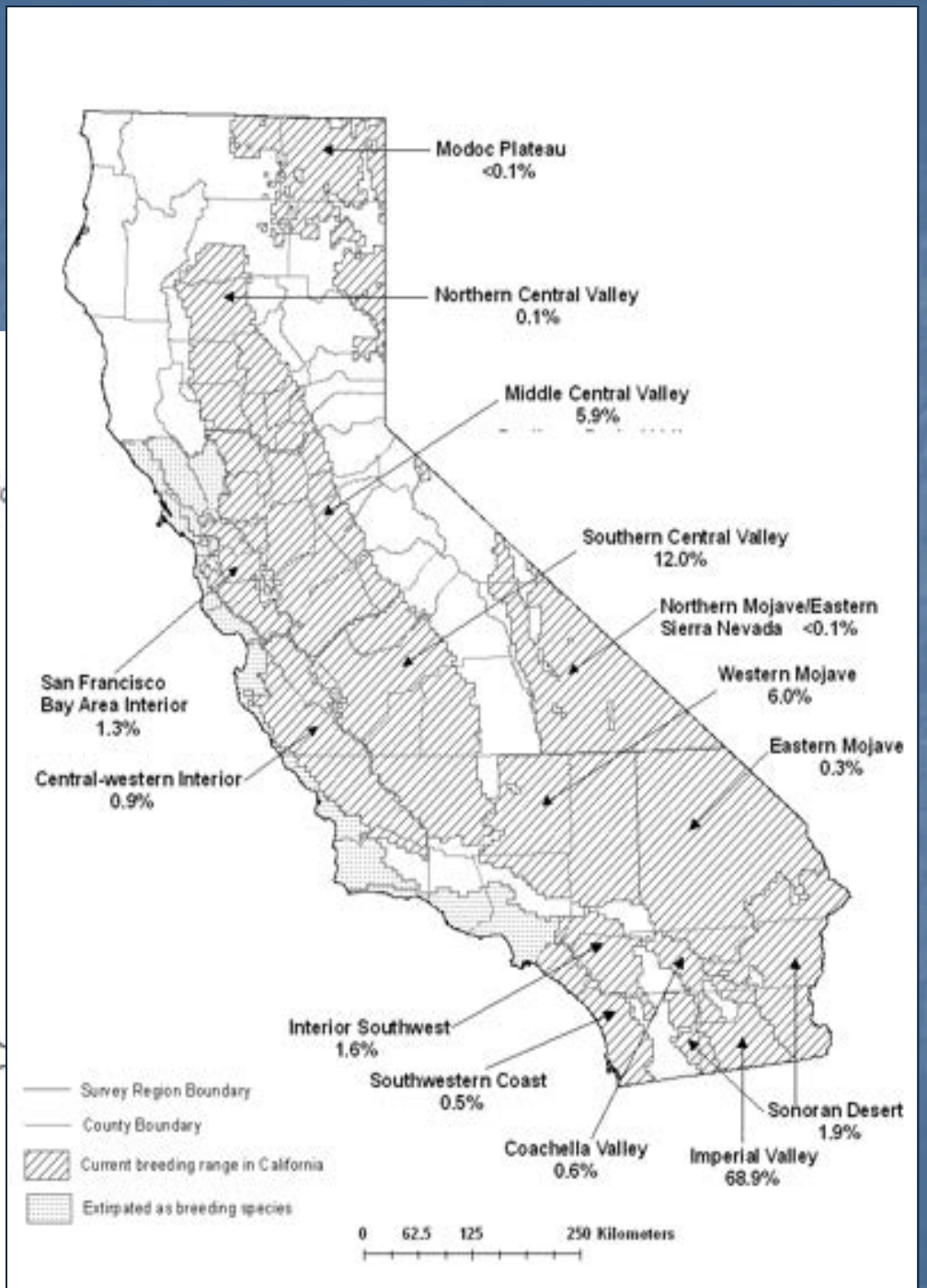
South American subspp. may be physically larger than North American which may be larger than Caribbean subspp. (Baladron, et al. 2015)

US Subspecies of Burrowing Owls

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

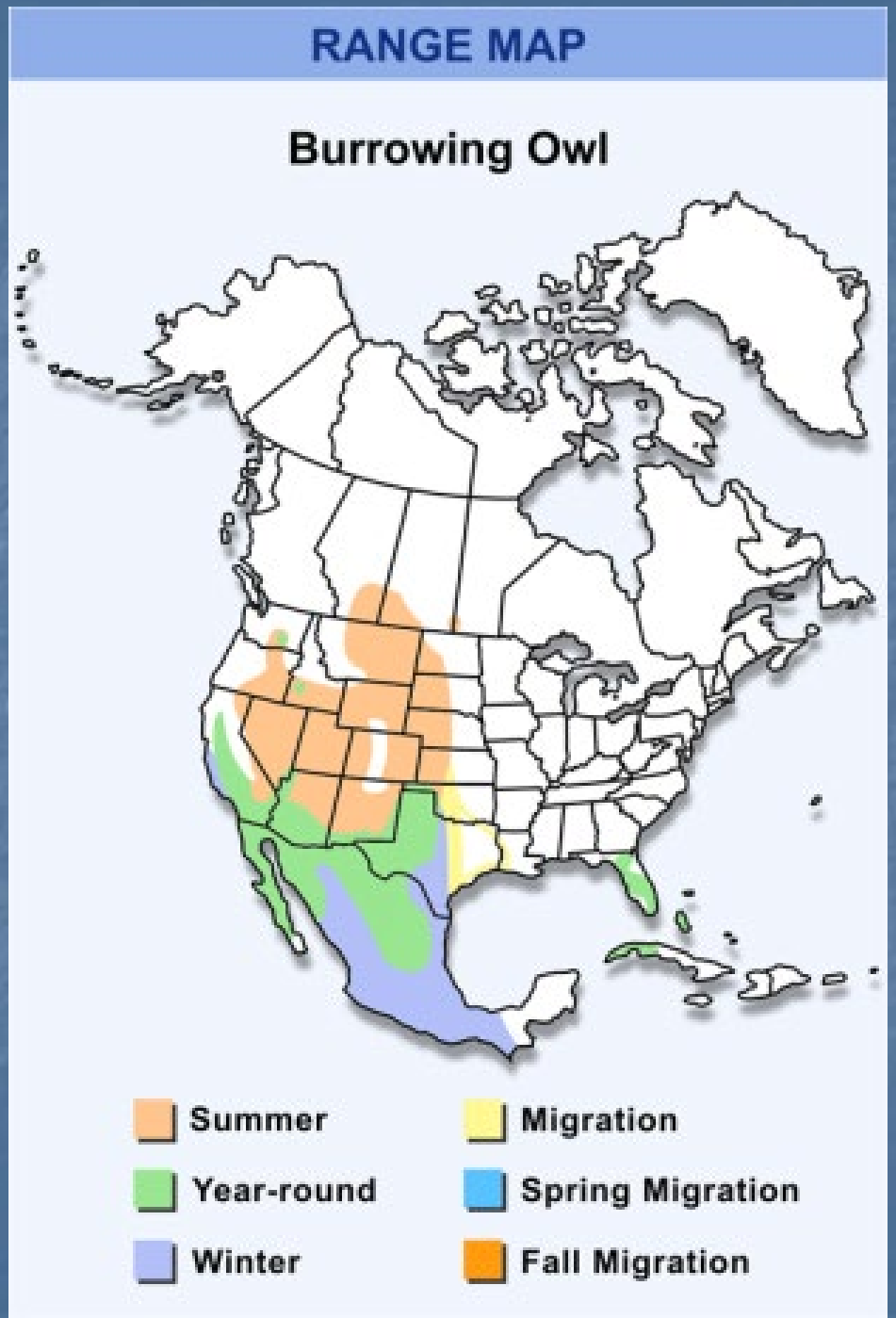
Range of the Western Burrowing Owl





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

Not sexually dimorphic, but male is slightly larger & paler in summer; behavioral differences

https://www.wonderstrucktv.com/video/californian-burrowing-owls-fall-in-love

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

https://video.thinktv.org/video/fun-burrowing-owls-zneypp/

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

- Inhabit 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
- Lay 2-12 eggs; one clutch per year
- Live ~3-5 years, but up to ~8 years

Population Factors

- 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)

Bird of Open Grasslands:

Prairies, Ag Lands, Bases, Golf Courses, Open Fields, Natural Grasslands and Urban Sites;
Often attracted to disturbed, cleared sites

Habitat Types - Statewide in CA

(Wilkerson & Siegel, 2010)

~30%=irrigation canals

~16%=natural grassland

~10%=idle/fallow field

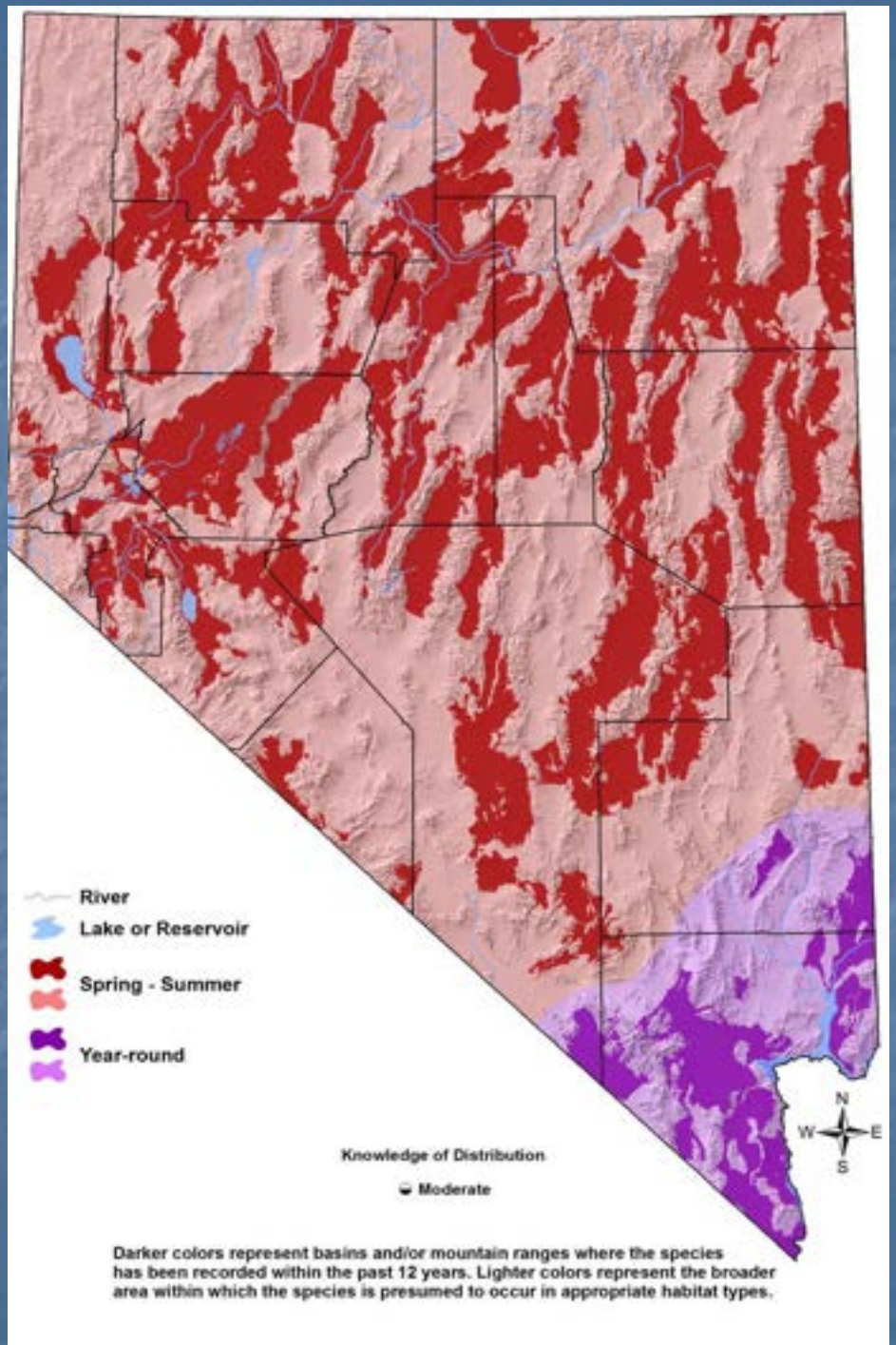
~10%=field crop

~10%=urban

~ 8%=pasture

~ 6%=brushland

~ 3%=grain/row



But in Nevada, for example…

- 44% in sagebrush
- 22% in grasslands
- 21% in salt desert scrub
- 9% in agriculture

(Great Basin Bird Observatory. 2010. *Nevada Comprehensive Bird Conservation Plan* at http://www.gbbo.org/bird_conservation_plan.html)

Nesting Habitat Requirements

Flexible requirements… within limits

Nesting owls are found…

- At lower elevations in much of California (often <200 ft) … but, the Altamont Pass!
- 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 in No CA
- Some level of soil disturbance, esp. from ground squirrels

Burrows are key, natural and artificial

Predators? Just about everything!

- Primary: hawks, larger owls, skunks, foxes, coyotes, snakes
- Others: crows & ravens (a growing concern), dogs, cats, badgers
- But the owls have defense tactics!

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.

Artificial burrow with lots of owl sign out front

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

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.

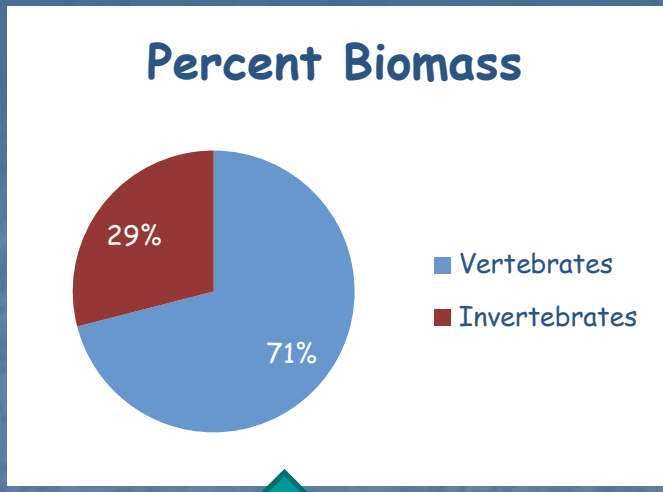
Key Findings

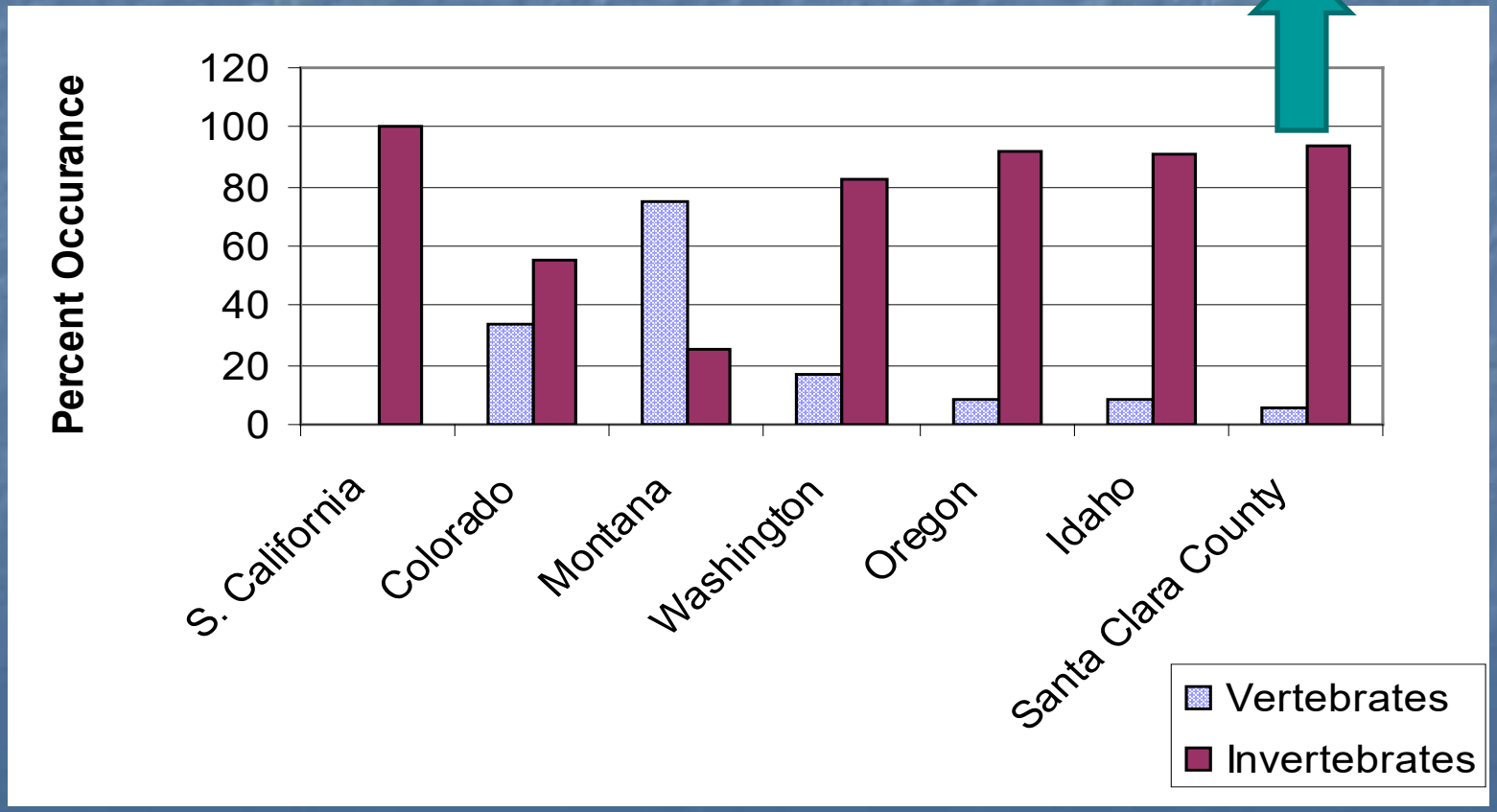
- Year-round prey - rodents and insects
- Composition and species, especially insect taxa, similar to other habitats
- CA vole and Botta's pocket gophers - do well in urban settings

Avg. mass = 53 g

Avg. mass = 155 g

Diet differs over the range based on prey availability





Wintering Season in CA

Many resident birds but…

Burrowing owls are formally endangered in Canada and of special concern in the USA. This map shows wintering distribution sites for 25 adult burrowing owls, based on geolocator data.

- 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 (Conway, Johnson, Holroyd, Trefry) …

… shows amazing migratory travels!

Bend, Oregon

to

Salinas, California

Wintering BUOWs in Santa Clara County

Every year we have them but…

- 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)

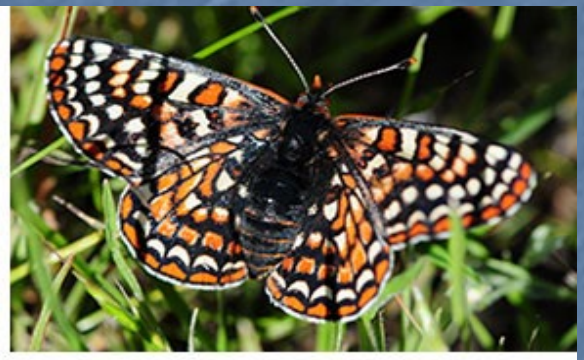
Colleagues:
Debra Chromczak
Philip Higgins
Sandra Menzel
Dr. Kristen Ruegg
Dr. Christen Bossu

Santa Clara Valley Habitat Plan
(HCP/NCCP)

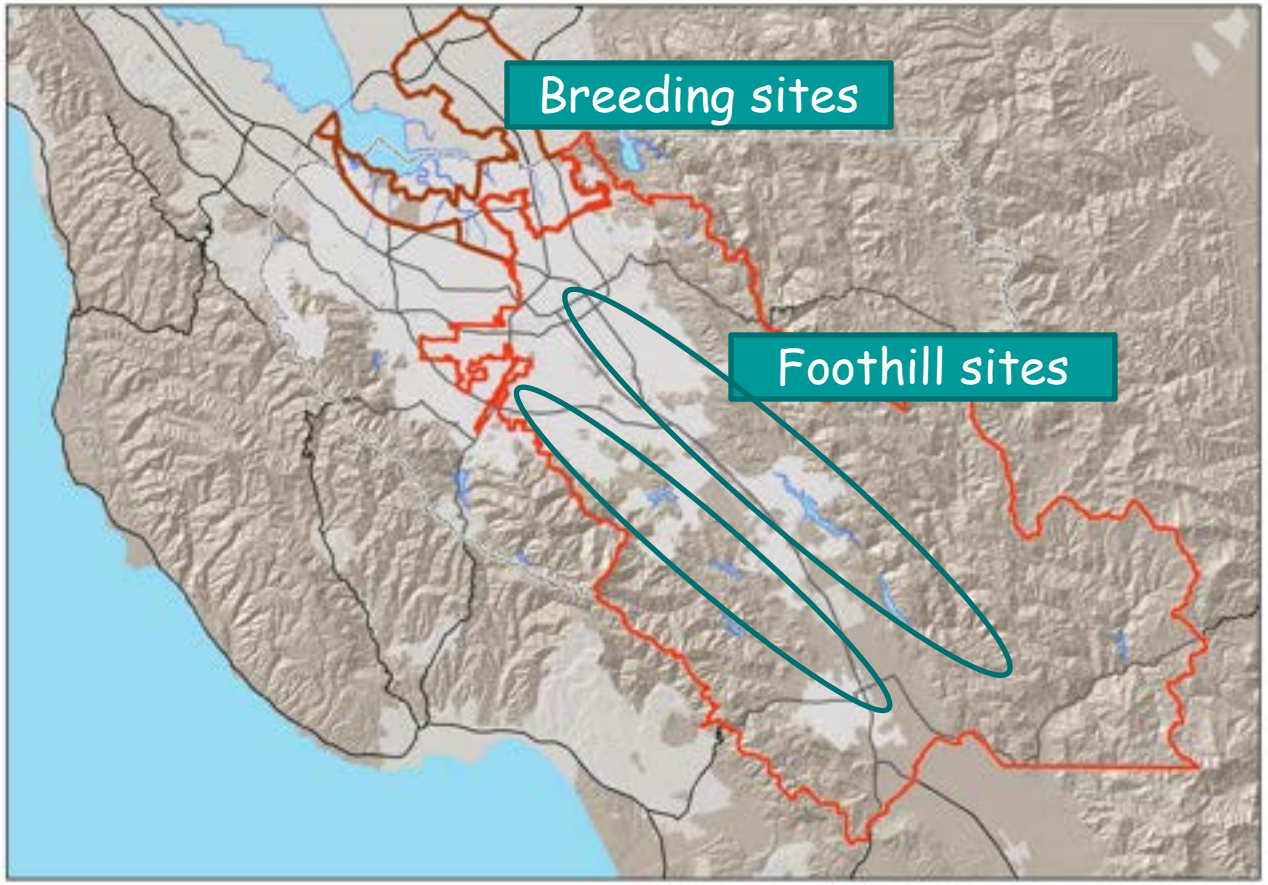
Burrowing owls - a covered species

Seeking ways to protect & recover

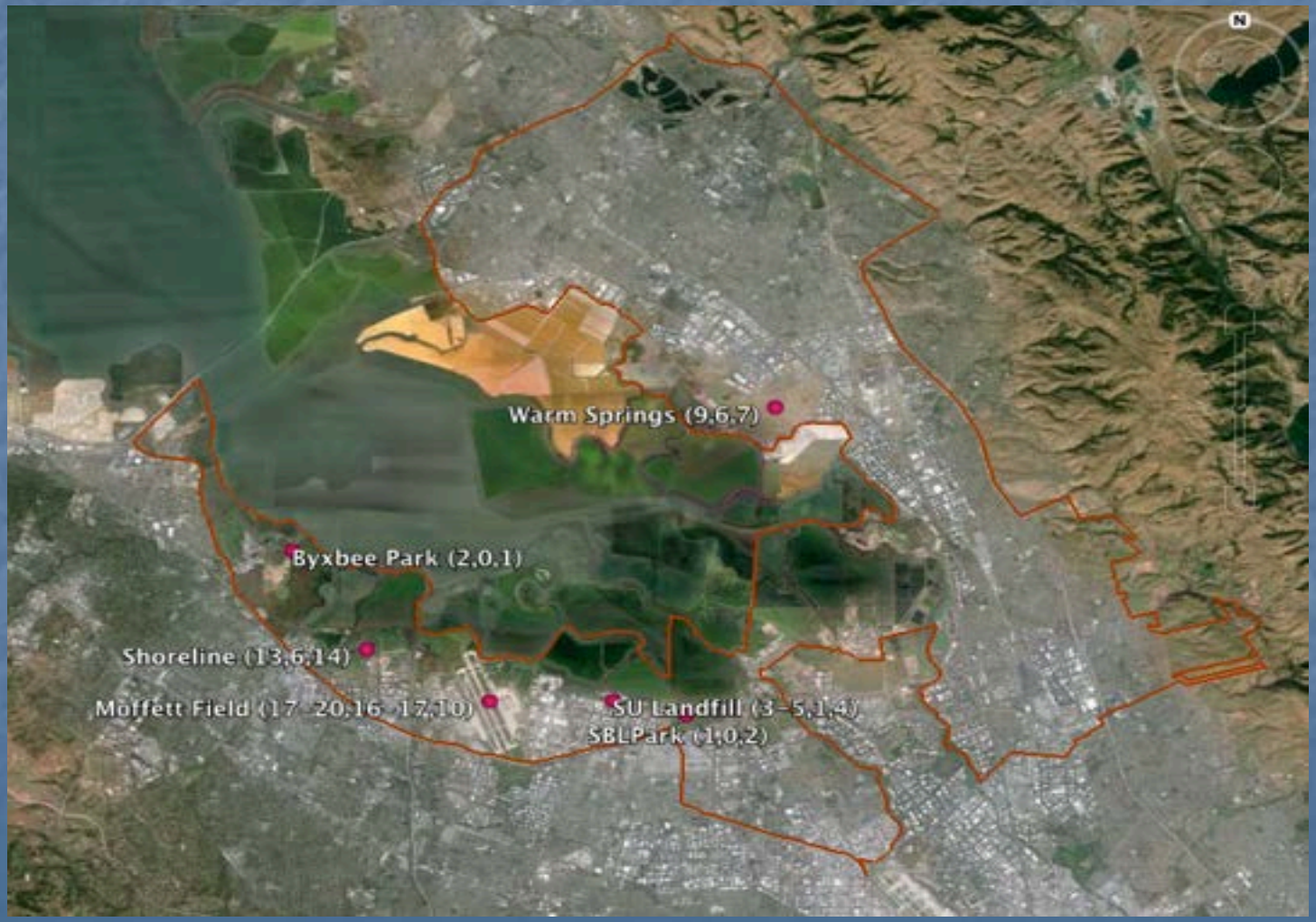
SANTA CLARA VALLEY
HABITAT AGENCY



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) Known breeding sites and
  - b) Foothill locations of wintering owls

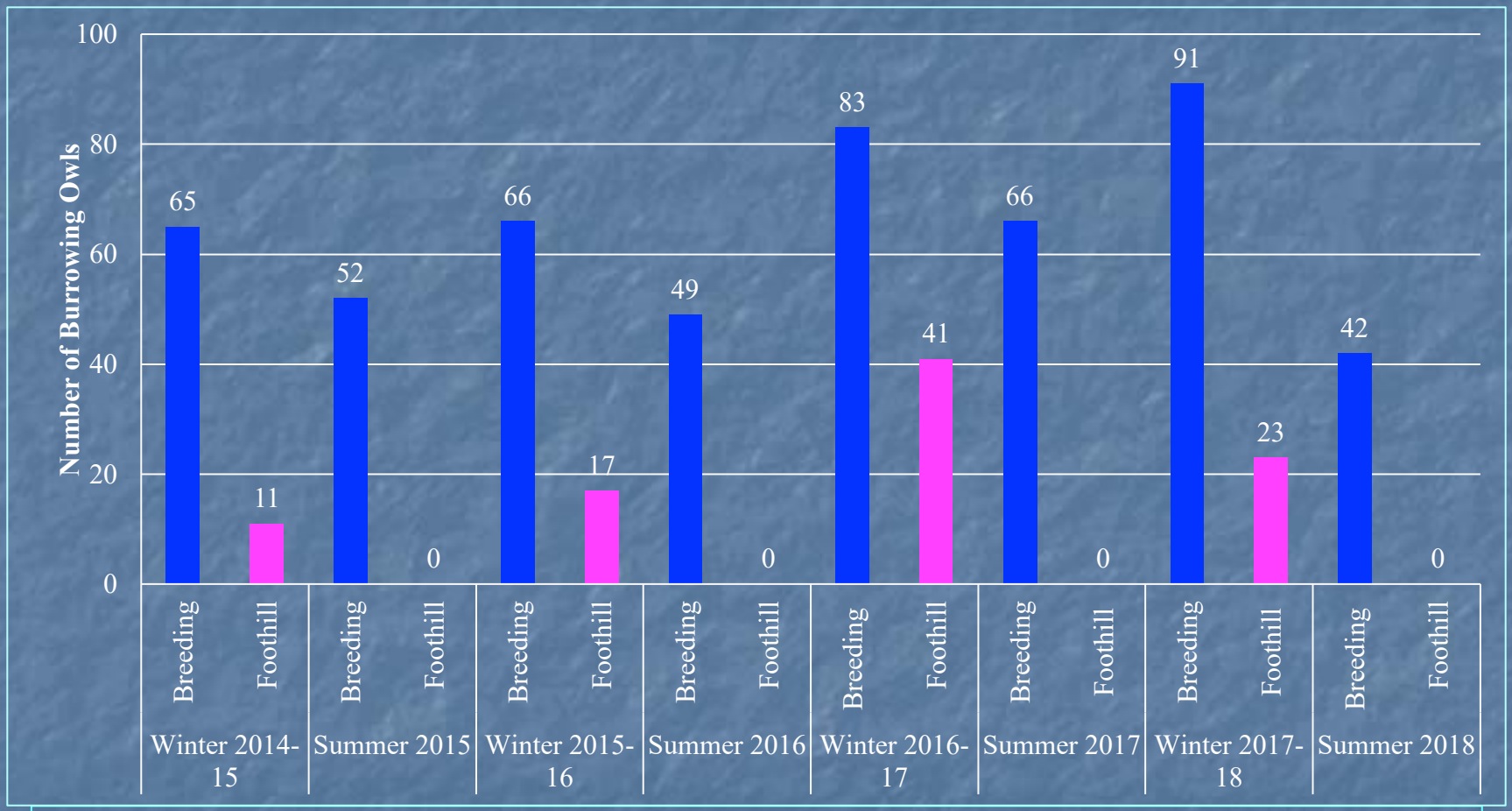
4 Winter-Summer field seasons – 2014-15 to 2017-18

- Overall in winter:
  - 23- 28 banded birds/winter
  - Up to 700m in elevation
- Winter returns:
  - 2-3 birds from previous winters that were not seen in the summer
- Resident birds (banded in summer):
  - At typical breeding sites only
  - Only banded bird in foothills was from British Columbia!

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
- Unbanded birds seen in winter at breeding sites disappeared by summer

Results - 2014-2018



True Migrants in Winter

What they seek in winter habitat

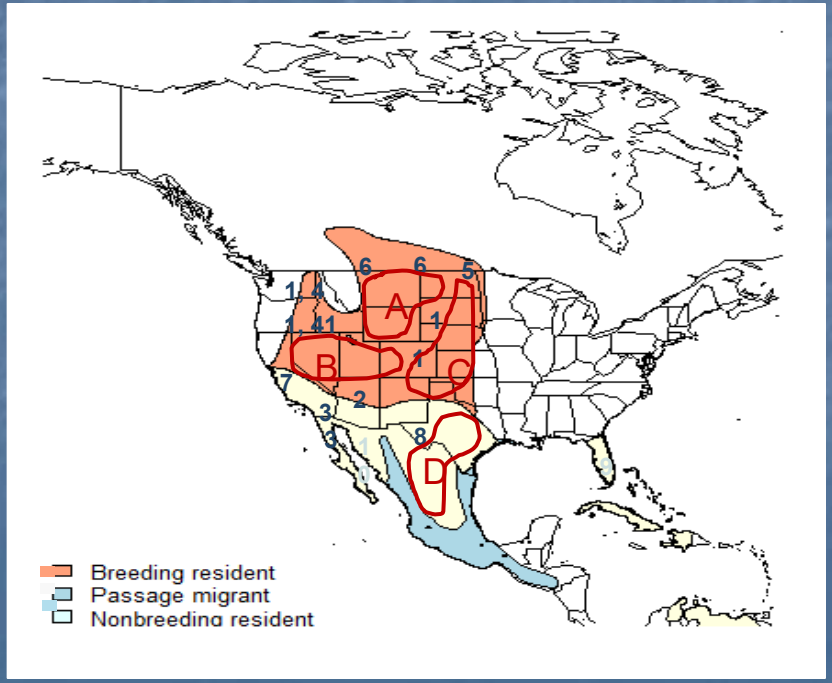
- Higher elevation, slopes are fine
- No trees; typically grassland or low shrubs
- Still need burrows, but simpler ones OK
- Fewer burrows, perhaps
- Single birds, perhaps
- Widely-distributed
- Low profile/cryptic

But are these migrants from other parts of the range or locals?

- Panmictic subspp—previous methods could not distinguish owl populations
- With powerful genome sequencing methods, distinguish *local residents* from *long-distance migrants* (outside CA)
- We used genomic analysis to determine:
  - Might some winter birds be local residents?
  - Might some summer birds be long-distance migrants that became residents?

Bird Genoscape Lab (https://www.birdgenoscape.org)

- Dr. Kristen Ruegg and Dr. Christen Bossu, Colorado State University
- Dr. Kelly Barr – UCLA
  - Migrant populations - indistinguishable
  - Resident populations – unique genomes



Using feathers collected from winter and breeding birds, we found…

- In winter = All long-distance migrants
- In summer, at the breeding sites we found residents, migrants and birds that were a hybrid of the two!
- Sometimes migrants stay to breed—and add their genes!

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

Valuing and Protecting all Habitat

Burrowing owls are formally endangered in Canada and of special concern in the USA. This map shows wintering distribution sites for 25 adult burrowing owls, based on geolocator data.

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

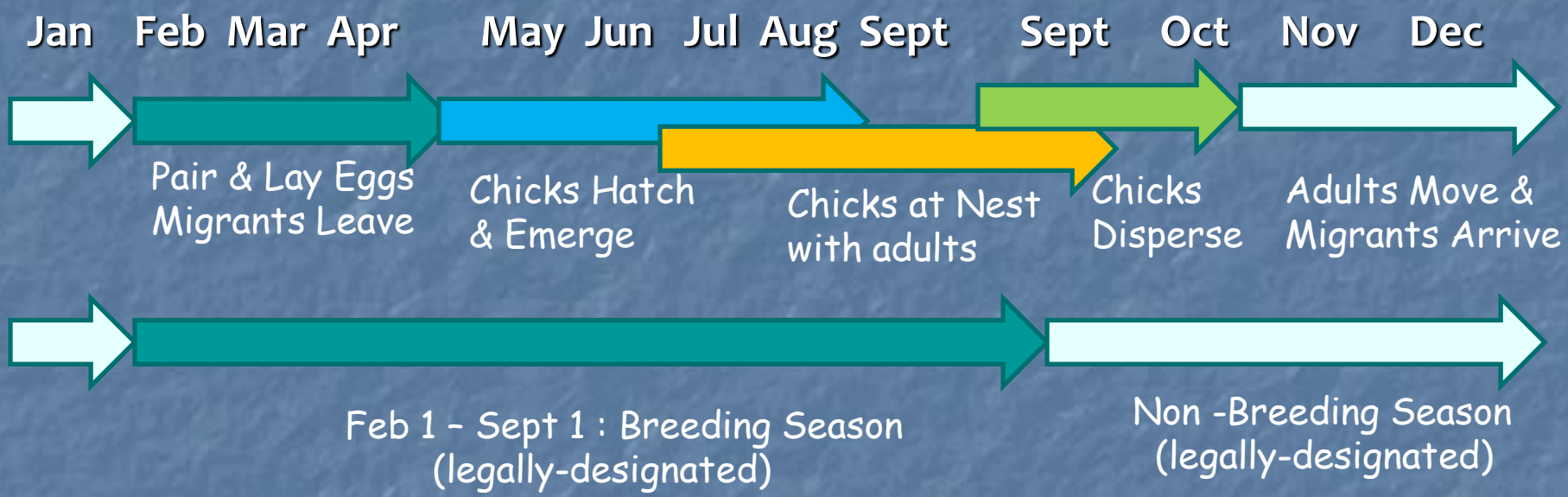
Chicks stay below ground for several weeks

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



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

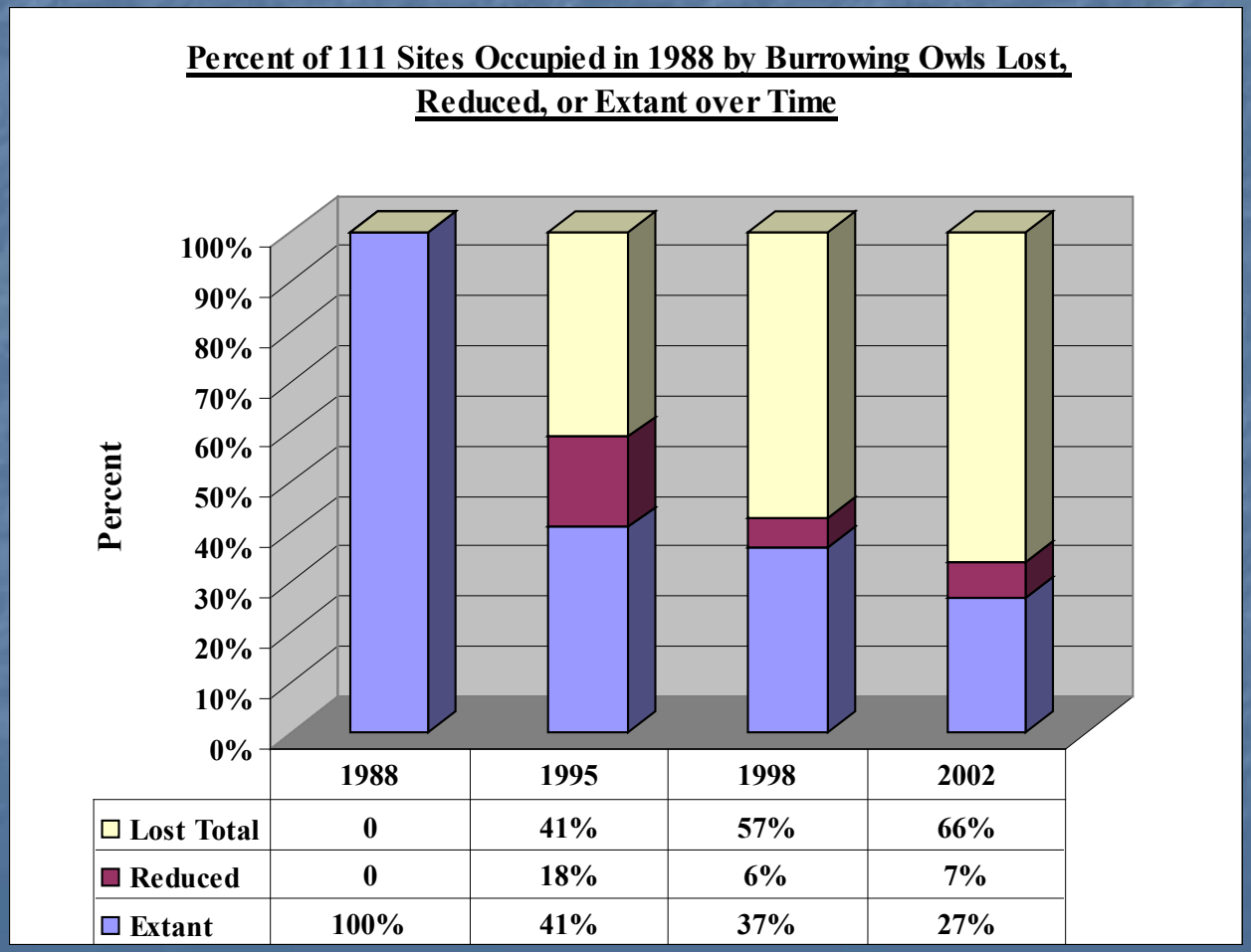
Status

- 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



	1988	1995	1998	2002
Lost Total	0	41%	57%	66%
Reduced	0	18%	6%	7%
Extant	100%	41%	37%	27%

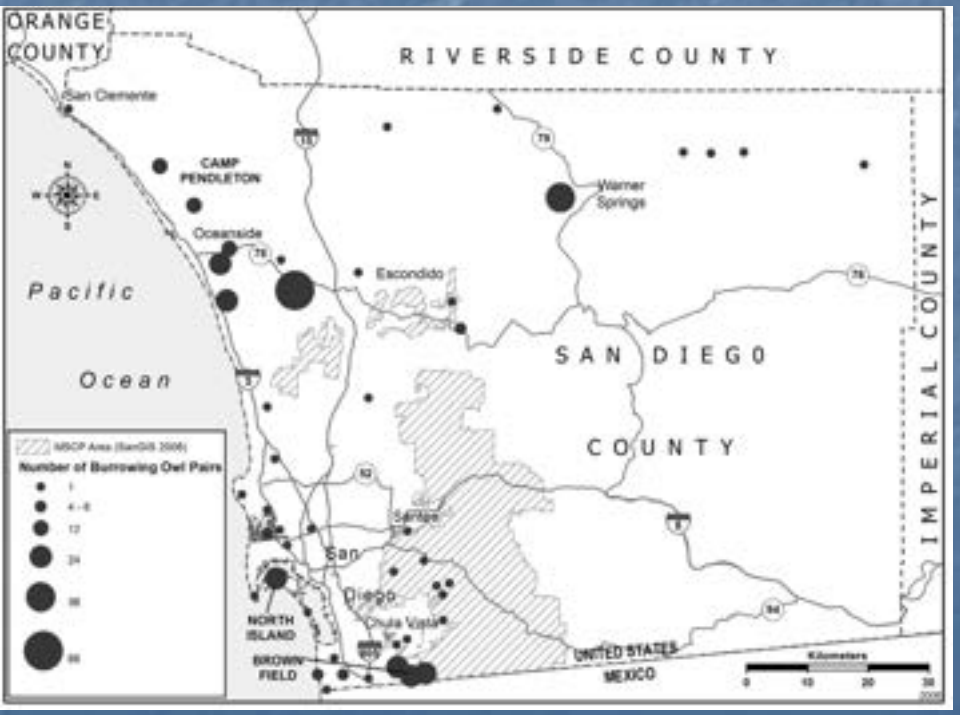
Between 1988 and 2002, 66% of locations lost

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

Example: San Diego County Status

- Population Status
  - 1970s/1980s, ~250-300 pr
  - 2003, 25-30 pr

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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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

Sustainble Energy Sources

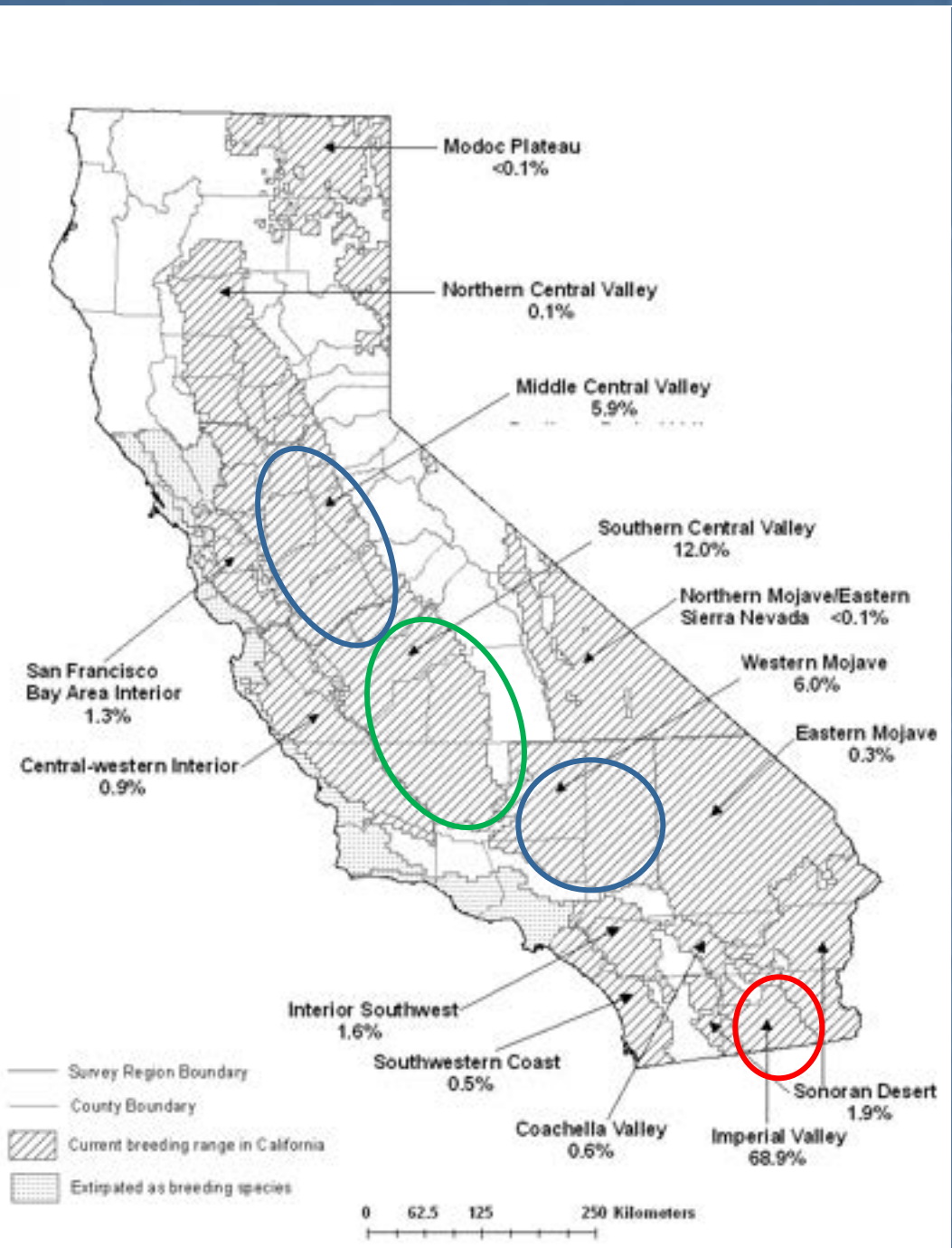
- Wind turbines – Significant source of local BUOW mortality; Altamont pass; See:
  - Smallwood, K.S., L. Neher, and D.A. Bell. 2009. Map-based repowering and reorganization of a wind resource area to minimize burrowing owl and other bird fatalities. *Energies* 2:915-943.

- 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 (HCP)
- State: California Fish and Wildlife Code Section 3503.5 - prohibits the taking, possession or destruction of birds of prey, their nests or eggs. Impacts to burrowing owls during the breeding season (February 1 to August 31) violate this code, unless approved by the CDFW.

Regulatory Framework

- State: ESA – California Species of Special Concern
- State: Natural Community Conservation Planning Act (NCCP) - 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

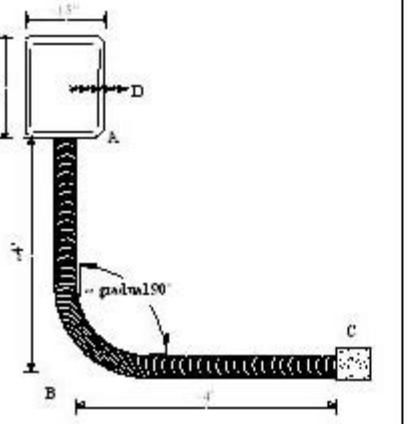
Landscape - a Factor in Mitigation Methods

On-site: Quality breeding habitat? Enough foraging habitat in the landscape?

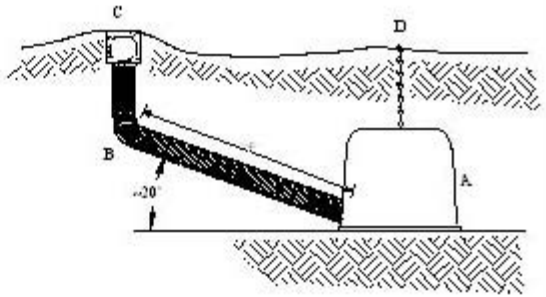
Passive relocation: Adequate, near-by, quality habitat?

Both: Ability to disperse between populations? Longevity of site? Expected land use change?

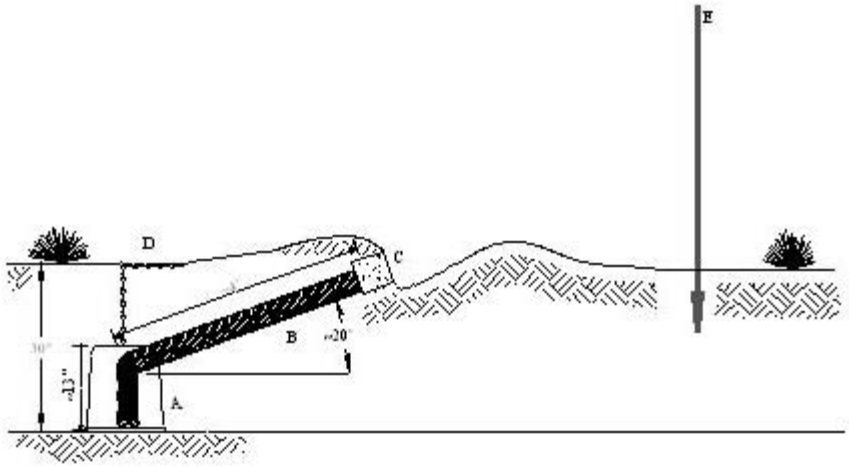
Artificial Burrows



TOP VIEW



FRONT VIEW



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?

Maintain owls and habitat in place
Passive relocation when approved
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

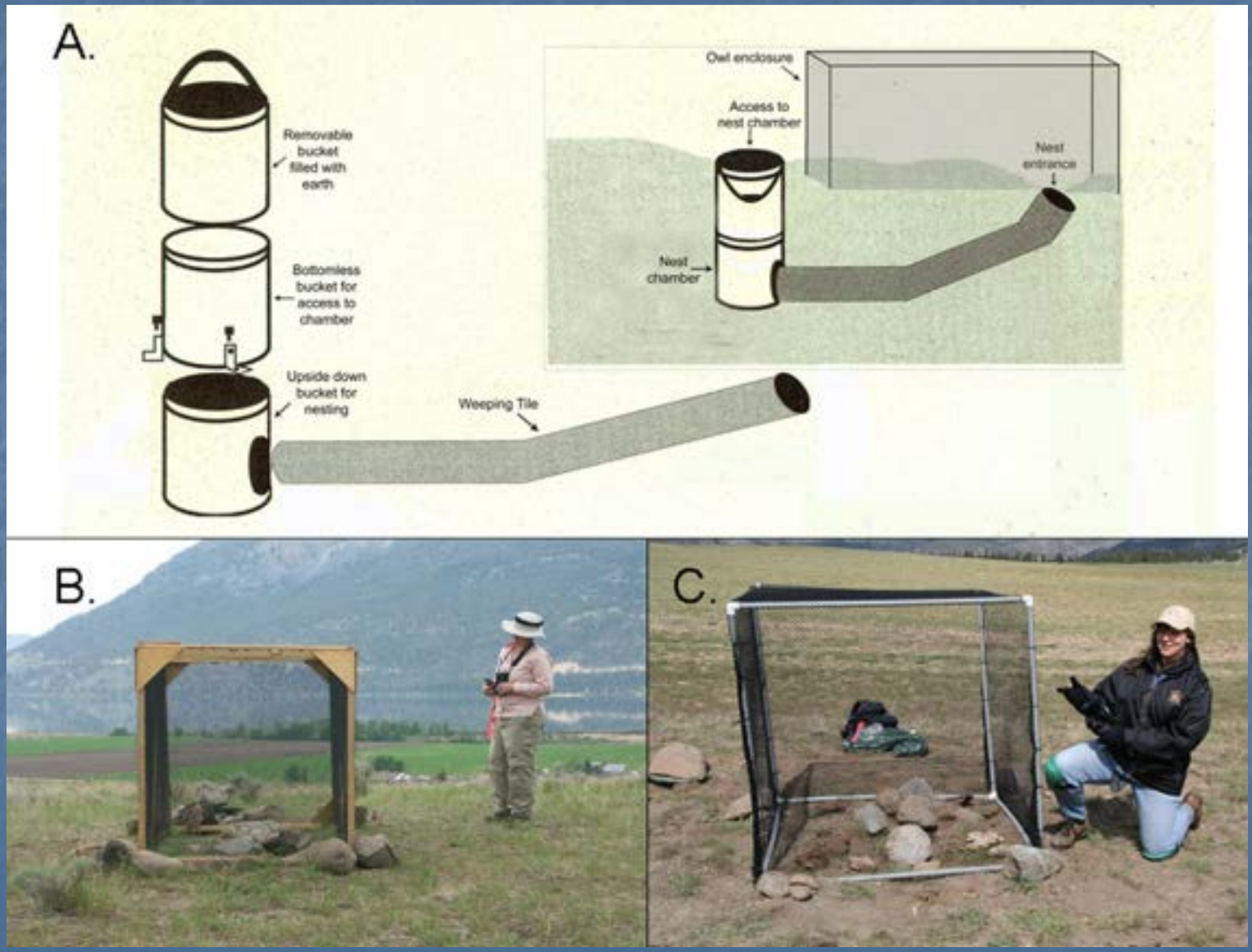
Translocation is difficult

- 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-month old 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

Methods with Greater Success

- **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

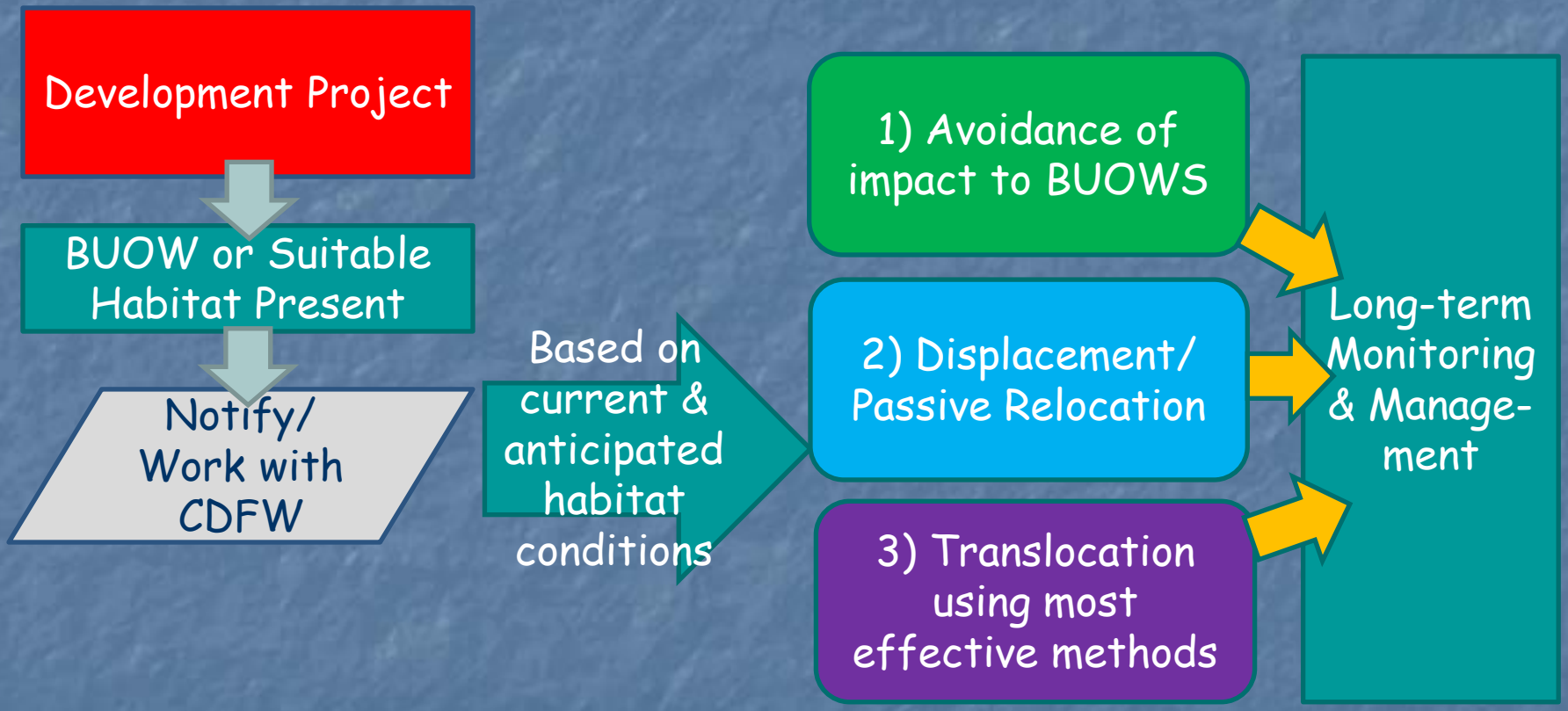
Recent research by Hennessy, et al. (2022):

- 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)



Hennessy, S.M., C.L. Wisinski, N.A. Ronan, C.J. Gregory, R.R. Swaisgood and L.A. Nordstrom. 2022. Release strategies and ecological factors influence mitigation translocation outcomes for burrowing owls: a comparative evaluation. *Animal Conservation* doi:10.1111/acv.12767

Some final notes on Tranlocation

- Expensive
- Time-consuming
- Labor-intensive
- Specialized materials/equipment
- BUOW experts
- Easy to do wrong
- EXPENSIVE
- But, may be appropriate, in some cases, for BUOW conservation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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

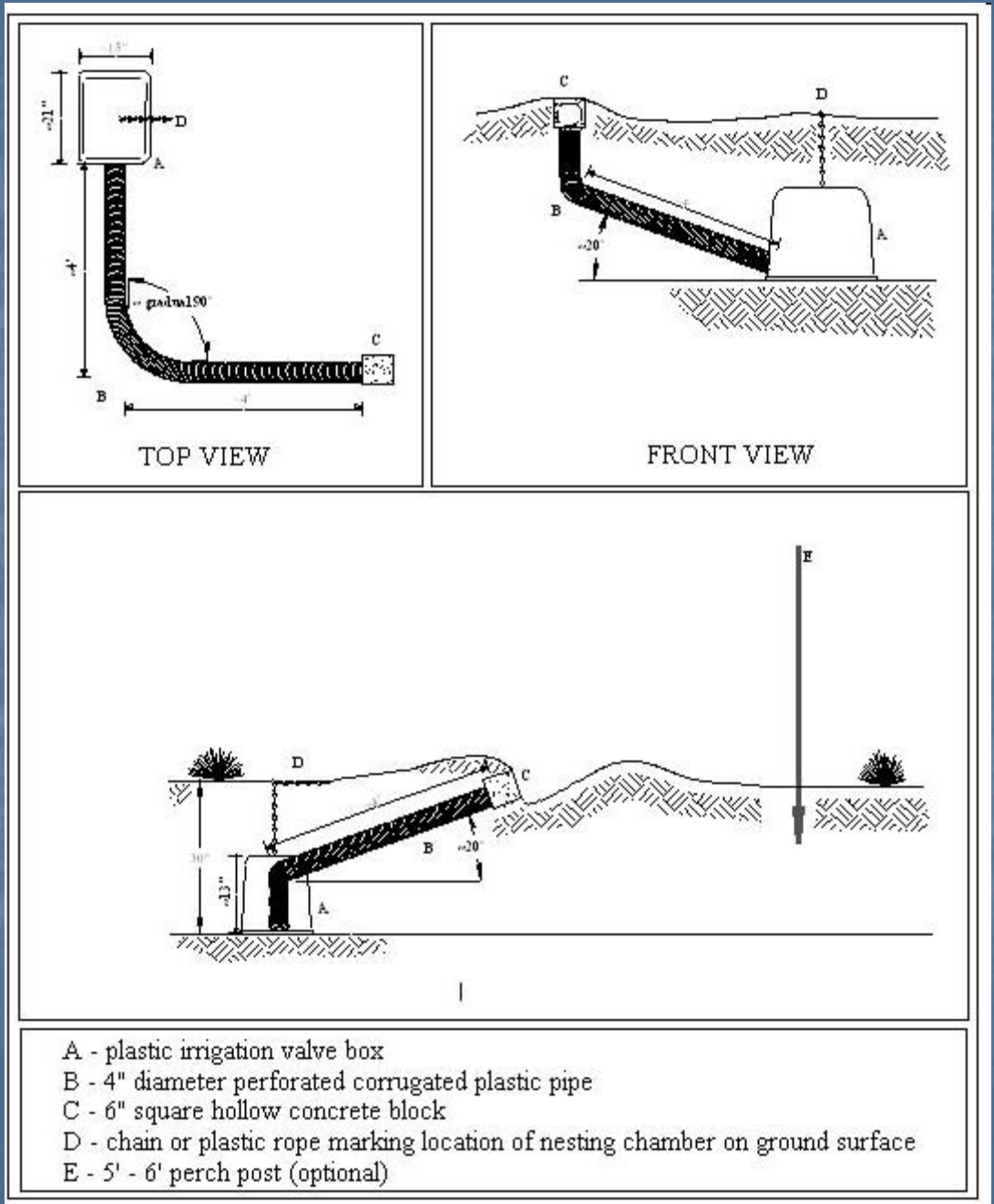
How to Manage Habitat to Preserve Burrowing Owls

- 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

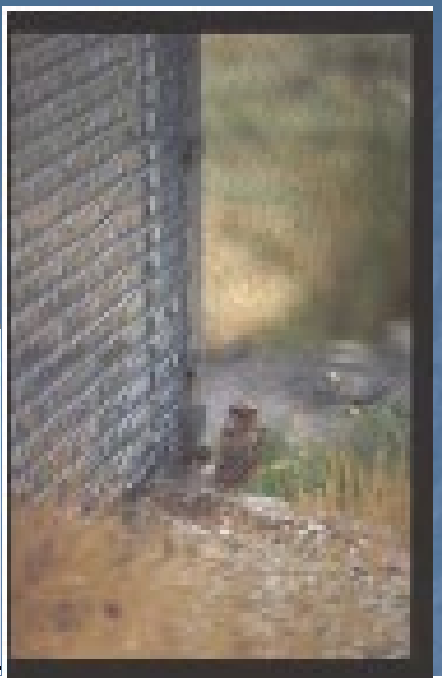
- Open grassland habitat, few to no trees or other obvious raptor-perching sites
- As large as possible – viable site size will vary depending habitat quality and qualities of the surrounding landscape
- Healthy, breeding ground squirrel population
- Lots of burrows
- Short grass (<6”) around burrows
- 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

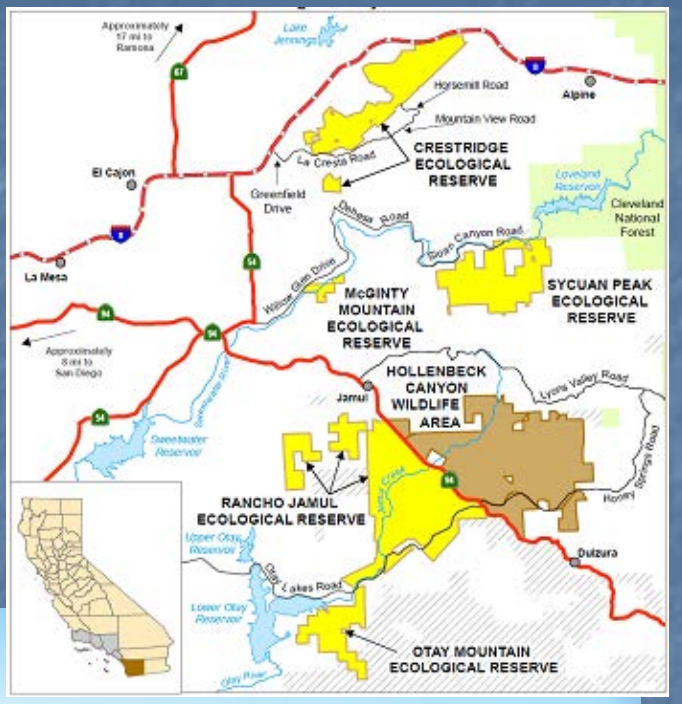
- Sites with the best chance of *attracting* nesting burrowing owls:
  - Add to adjacent, owl-occupied nesting habitat or within 300m of occupied habitat
  - Nesting owls recently on the site
  - Relatively large (~30-140 acres/owl pair??)
  - Not fragmented with roads or paths
  - Low elevation and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

Keeping breeding BUOWs in San Diego County

- Mitigation translocation
- Captive breeding
- Establishing new breeding colonies
  - Habitat management
  - Ground squirrels



…and in Santa Clara County

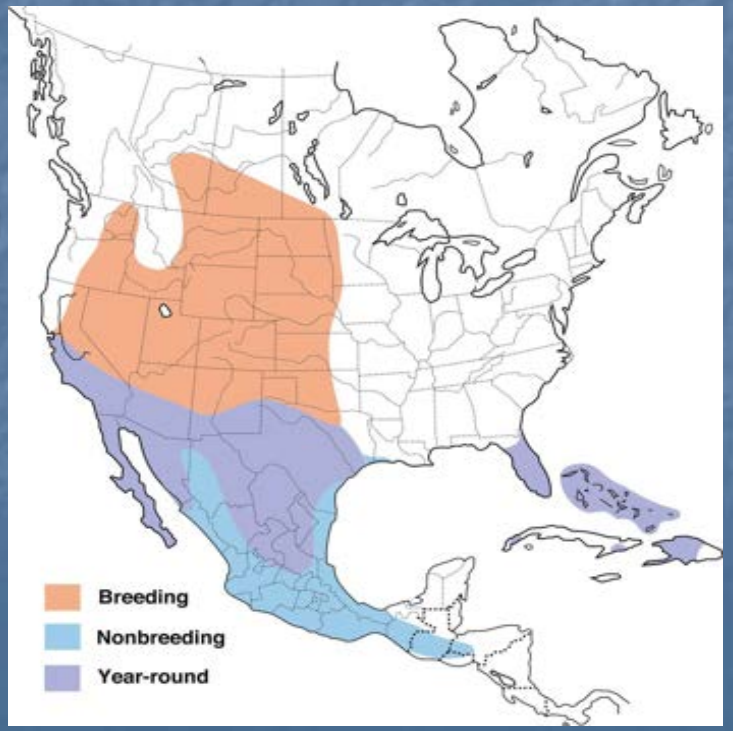
- Head- starting juveniles
- Captive breeding
- Establishing new breeding colonies
  - Land-owner support
  - Land management
  - Ground squirrels

Need to consider the big issues

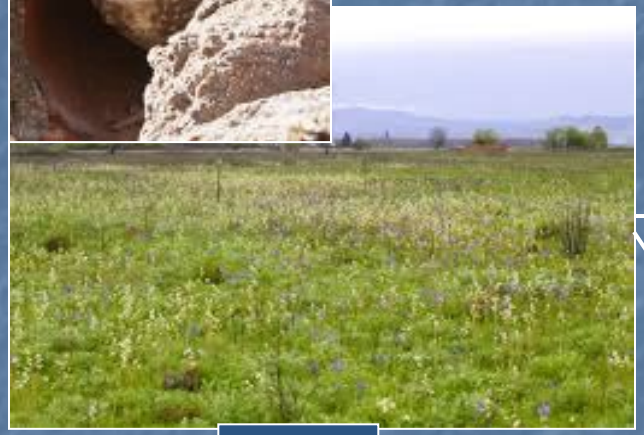
- How will climate change affect burrowing owl populations?

National Audubon Climate Report: "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…" (http://climate.audubon.org/birds/burowl/burrowing-owl)

- And what about the intersection of human activities, urbanization & climate change?
- California - the edge of the species distribution



Our Challenge



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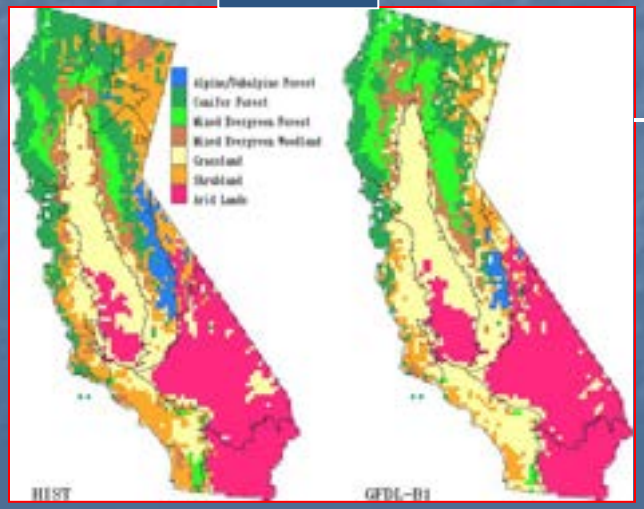

Develop Local & Regional Plans

Protect & Enhance & Manage Current Habitat

Identify Future Owl Habitat

Predict
Protect
Enhance
(Manage)
Attract

Provide conditions for owls to persist

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

9-11am & 11:30-1:30pm

- 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. (Near 150 Nortech)