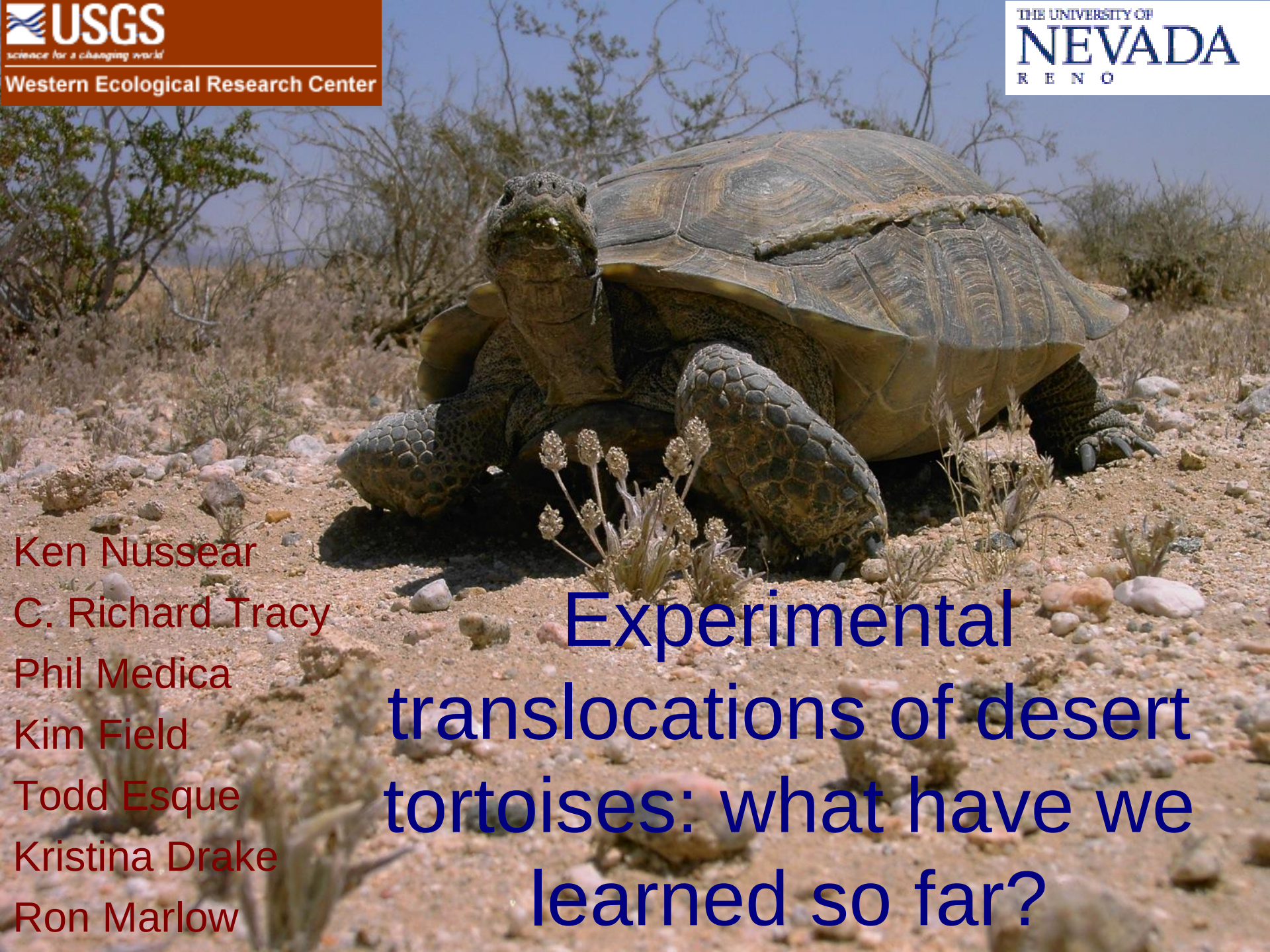

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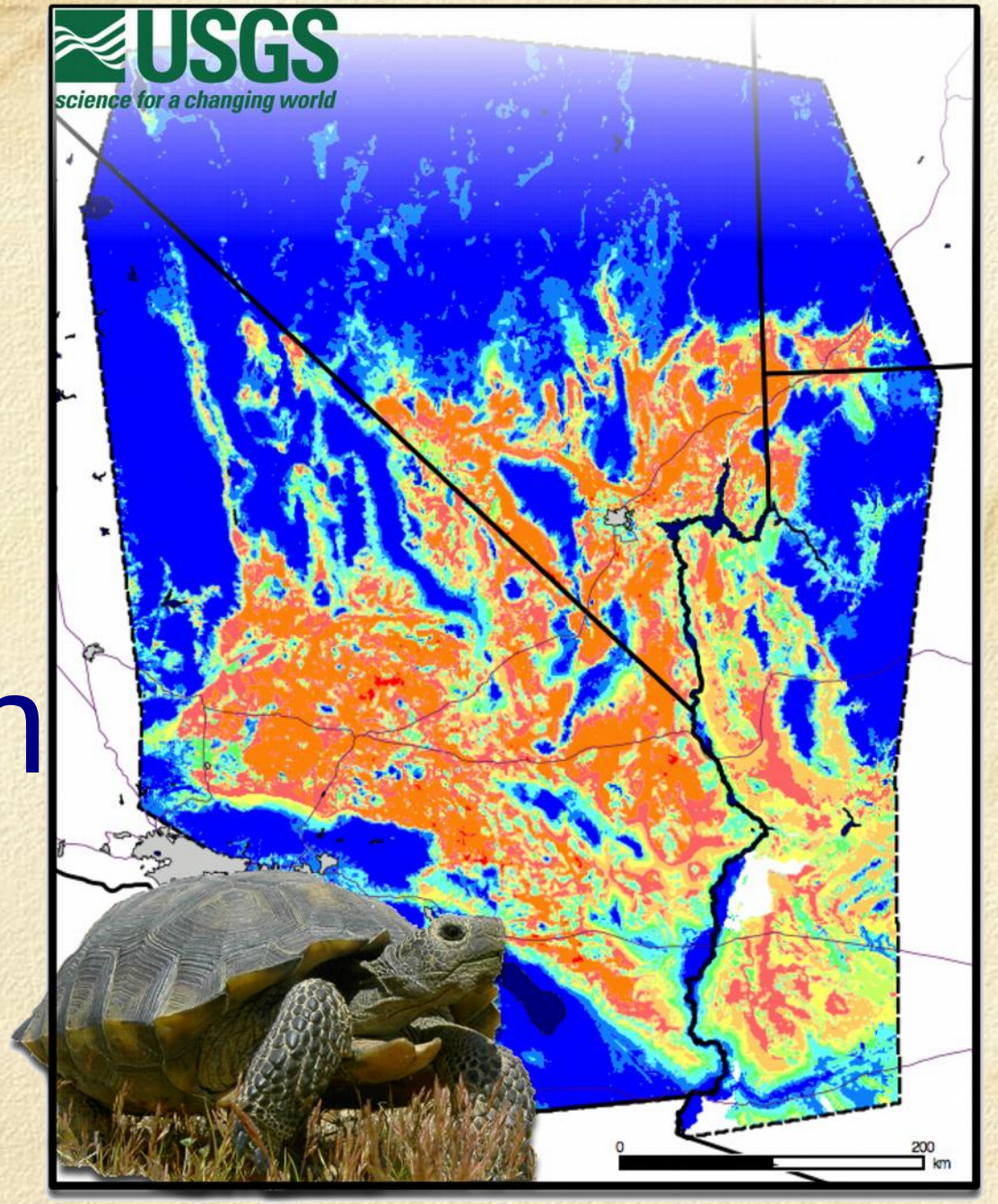
Western Ecological Research Center

THE UNIVERSITY OF NEVADA RENO

Experimental translocations of desert tortoises: what have we learned so far?

Ken Nussear
C. Richard Tracy
Phil Medica
Kim Field
Todd Esque
Kristina Drake
Ron Marlow

Desert Tortoise Distribution



Adapted from Nussear et al. 2009

Urban Growth

1963

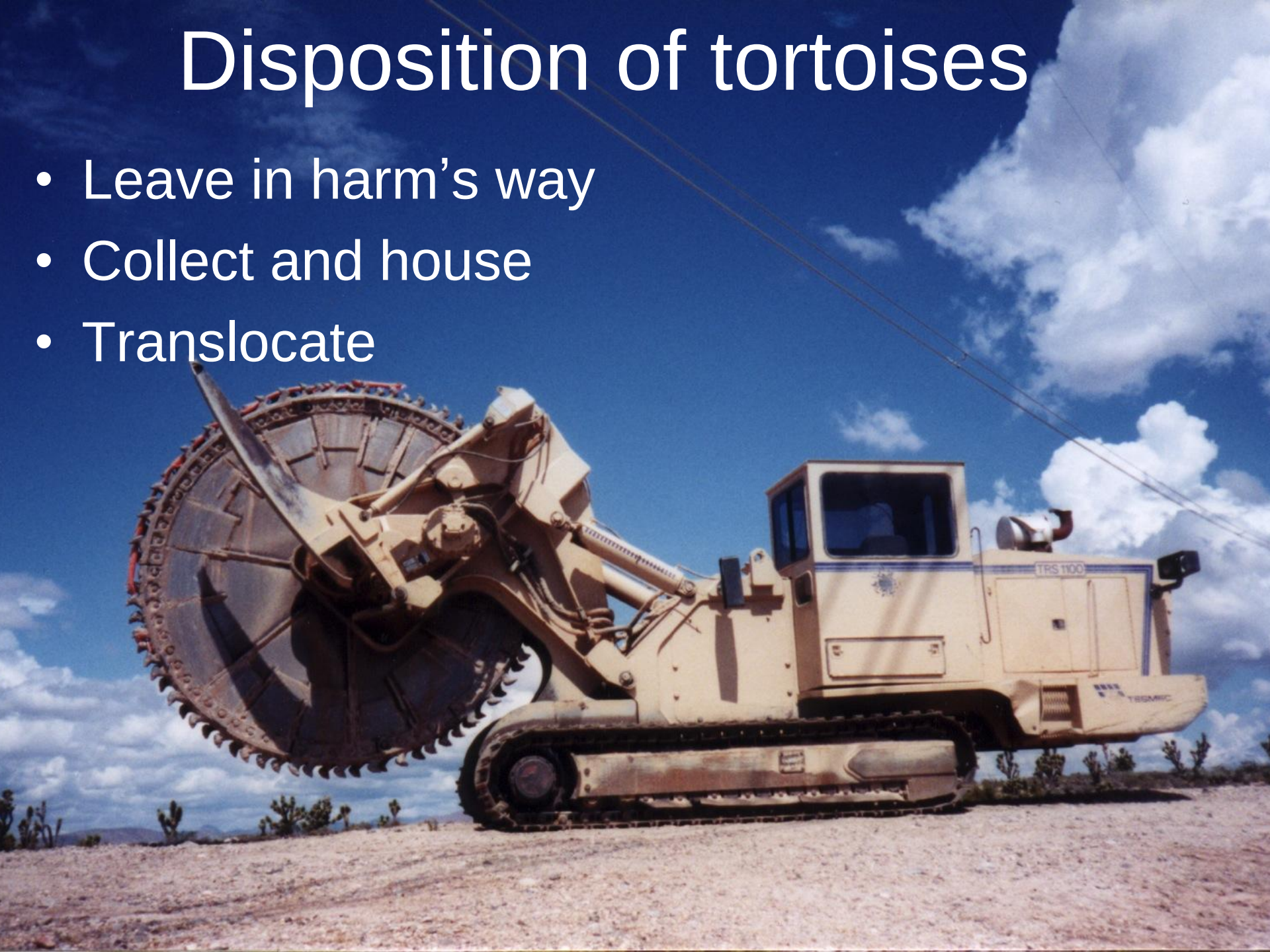

MGM
TROPICANA
LUXOR

Military Training Activities

Alternative Energy

Disposition of tortoises

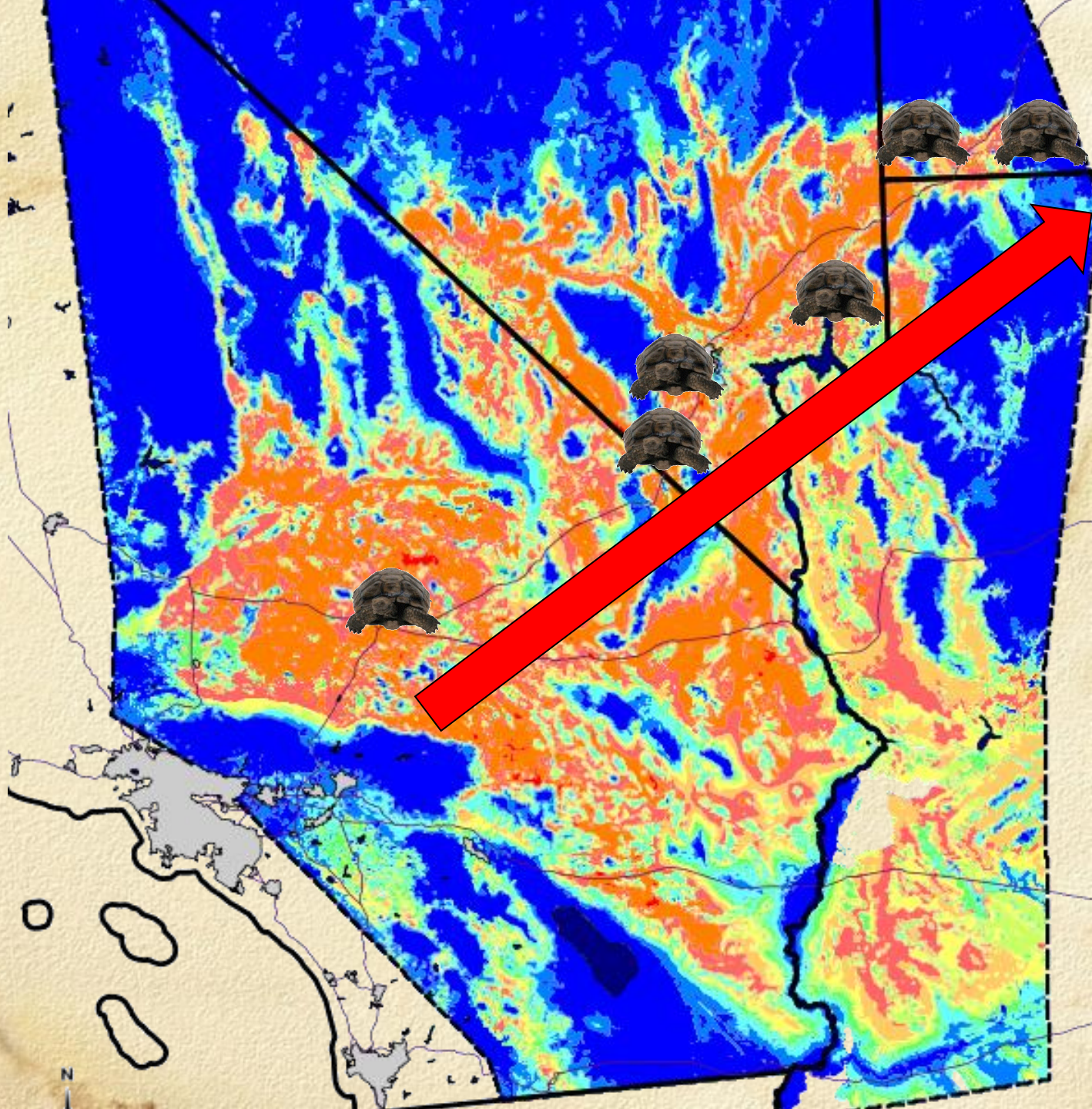
- Leave in harm's way
- Collect and house
- Translocate



Possible Consequences of Translocation

- Death
- Disruption of genetic structure
- Disruption of social structure
- Increased susceptibility to disease due to stress
- Introduction and transmission of disease
- Others….

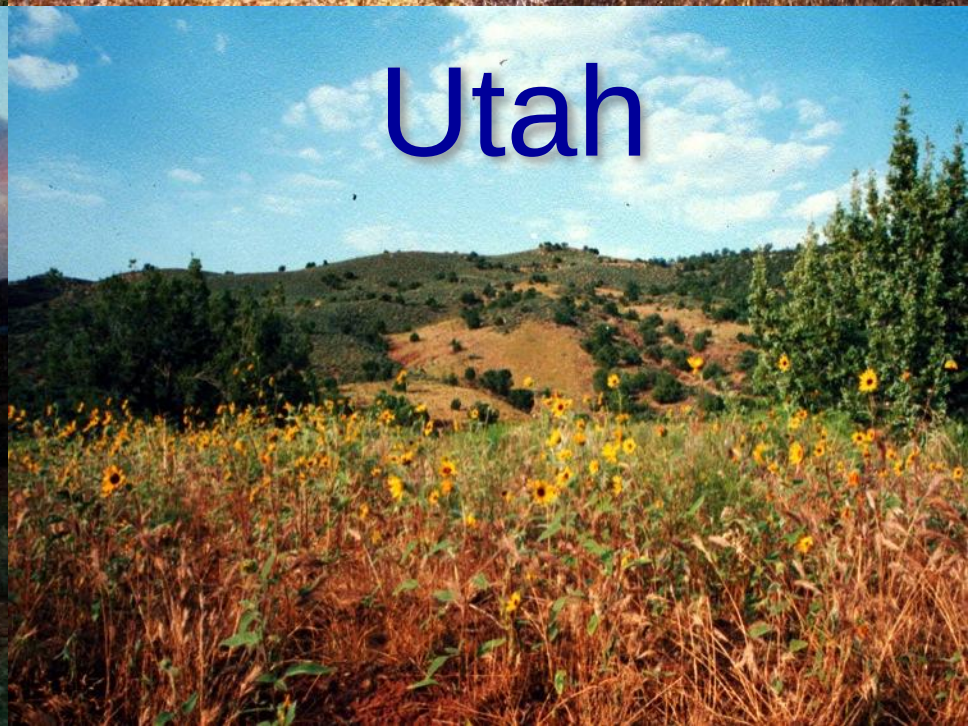
Study Sites




West
Mojave


Las Vegas


Lake Mead


Utah

How do we judge the success of translocation?

- Survival
- Reproduction
- Habitat use
- Movement
- Stress/Health
- Site colonization?

Relocated desert tortoises attacked by coyotes

Louis Sahagun, Los Angeles Times
Published 4:00 a.m., Sunday, May 18, 2008

VIEW: SMALLER | HIDE

1 of 2 ◄ PREV NEXT ►

Michael Maloney / The Chronicle

Desert tortoises like this one have been relocated by the Army to another part of the Mojave Desert to make room for training grounds. Photo: Michael Maloney, The Chronicle / SF


As the sun rose over the Mojave Desert, researcher Kristina Drake approached with caution as a creature with weary eyes, a scuffed carapace and

Photo Galleries 1-3 of 40 « »


Rockies shut out Giants, 3-0


Raising hands for Outside Lands


Best of Olympics in pictures

Most Read | Most Commented | Most Emailed

1. Obama widens lead over Romney in polls
2. AP source: Romney picks Ryan for running mate
3. Long Colin Kaepernick TD in 49ers' win
4. D'oh: Oxford dictionary adds words
5. Woody, don't just take the shot and run
6. U.S. women break 4x100 record
7. Depth on this team is "ridiculous"

Survival – Early Studies

- High Mortality (up to 100%) during summer releases - Cook et al 1978
- Lower mortality during spring releases – Cook et al. 1978, Berry 1973
- Captive animals adapted poorly and had lower survivorship – Berry 1973
- Survivorship related to climatic conditions – High predation 21% - 28% (both on residents and translocated “captives”) following drought - (Berry 1973)

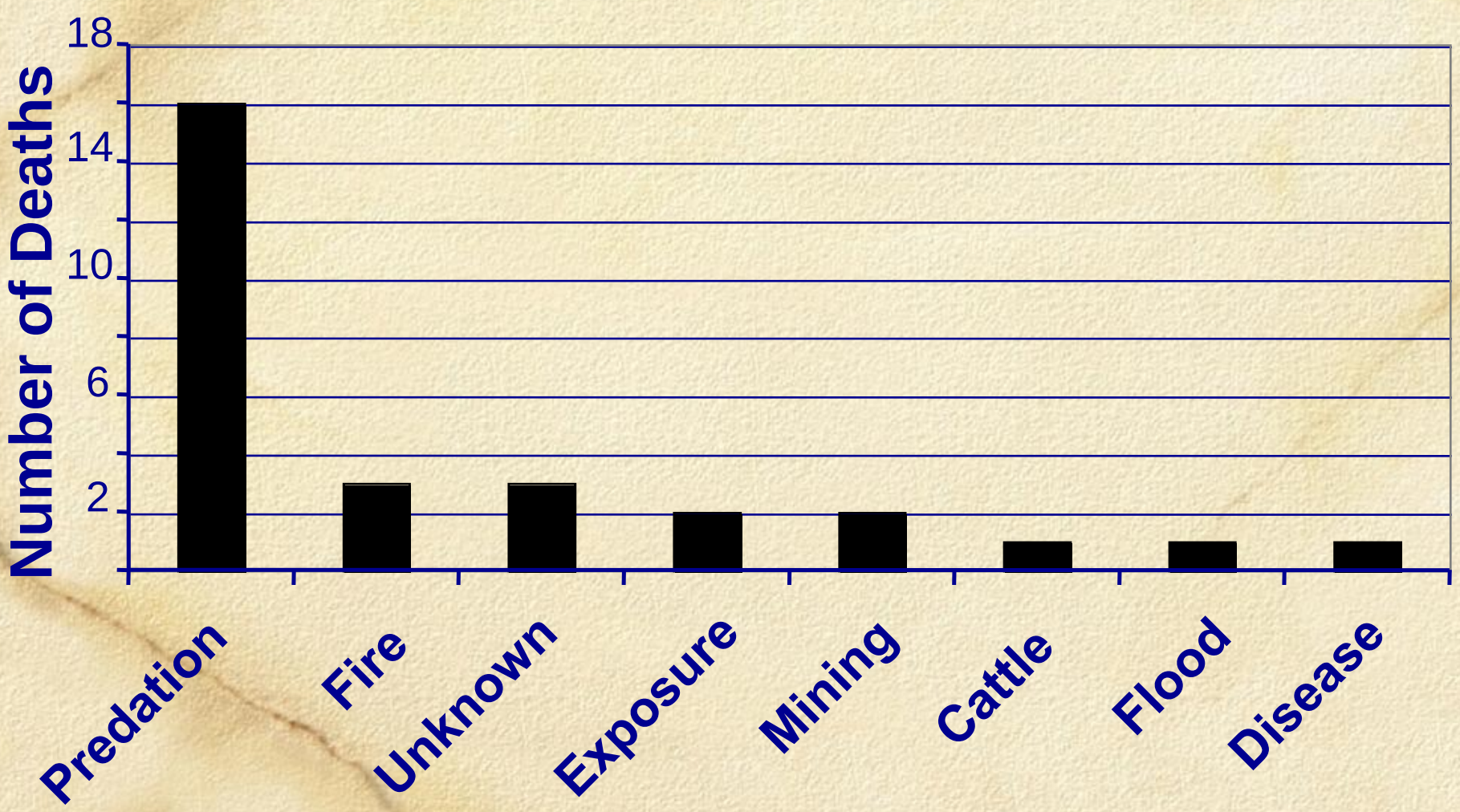
Survival – Recent Studies

- No difference in survivorship from Residents/Controls
- No apparent effects of time in captivity (~ 125 – 3000 days) or pre-release food and water
- Survivorship related to climatic conditions – anthropogenic influences – with 15 to 22% mortality in years following drought

Field et al. 2007, Esque et al. 2010, Nussear et al. 2012

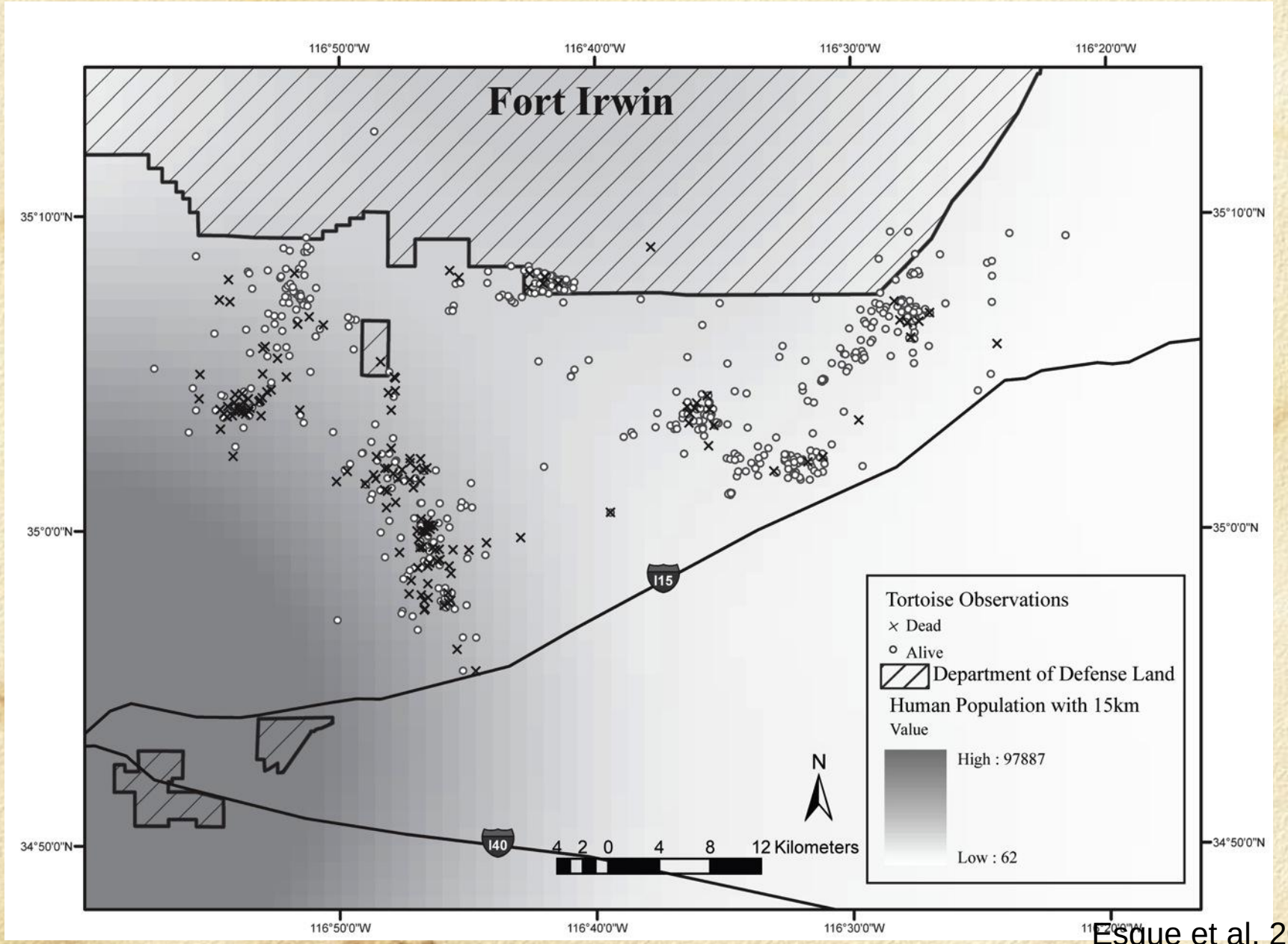
Sources of Tortoise Mortality

Cumulative Mortality at Five sites **N=146**



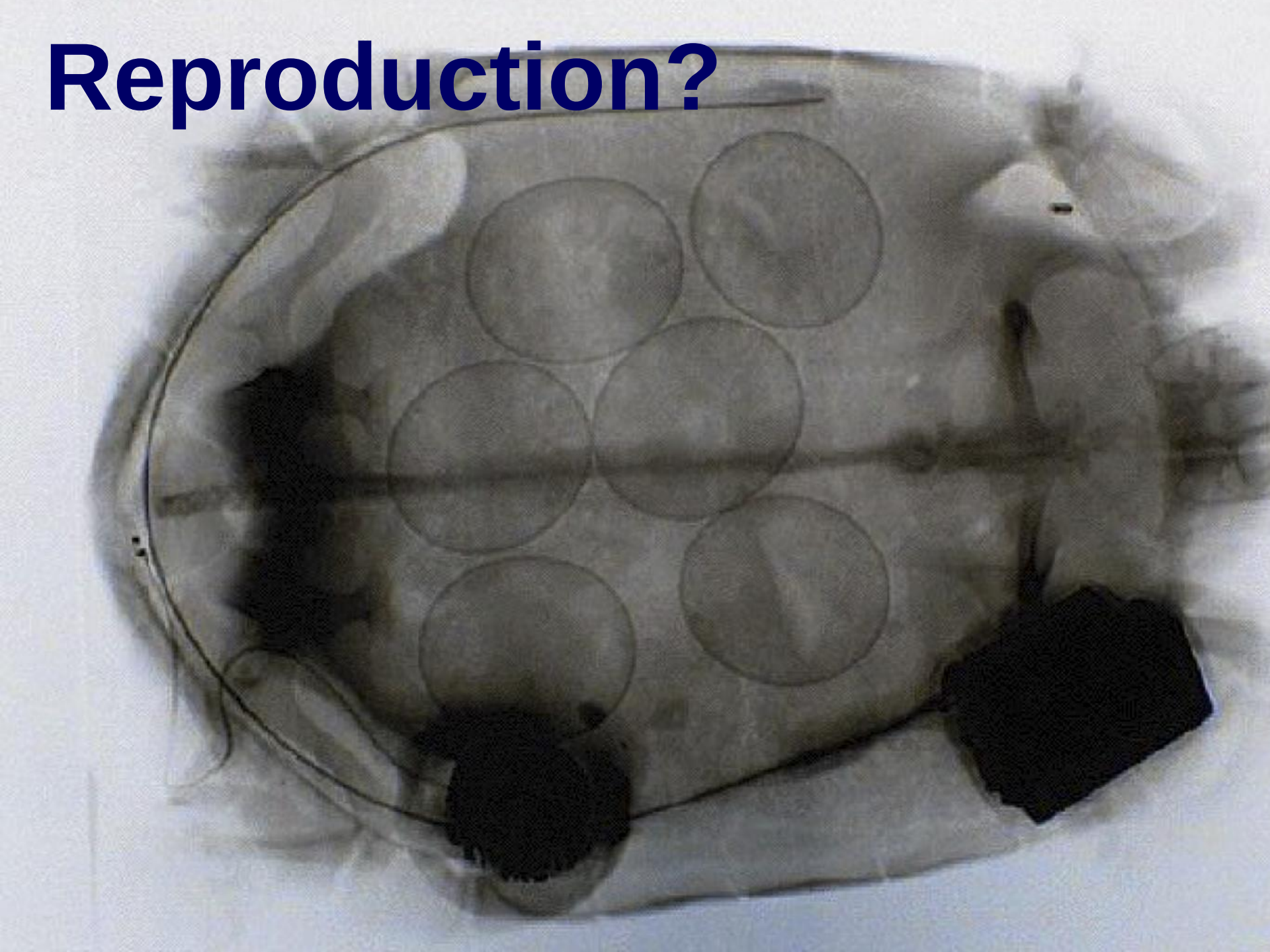
Nussear et al. 2012

Spatial Pattern to Predation

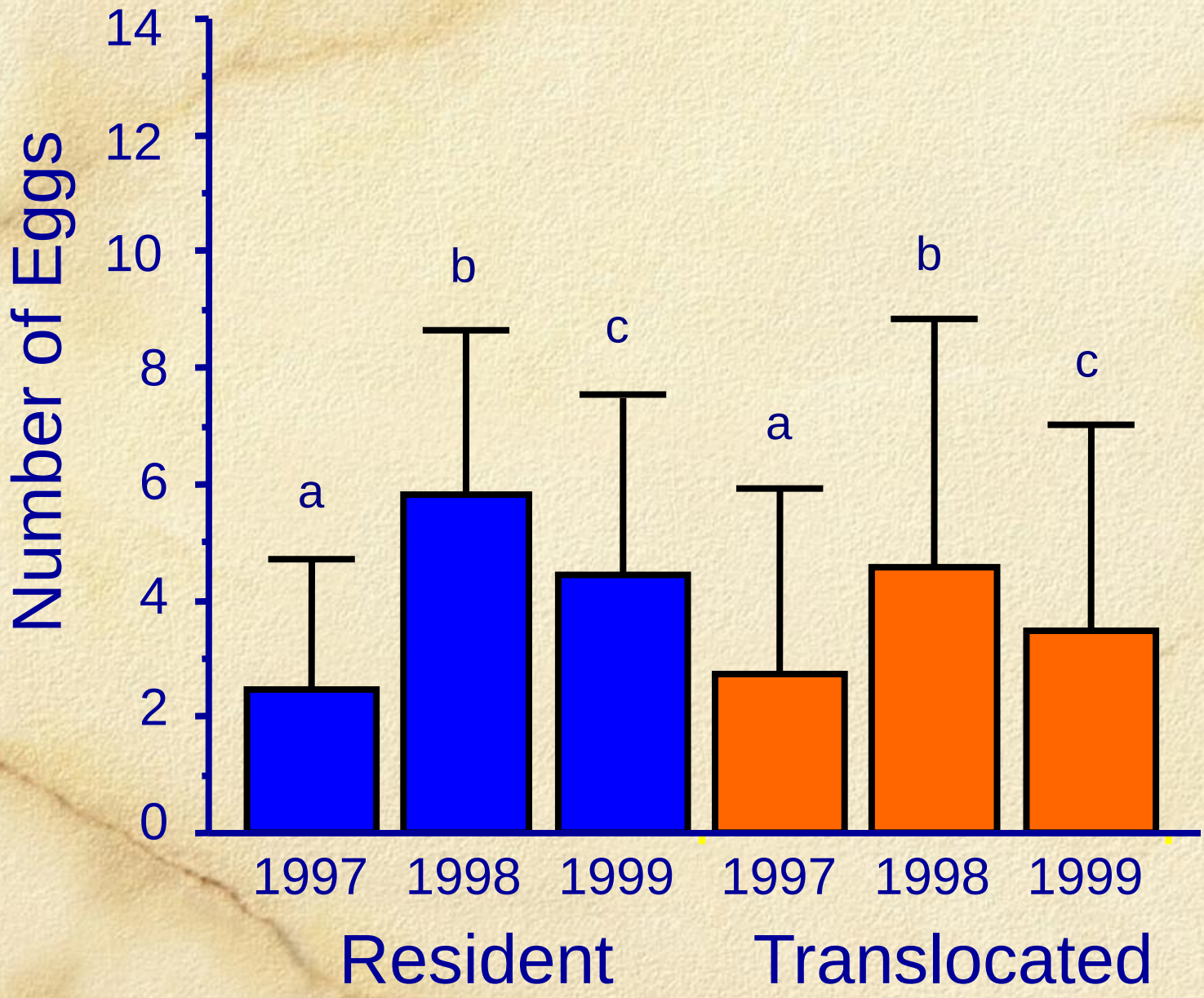


Esque et al. 2010

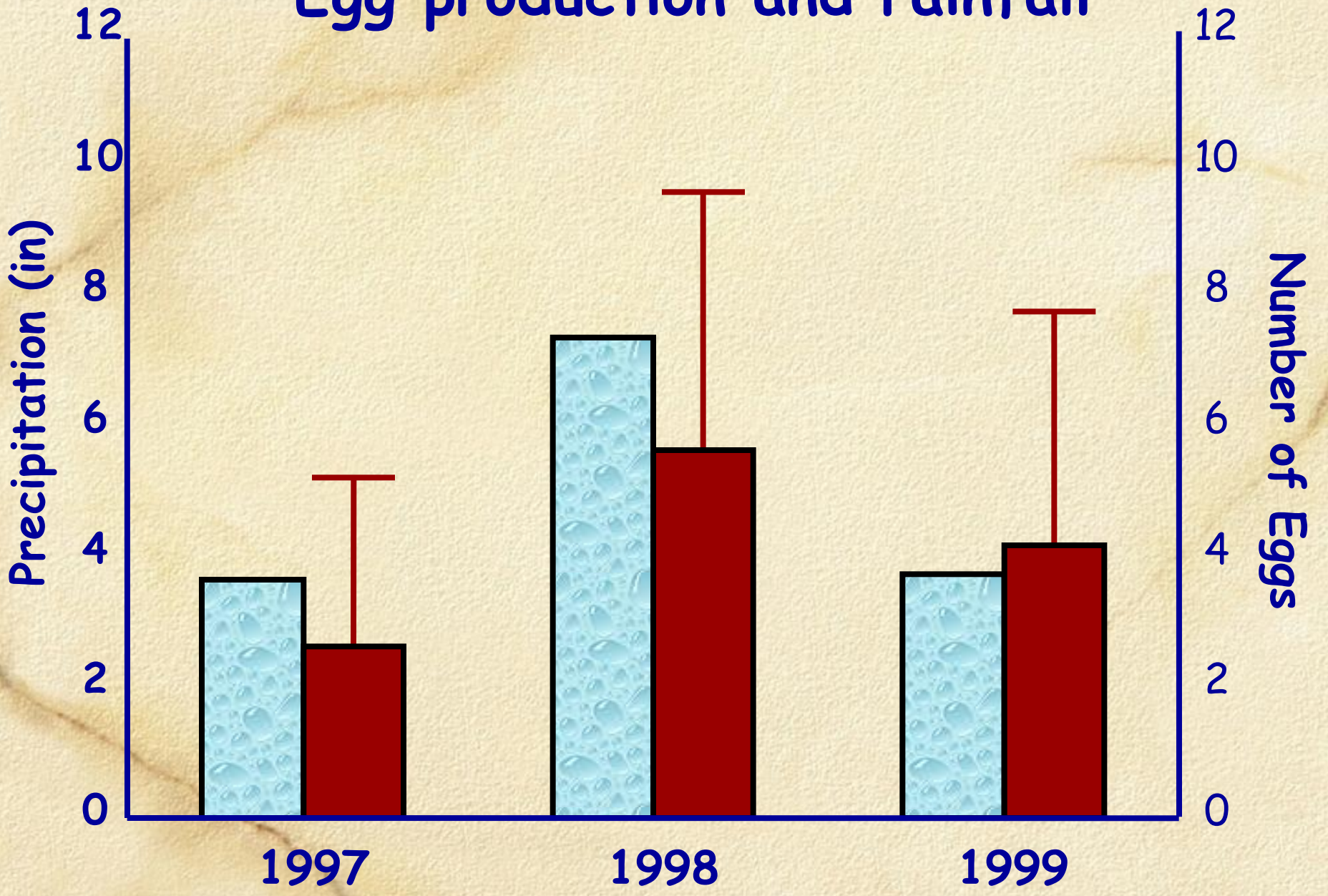
Reproduction?



Egg Production, Bird Spring Val



Egg production and rainfall



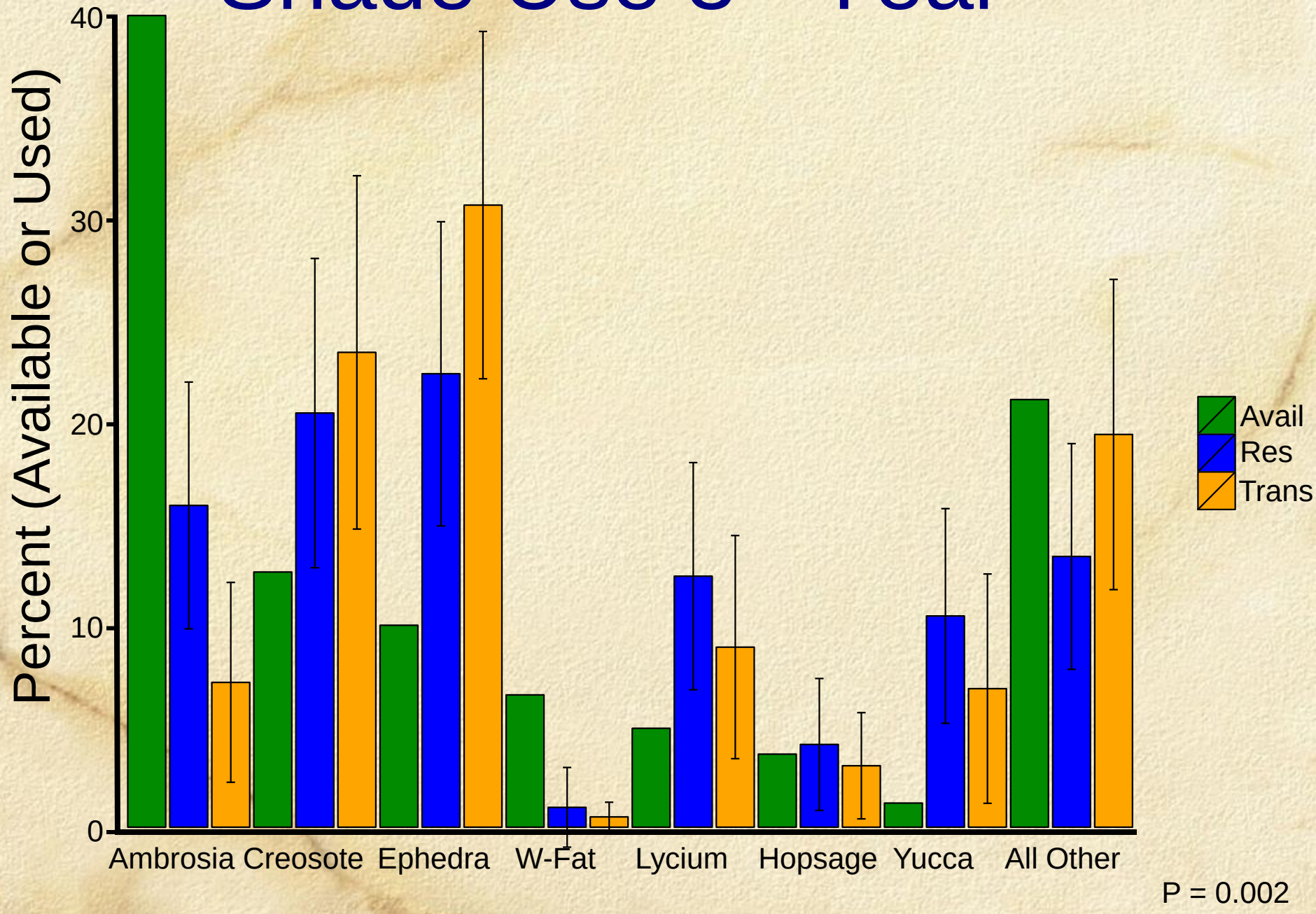
Each year produces different rainfall and production of annual plants.


Microhabitat Use

Shade Use Release Year

P = 0.002

Shade Use 3rd Year

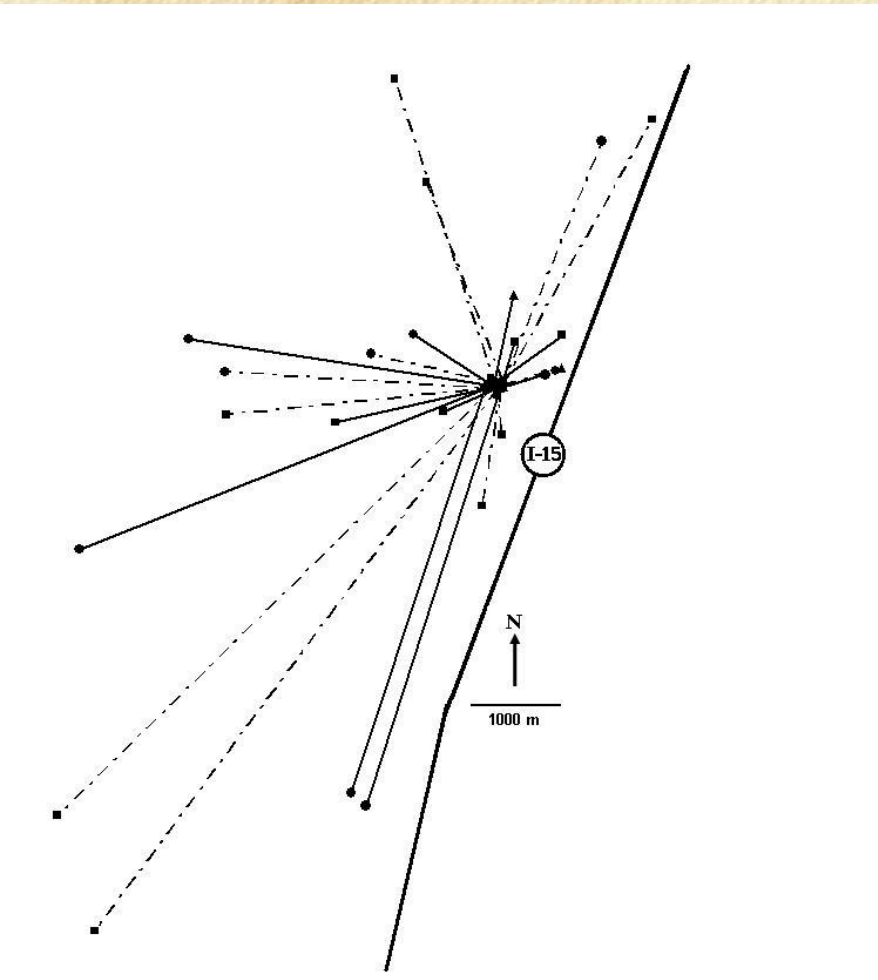


P = 0.002

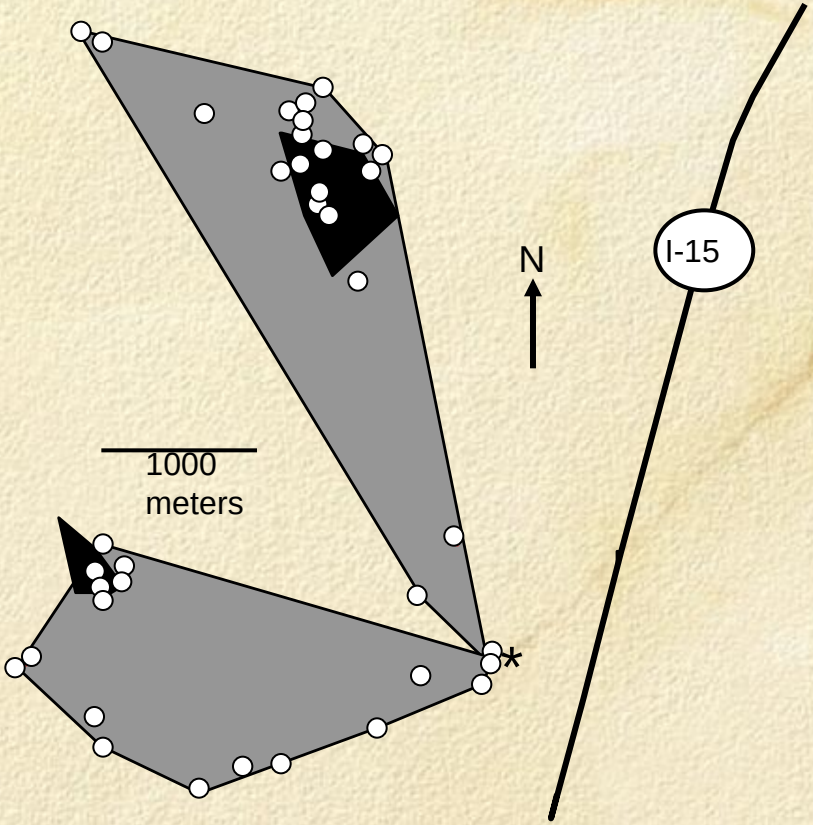
Movements of Translocatees

- Tendency toward homing if released close to point of origin – Berry 1973, Corn 1991, Hinderle 2011
- Extensive Movements in first year to 2 years
- Similar patterns of movements (relative to residents) and later settling behavior

Movements of Translocatees



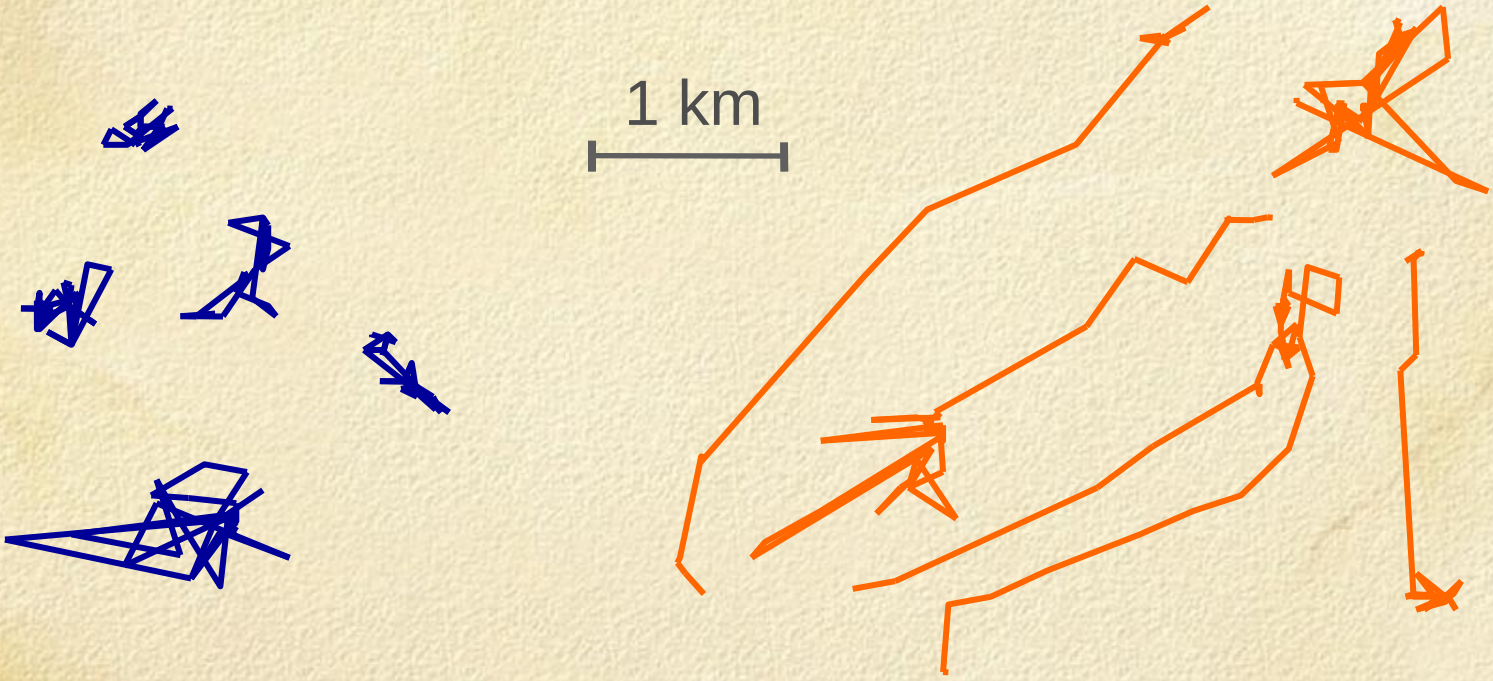
No homing tendency



Reduced movement in second yr

(from Field et al. 2007)

Movement Patterns (Bird Spring Valley)

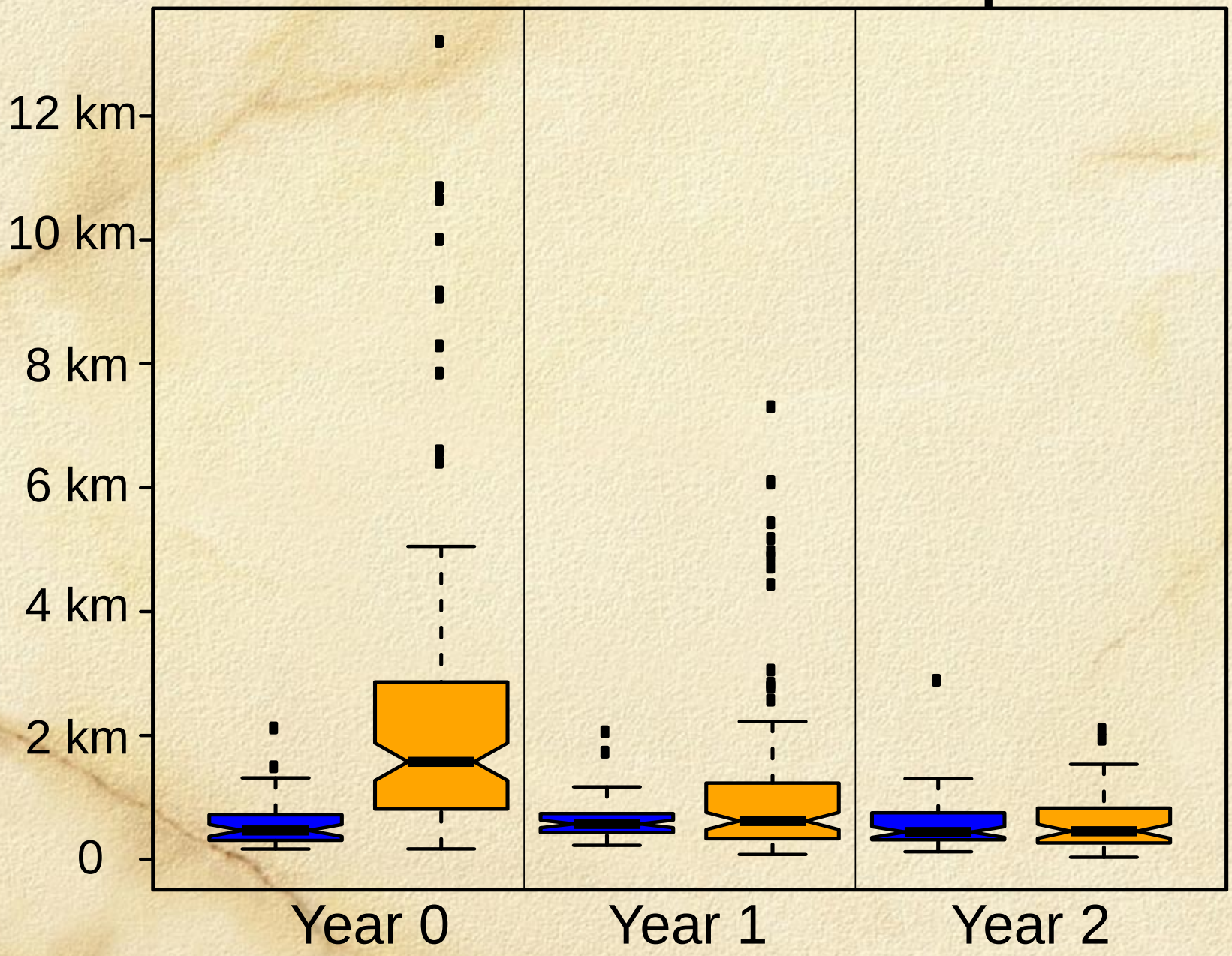


Resident

Translocated

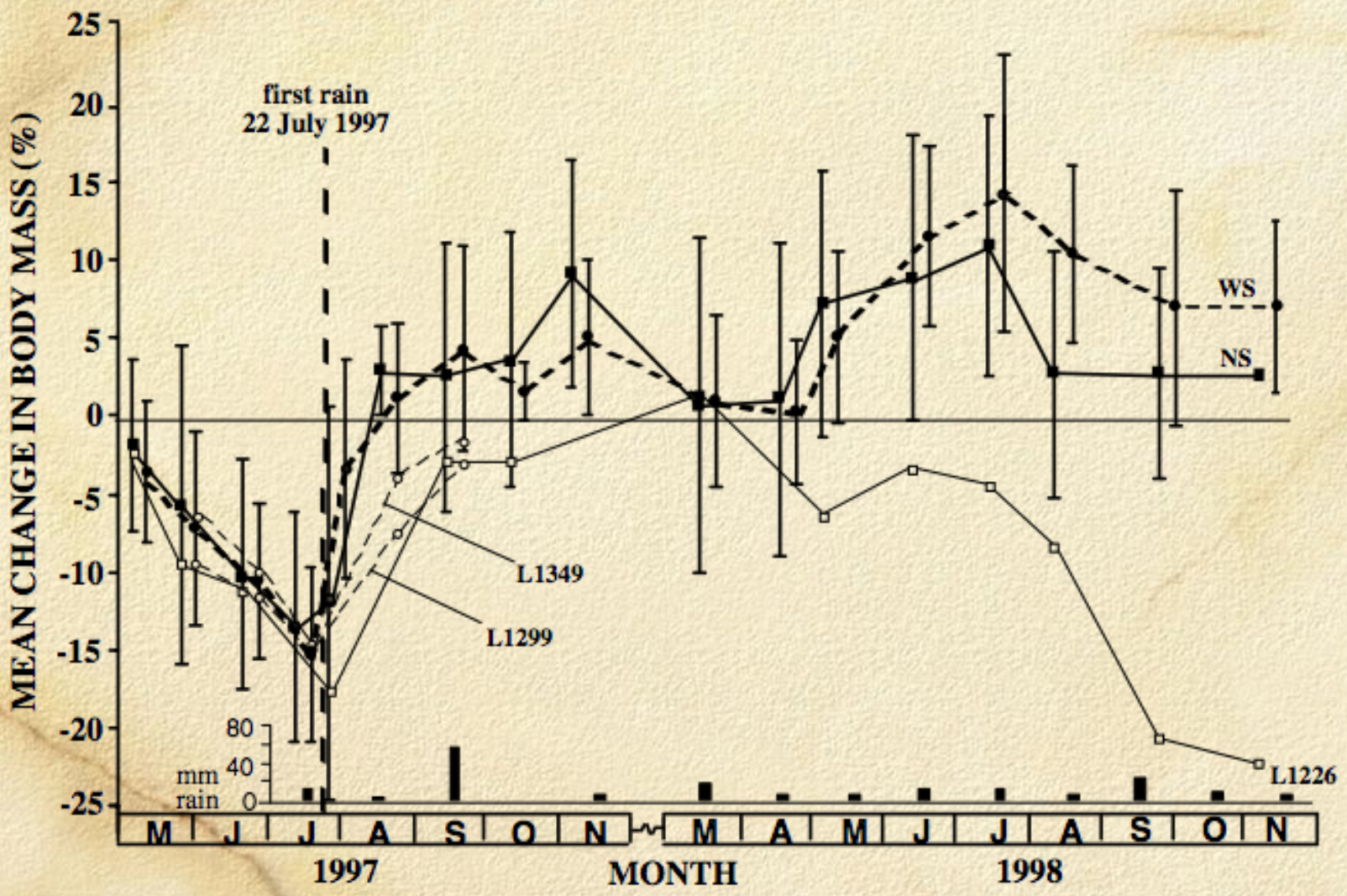
Nussear et al. 2012

Maximum Annual Displacement



Nussear et al. 2012

Body Mass



Field et al. 2007

Desert Tortoise Translocation

Capture

Handling

Restraint

Acute Response

H_A: Likely translocation causes chronic stress to translocated animals & lesser extent to resident animals.

Chronic Response

Ecological Performance

Immune Competence

Behavior

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Measuring Stress In Wild Tortoise

Blood Collection

- 224 Animals
- Sampled Monthly (April-October) each Year
- Only Used Samples Collected ≤ 20 Minutes

Laboratory Analysis (RIA)

- Total Plasma Corticosterone

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Corticosterone Level

Variables & CoVariates

- Monthly Movement
- Annual Home-Range
- Precipitation
- Annual Plant Production
- Treatment
- Sex $F_{1,174}=16.5$, $p<0.01$
- Year $F_{2,1544}=111.3$, $p<0.01$

Linear-mixed Effects Models
AICc

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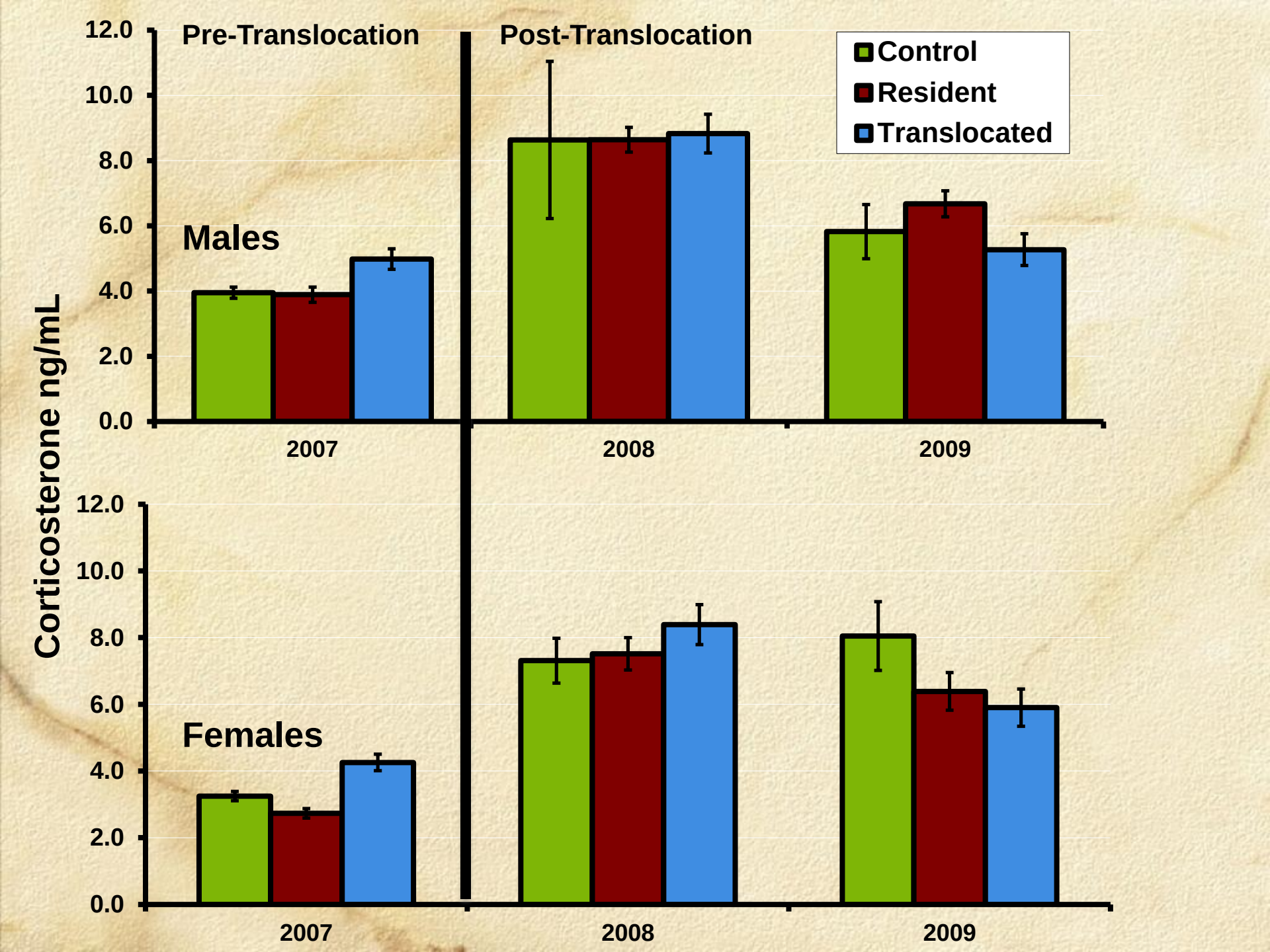
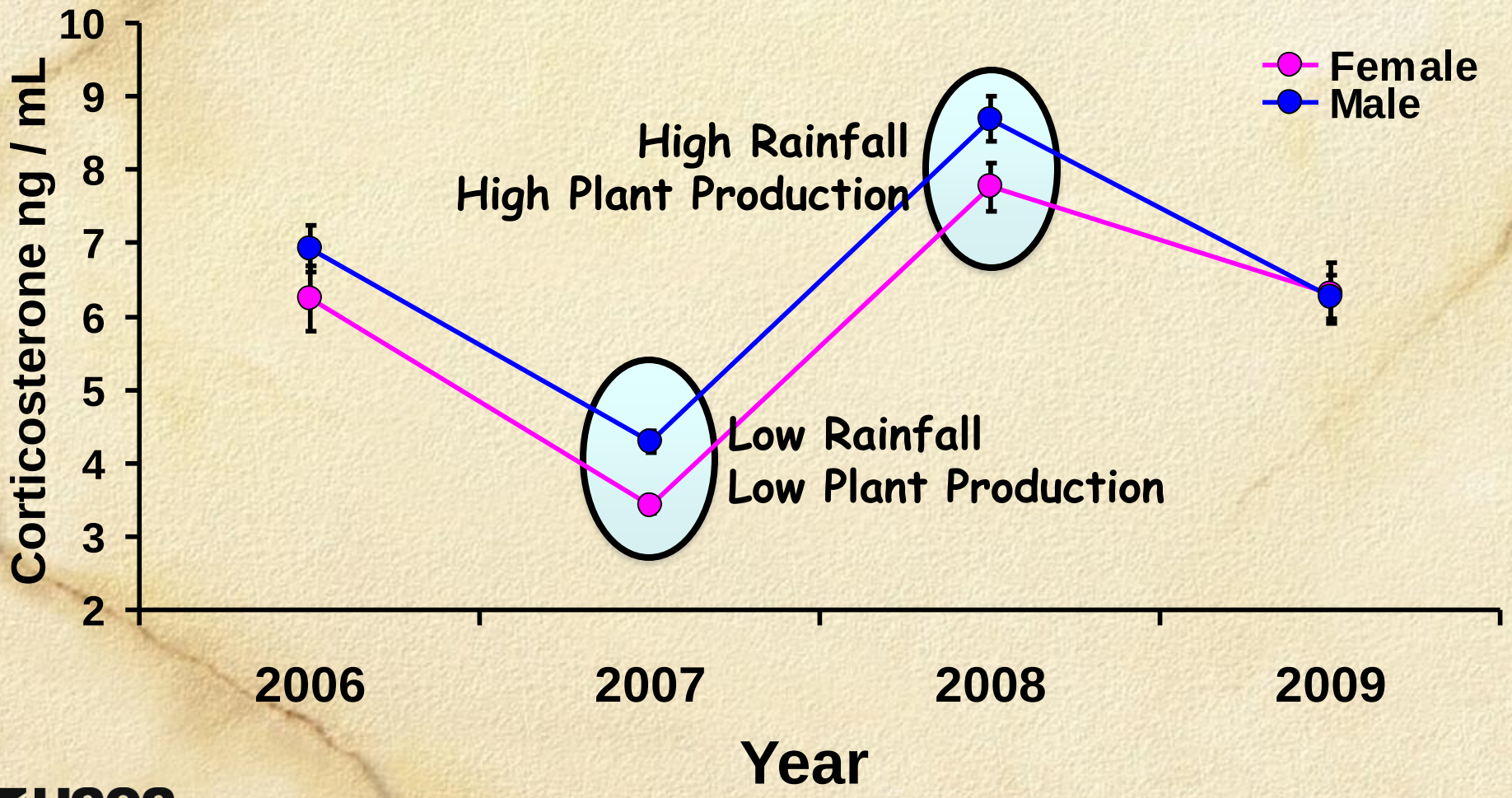

Pre-Translocation
Post-Translocation
Control
Resident
Translocated
Males
Females
Corticosterone ng/mL
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2007
2008
2009

Annual "Cort" Values



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Experimental Conclusions

1. **Translocation Did Not Cause a Measureable Physiological Stress Response** within the first two years of translocation.

2. **Increased Animal Movement** (often associated with translocation) **Did Not correlate with Animal Stress in our experiment**

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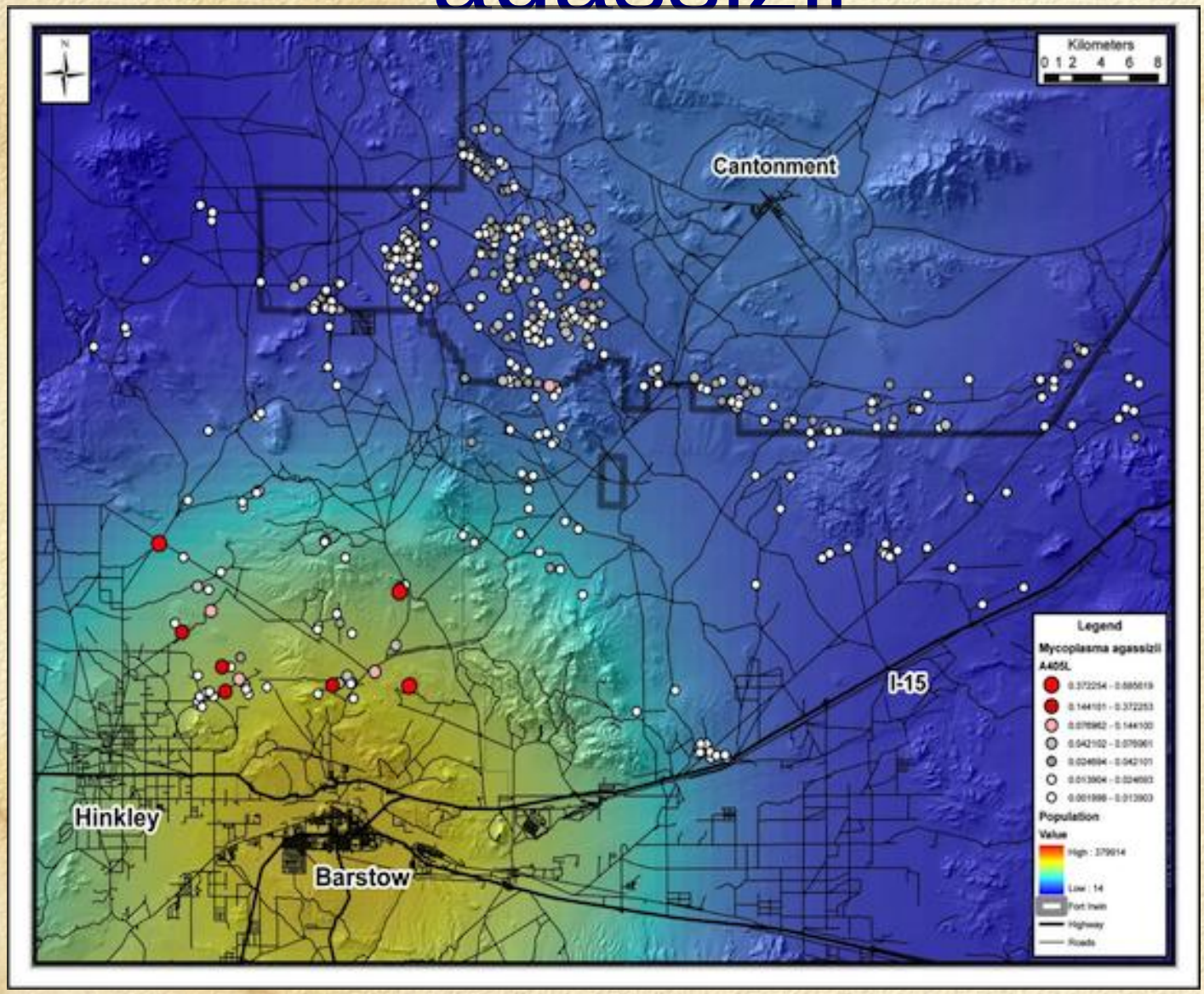
Disease Results – Cort study

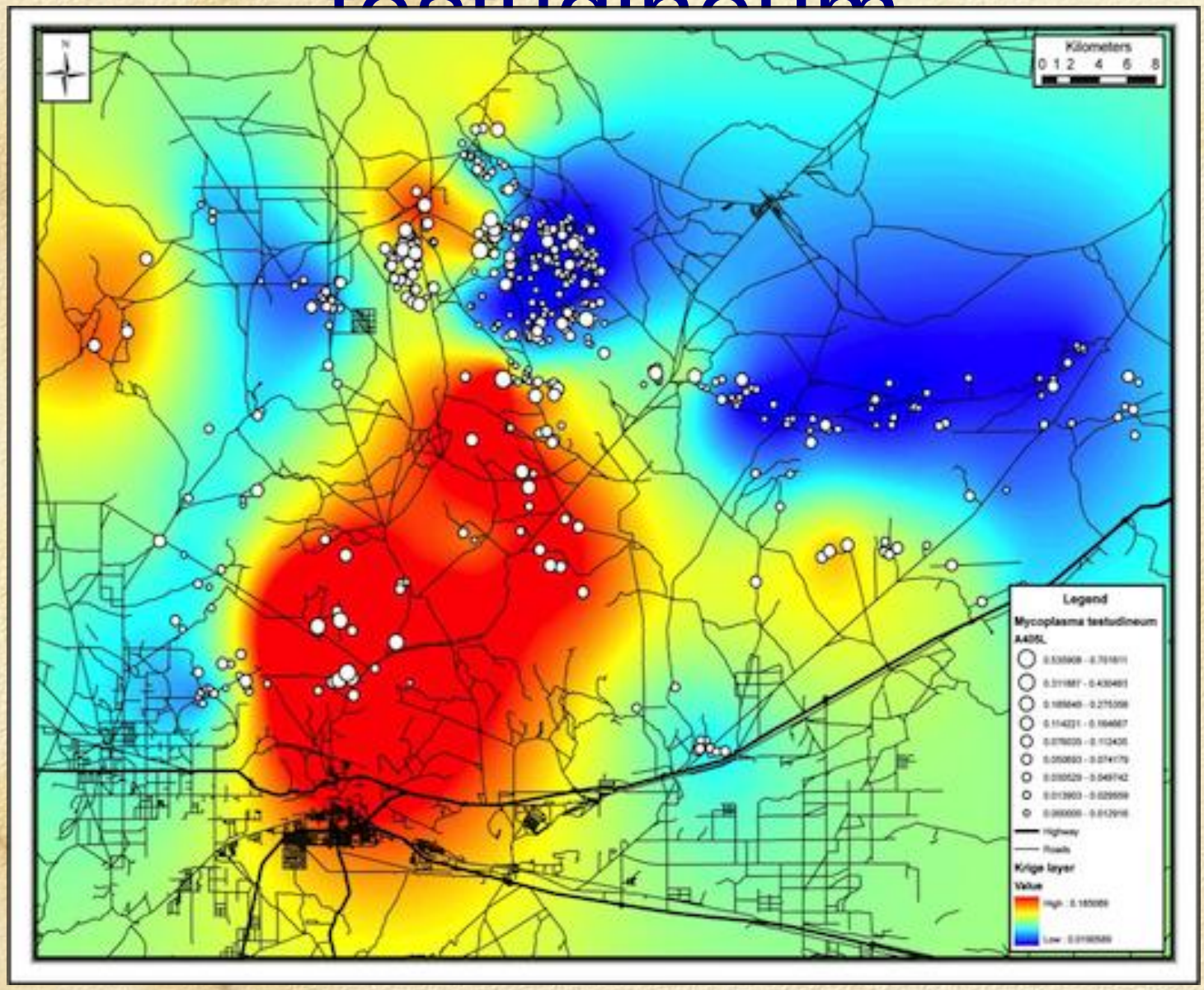
Year	Treatment	Individuals	Clinical Signs	% Clincial Sign	Antibodies Present for Mycoplasma	% Antibody Presence
	Control	40	2	5.0	0	0.0
2006	Resident	40	4	10.0	2	5.0
	Translocated	38	0	0.0	0	0.0
	Control	48	4	8.3	0	0.0
2007	Resident	34	5	14.7	0	0.0
	Translocated	43	3	7.0	0	0.0
Translocation Occurred						
	Control	29	3	10.3	0	0.0
2008	Resident	43	7	16.3	1	2.3
	Translocated	33	6	18.2	0	0.0
	Control	19	0	0.0	0	0.0
2009	Resident	40	4	10.0	2	5.0
	Translocated	19	2	10.5	1	5.3
	Control	11	0	0.0	0	0.0
2010	Resident	36	2	5.6	1	2.8
	Translocated	17	0	0.0	0	0.0
	Control	5	0	0.0	0	0.0
2011	Resident	17	2	11.8	0	0.0
	Translocated	16	3	18.8	0	0.0

Spatial Distribution of M. agassizii



Van Zerr et al. 2012

Spatial Distribution - M. testudineum



Van Zerr et al. 2012

Conclusions

- Evidence from our studies suggests that translocation can be an efficacious tool for dealing with tortoises displaced by urban development.
- Mature reproductive animals can be returned to the wild
- May aid in recovery of this species

But……

Conclusions

- There is still a need for long-term research to confirm persistence
- We need better long term protection of tortoise release sites
- Need to investigate use as a PRO-active tool, rather than a RE-active response to habitat development

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