

LINKING RAVEN DEMOGRAPHY & BEHAVIOR ACROSS ECOSYSTEMS

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Raven Workshop
November 1, 2016

TOPICS

1. Space use differs by social class
 2. Resource use → survival & reproduction
 3. Predatory behavior
- Radio-tracking studies:
 - CA - western Mojave
 - Nonbreeders
 - WA State – Olympic Peninsula
 - Breeding & nonbreeding ravens
 - Interpret for desert tortoise conservation

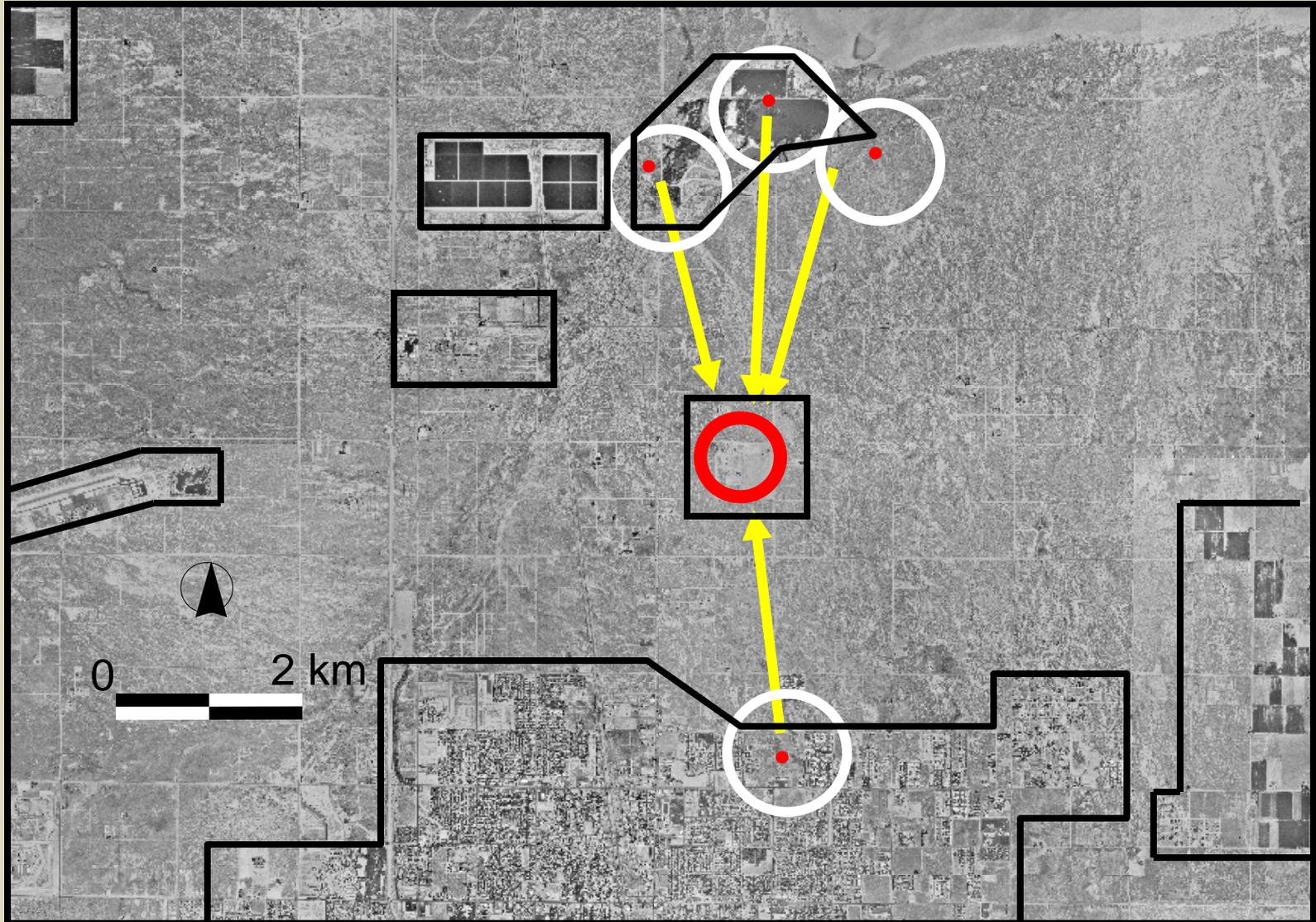


RESOURCES FOR RAVENS

- Anything that attracts ravens:
 - Sources of food and/or water
 - Other ravens
 - Land cover types
 - Land use types
 - Configuration of land cover / use

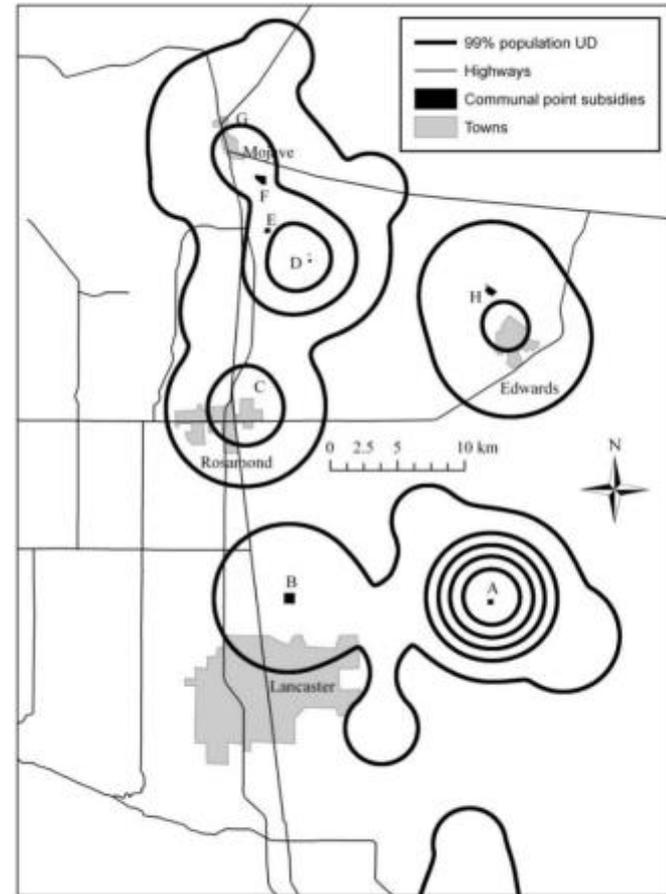
1. MOVEMENTS & SPACE USE

JUVENILES DO NOT DISPERSE TO NEAREST FOOD OR WATER SOURCE



NONBREEDERS CONCENTRATE AT COMMUNAL POINT SUBSIDIES (CA)

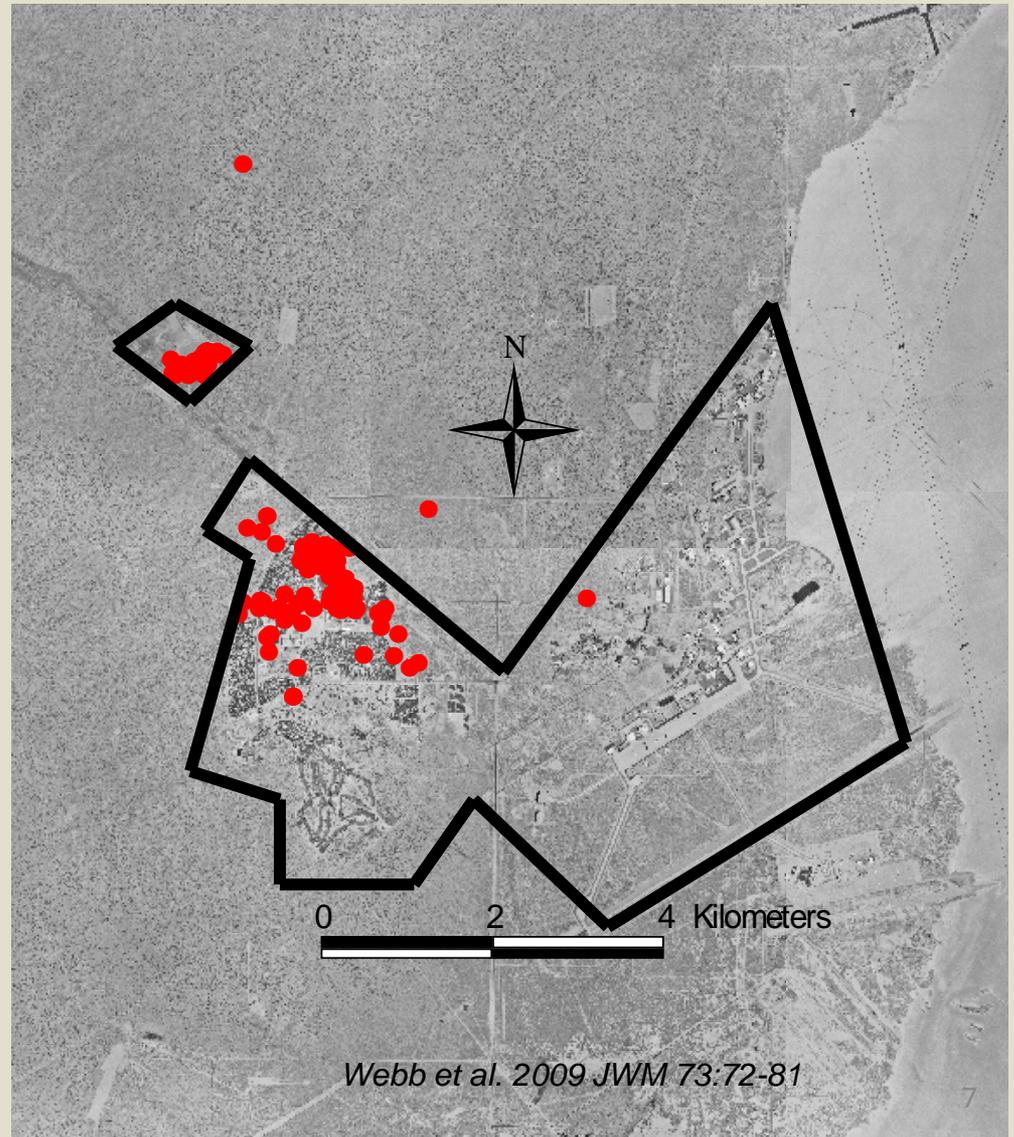
- Permanent, continually-renewed rich sources of food &/or water:
 - Landfills
 - Sewage ponds
 - Dairies
 - Hobby farms



Webb et al. 2009 JWM 73:72-81

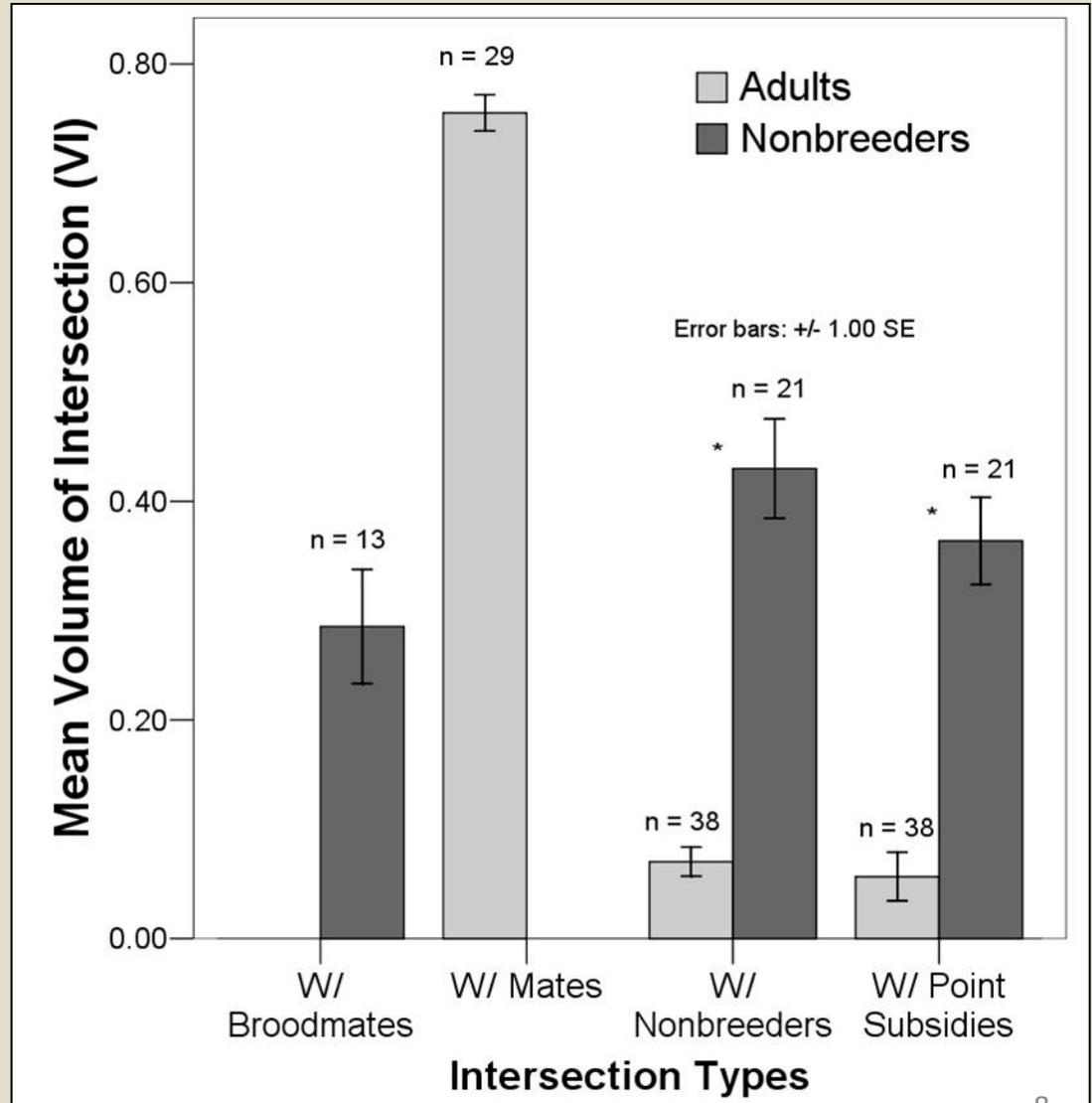
NONBREEDERS USE ANTHROPOGENIC HABITAT(CA)

- > 1400 locations for 81 juveniles & nonbreeders
- < 3% in “open desert” ($\chi^2 = 142, P \ll 0.01$)



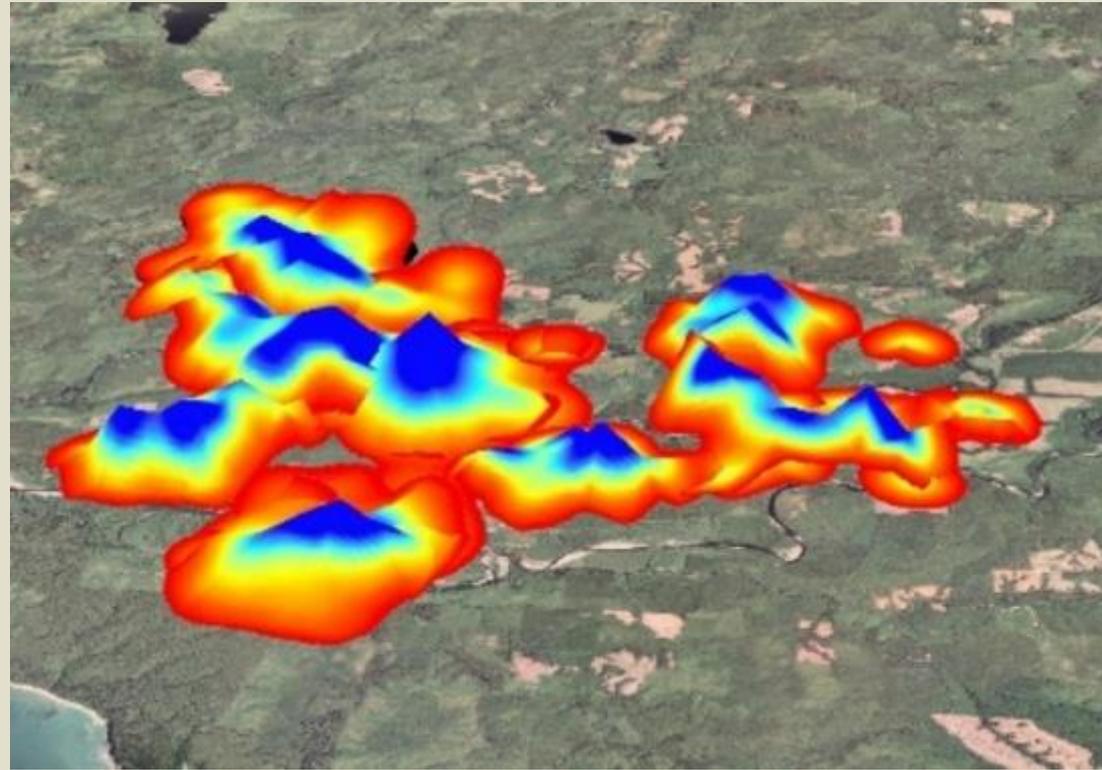
BREEDING RAVENS SHARE SPACE DIFFERENTLY THAN NONBREEDERS (WA)

- Breeding ravens:
 - Shared space with mates
 - Used point subsidies less
- Nonbreeders shared space with each other (42% overlap)

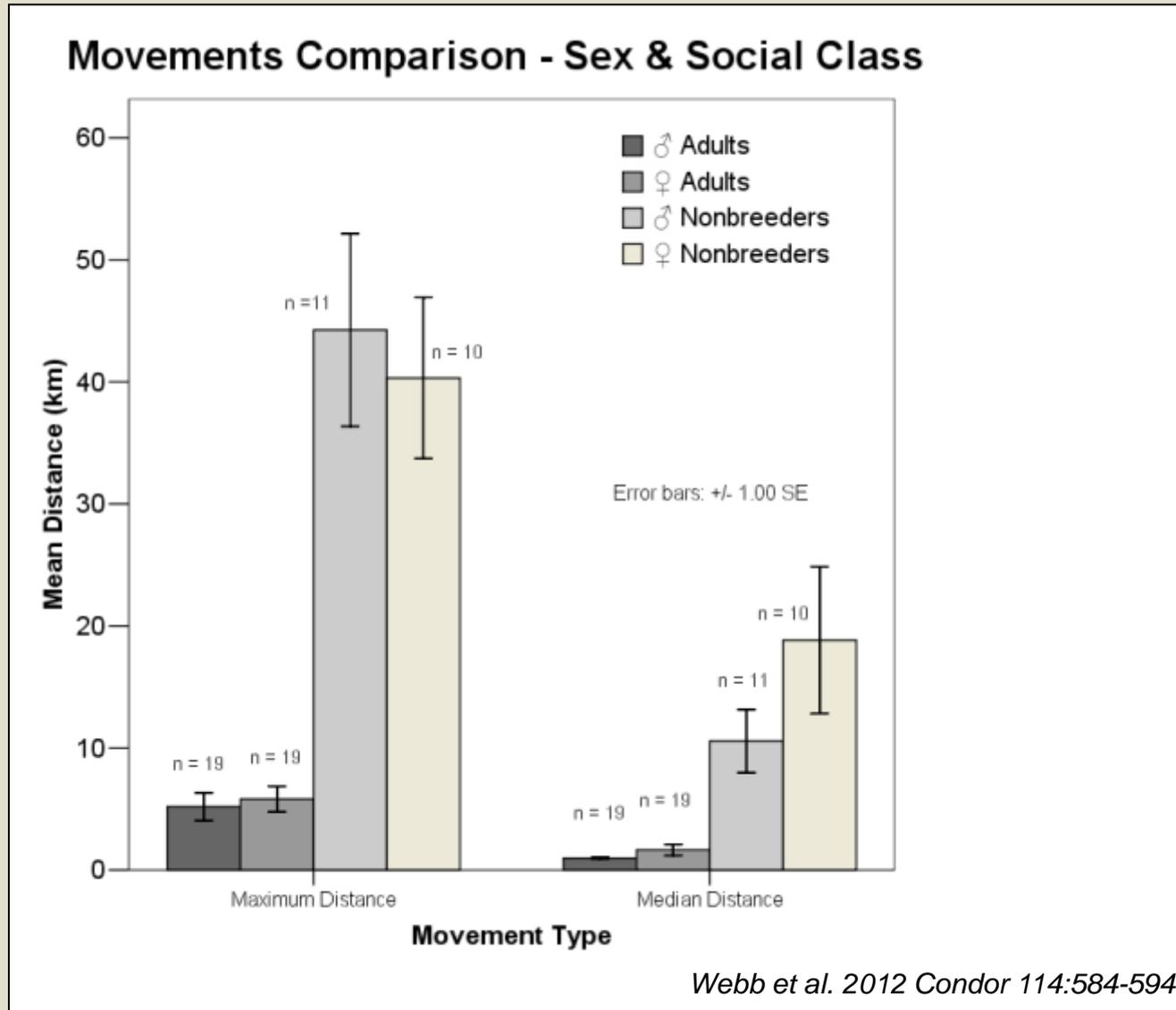


BREEDING RAVENS DEFEND TERRITORIES (WA)

- Each “pyramid” represents a UD
- Blue peaks = higher use
- 8% overlap between neighbors

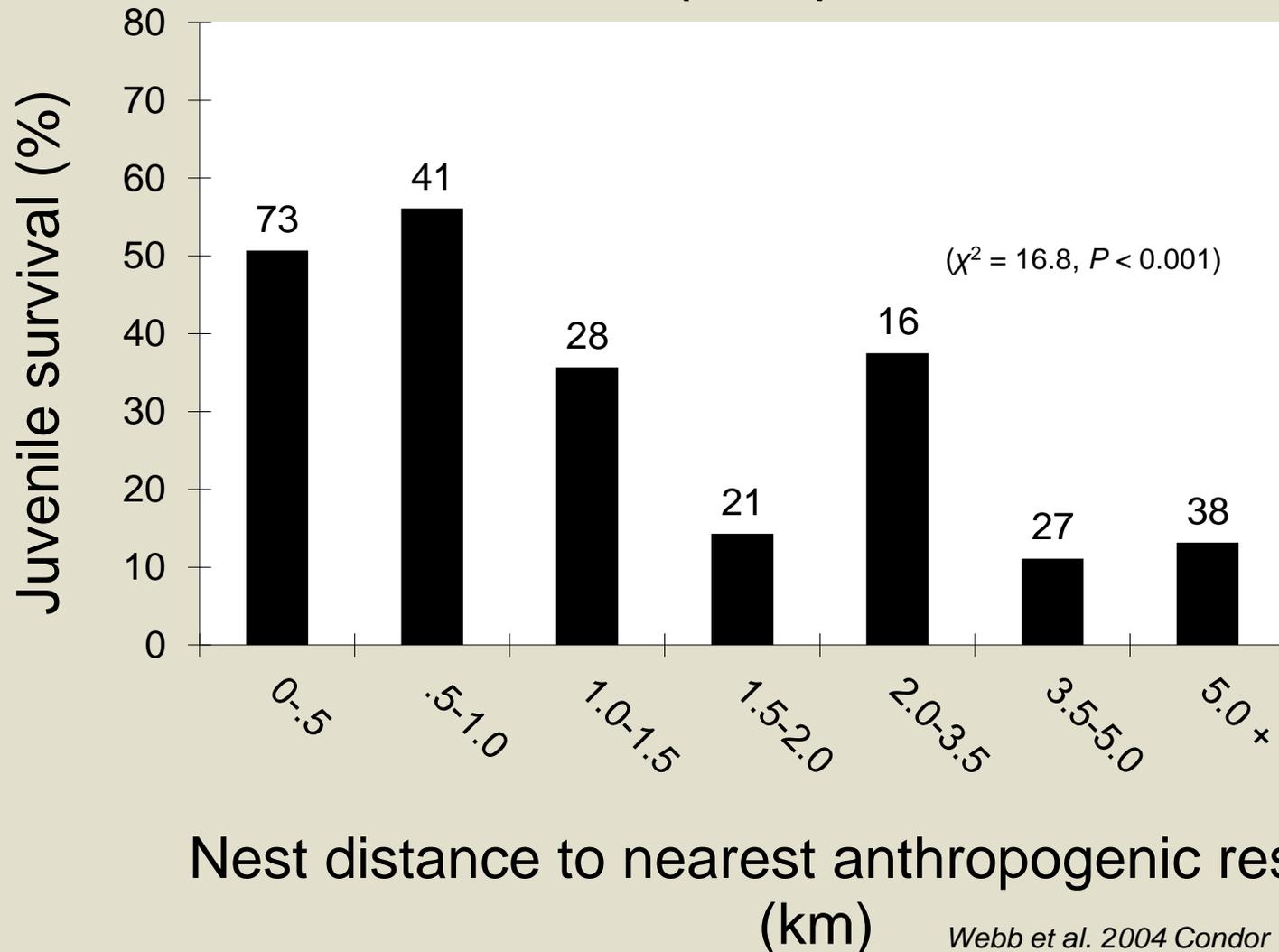


NONBREEDERS MOVE MORE THAN BREEDING RAVENS (WA)



2. RESOURCE USE & DEMOGRAPHIC EFFECTS

ANTHROPOGENIC RESOURCES INCREASE SURVIVAL TO DISPERSAL (CA)



ANTHROPOGENIC RESOURCES INCREASE NONBREEDER SURVIVAL

Year hatched | Lasting effect of nest location on survival

Time since fledging

Post-dispersal Survival Models ΔAIC

Cohort+ (9 months***Distance food/water**) 0.00

Cohort+ (12 months***Distance food/water**) 2.84

Cohort+ (15 months***Distance food/water**) 6.24

Cohort+ (18 months***Distance food/water**) 7.64

Nest proximity to anthropogenic resources
increased survival for ~ 9 months post-dispersal

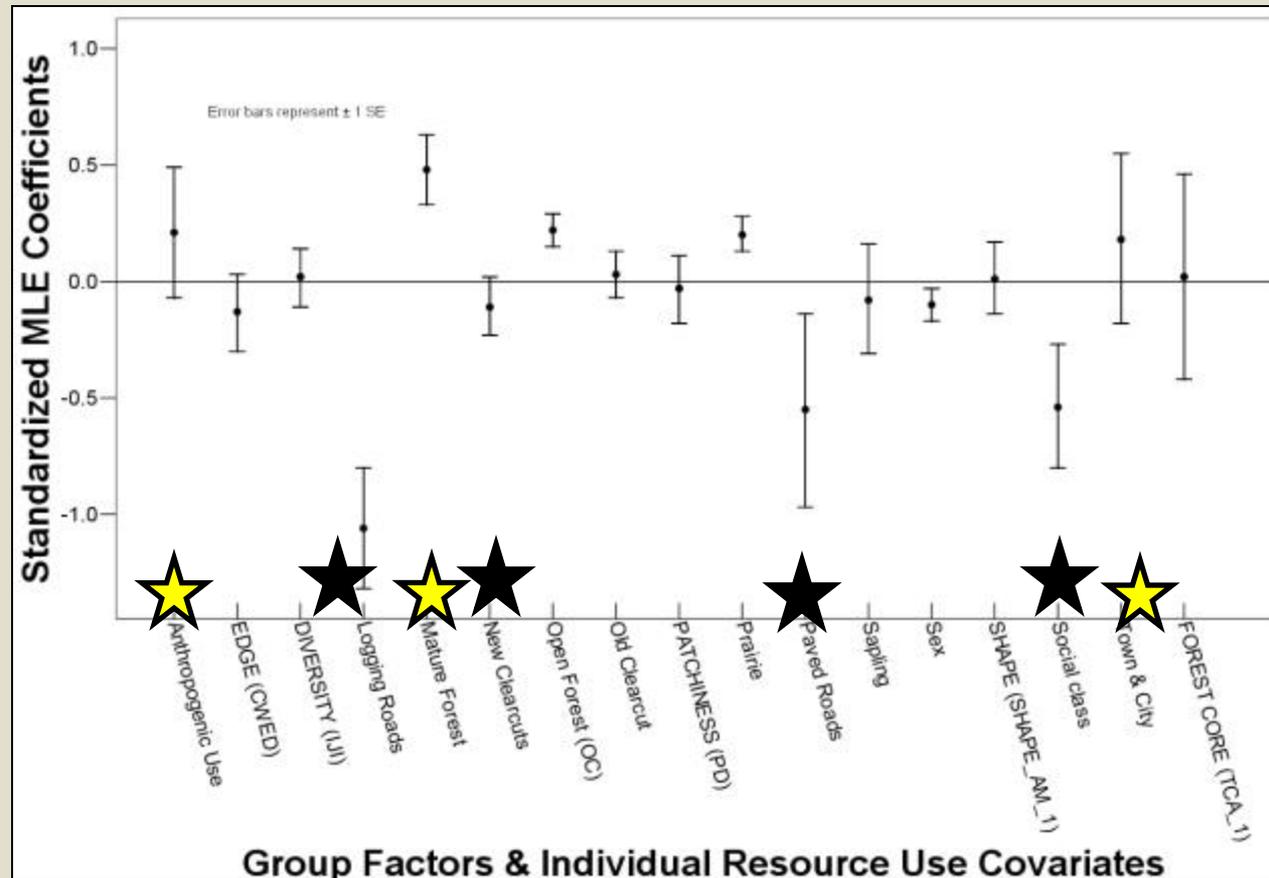
SURVIVAL OF BREEDING & NONBREEDING RAVENS (WA)

+ Association: ★

- Anthropogenic
- Mature Forest
- Towns & Cities

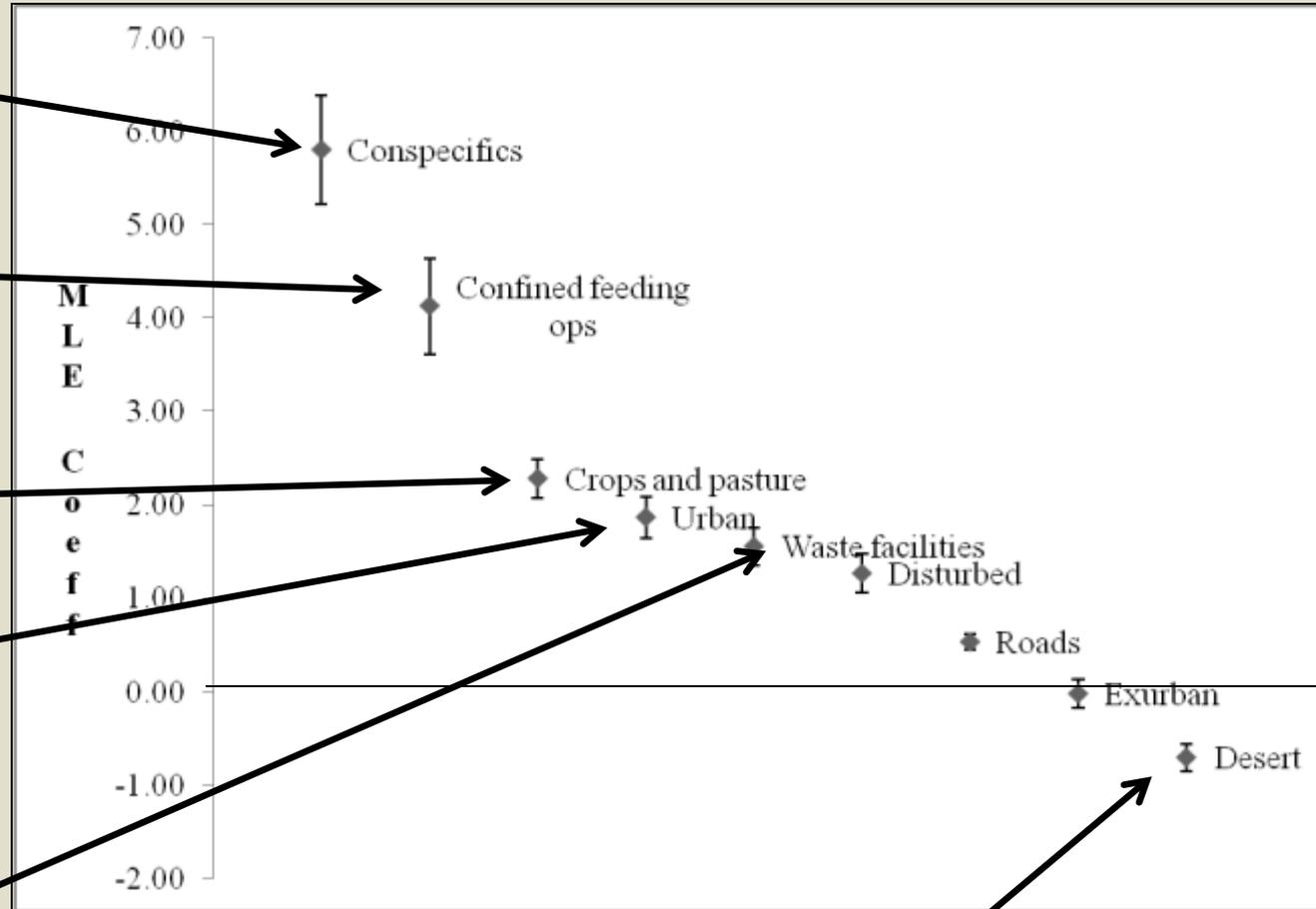
- Association: ★

- Logging Roads
- New Clearcuts
- Paved Roads
- Nonbreeder class



WHAT RESOURCES DO NONBREEDERS USE IN THE MOJAVE?

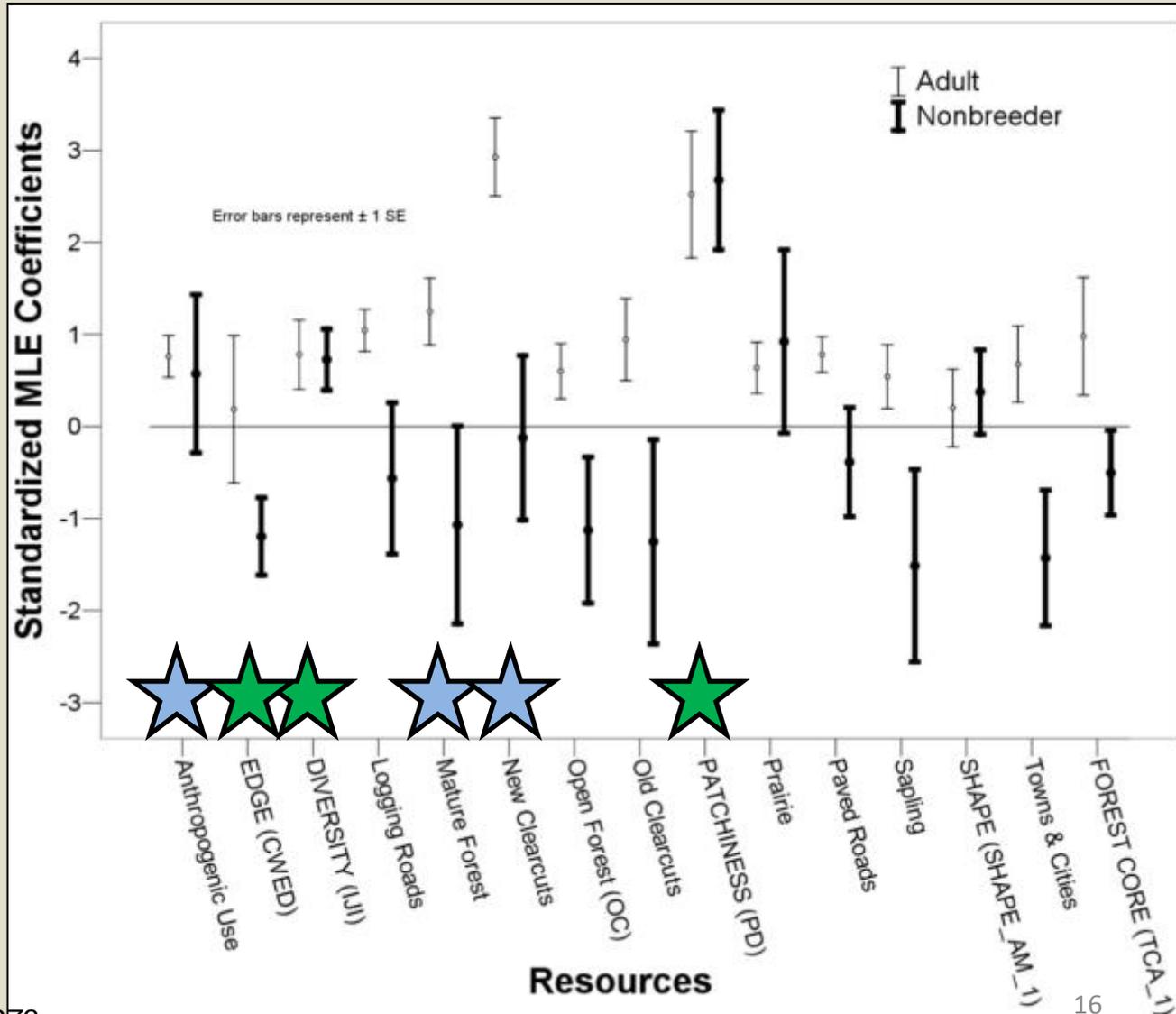
- Each other!
- Dairies & hobby farms
- Agriculture
- Towns
- Landfills & sewage ponds



Nonbreeders rarely use desert

BREEDING & NONBREEDING RAVENS USE DIFFERENT RESOURCES (WA)

- 9 resources important to breeding  raven (*t*-tests, $n=38$, all $P < 0.05$)
- Nonbreeders avoided edges but  used patches & diverse habitat (*t*-tests, $n=21$, all $P < 0.05$)



RESOURCE USE AFFECTS BREEDING SUCCESS (WA)

- Adults using diverse & patchy habitat fledged fewer young ($|J|, B = -0.40, P = 0.04$; PD, $B = -0.39, P = 0.04$)
- Adults using new clearcuts fledged more young ($B = 0.77 P < 0.01$)
 - New clearcuts & roads negatively associated with survival



3. RAVEN PREDATORY BEHAVIOR

WHAT INFLUENCES NEST PREDATION BY RAVENS? (WA)



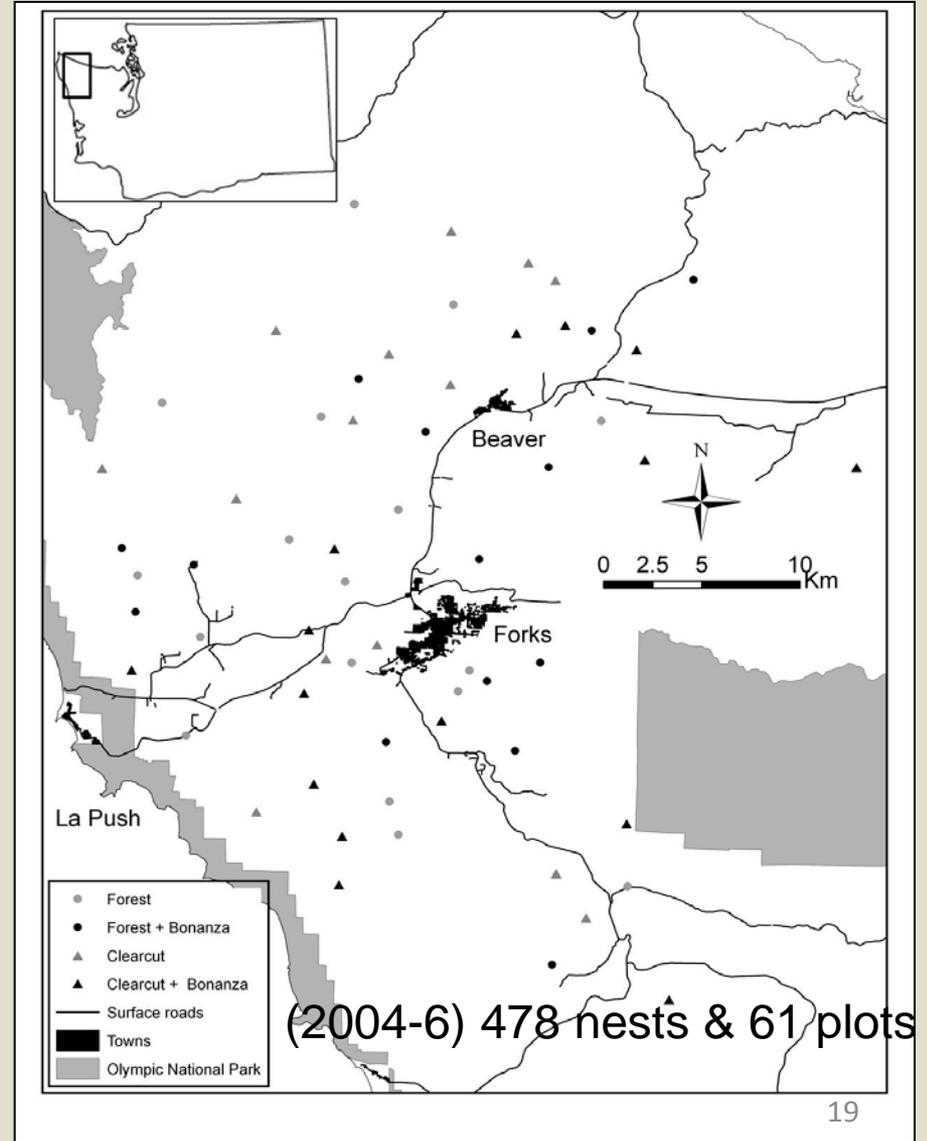
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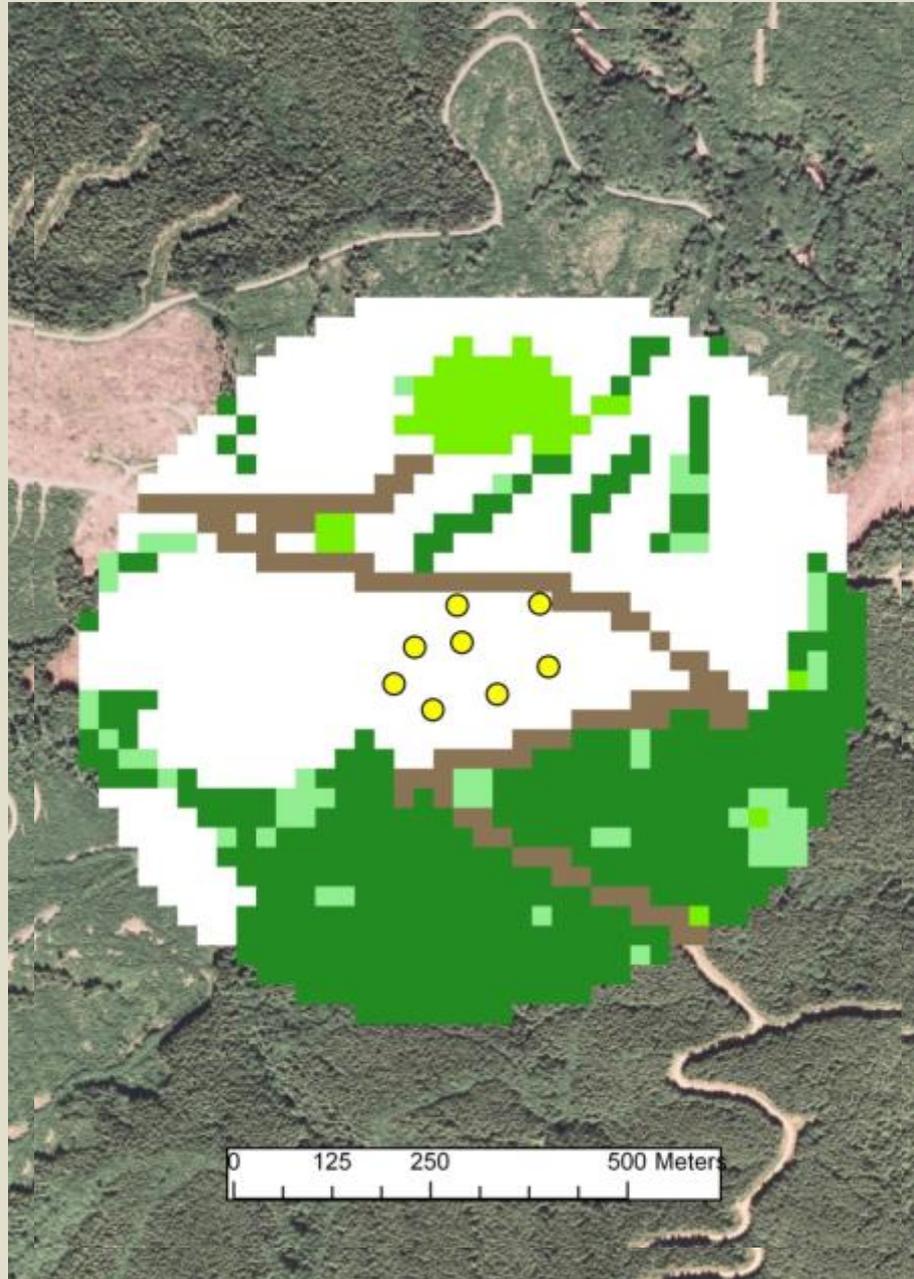


= ~ 40 KG



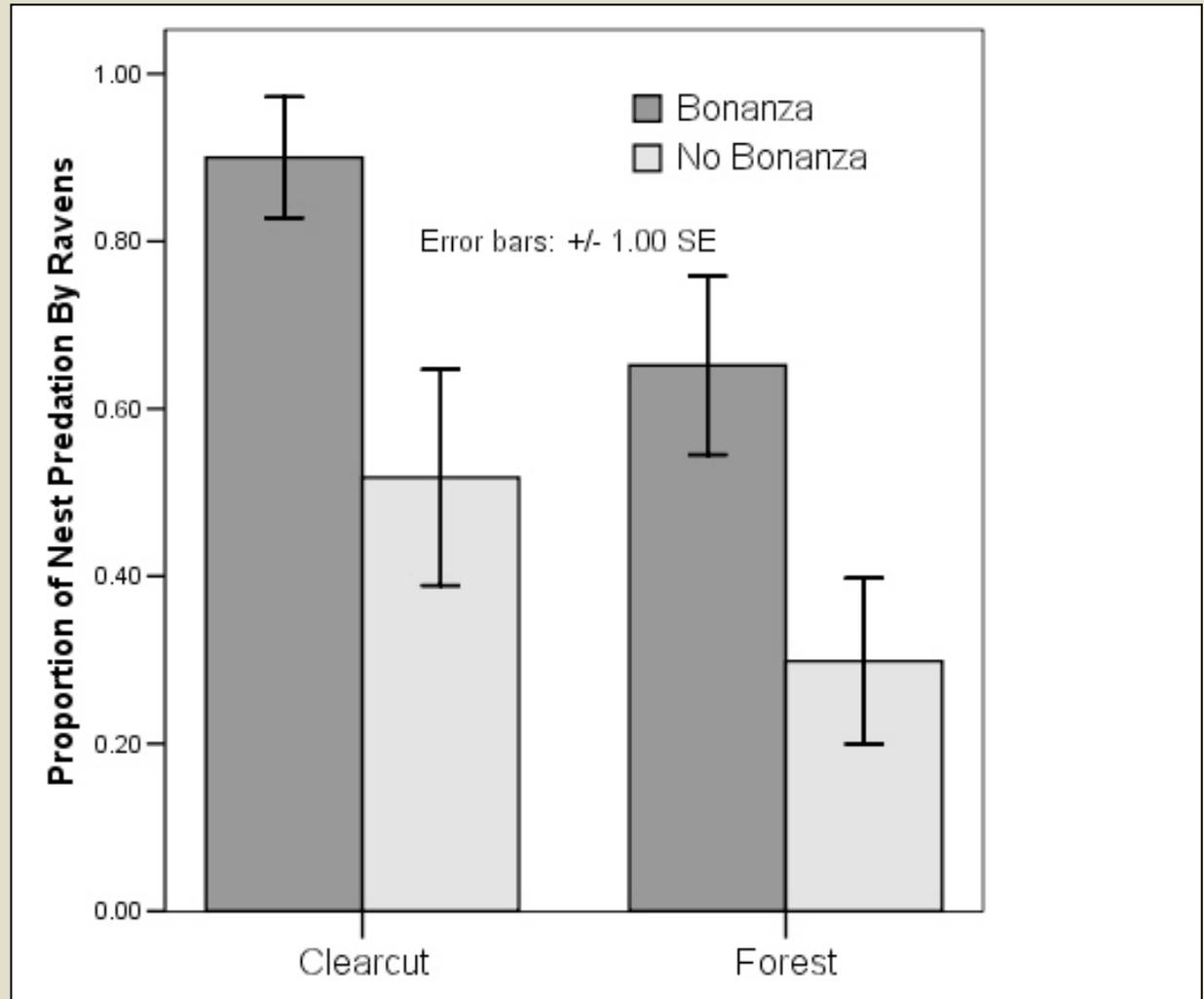
NEST SURVIVAL

- Predictor variables:
 - Indices of landscape structure 100, 200, 300 & 400m scales
 - Plot type
 - Bonanza?
 - Abundance



CLEARCUTS & BONANZAS INCREASE NEST PREDATION

- Ravens depredated more nests in clearcuts & bonanza plots



OTHER FACTORS ASSOCIATED WITH NEST PREDATION BY RAVENS

- Raven abundance
- Clearcut-related landscape indices
- Mature forest associated with less predation at smaller spatial scales (plot & 100m)



SOME KEY RESULTS

- Space use & resource use differ between breeding ravens & nonbreeders
- Nonbreeders rarely use desert (tortoise habitat)
- Not all anthropogenic resources associated with increased survival & reproduction (e.g. roads in WA)
- Increased raven predation associated with:
 - Food bonanzas/point subsidies
 - Abundance of ravens

REGIONAL RISKS TO DESERT TORTOISE

- (Some) anthropogenic resources increase raven survival & reproduction



- Leads to increased raven abundance



- Increased risk of predation

LOCAL RISKS TO DESERT TORTOISE

- Nonbreeders are unlikely tortoise predators
 - Rarely use desert tortoise habitat
 - Unless a food bonanza / point subsidy occurs within tortoise habitat
- Breeding ravens nesting far from humans pose greatest risk to tortoises

INFORMATION GAPS

- Breeding ravens in desert tortoise habitat largely unstudied
- Two papers:
 - **Kristan et al. 2003**: Predation experiment
 - **Kristan et al. 2007**: Nesting biology
- Two unpublished sources:
 - **Sherman 1993**: Space use of breeding ravens
 - **Boarman et al. (*unpub*)**: Space use of ravens trapped at Edwards landfill

RAVENS BREEDING FAR FROM HUMANS SHOULD BE STUDIED

- How do particular resources influence survival & reproduction?
- To what extent do they use anthropogenic resources?
- Do they “commute” to distant point subsidies?
- Do they remain in their territories year-round?
 - Ravens breeding in some harsh environments migrate seasonally

RESEARCH APPROACHES

- Ecological studies are informative but time & resource-intensive

- Alternatives:
 1. Analyze existing space use data from landfill studies at Edwards Air Force Base

 2. Use population models to compare demographic effects of reducing subsidies

RECOMMENDATIONS - MANAGEMENT

- Reduce access to anthropogenic subsidies:
 - Food, water, & nesting sites
- Standardize methods for raven management
- Always conduct effectiveness monitoring to evaluate raven management

THANK YOU

- Tara Callaway
 - Peter Coates
 - John Marzluff
 - Bill Boarman
 - John Rotenberry
 - & many others for funding, logistics & field help
-
- PDF's of all papers available at:
<http://www.williamwebbsite.com/research.html>

