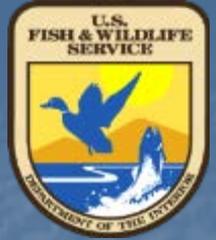
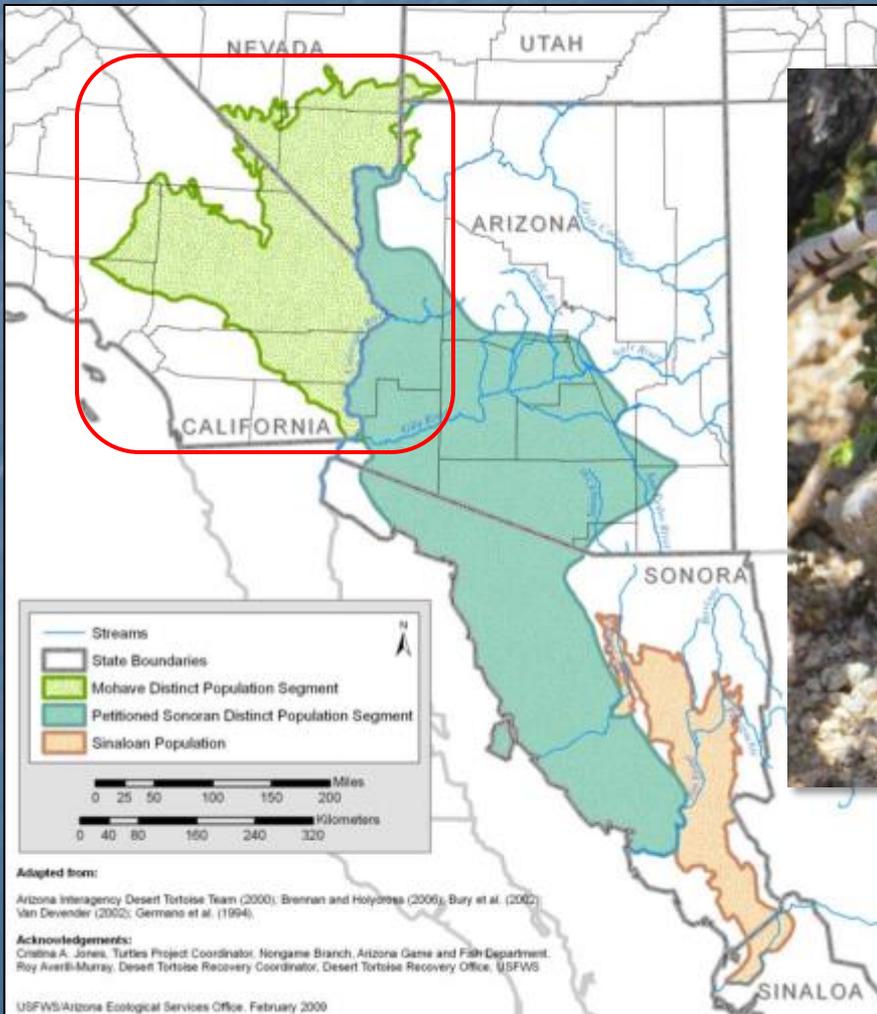


Population Augmentation as a Recovery Strategy for the Mojave Desert Tortoise (*Gopherus agassizii*)



Roy C. Averill-Murray & Kimberleigh J. Field
Desert Tortoise Recovery Office
US Fish and Wildlife Service

USFWS listed the Mojave Desert Tortoise as Threatened in 1990



Gopherus agassizii

The Recovery Plan includes a number of recommendations to ...

U.S. Fish & Wildlife Service

Revised Recovery Plan for the Mojave Population of the Desert Tortoise

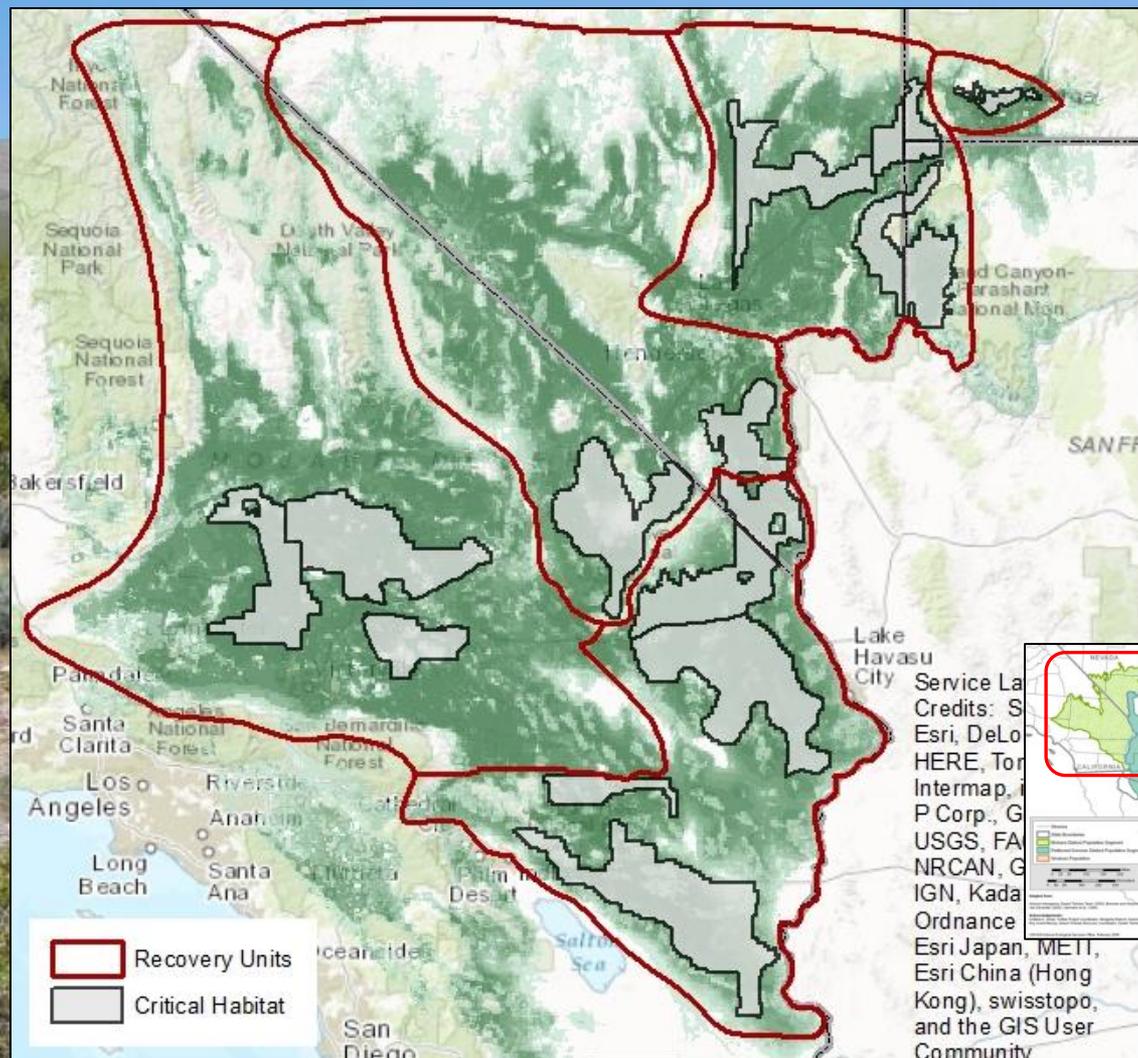
(Gopherus agassizii)



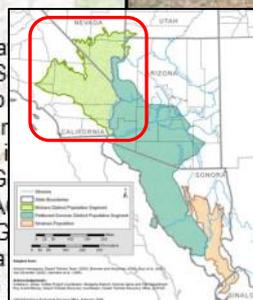
©Dennis Caldwell

*Protect existing
populations and
habitat*

Management focuses on removing threats in "Tortoise Conservation Areas"

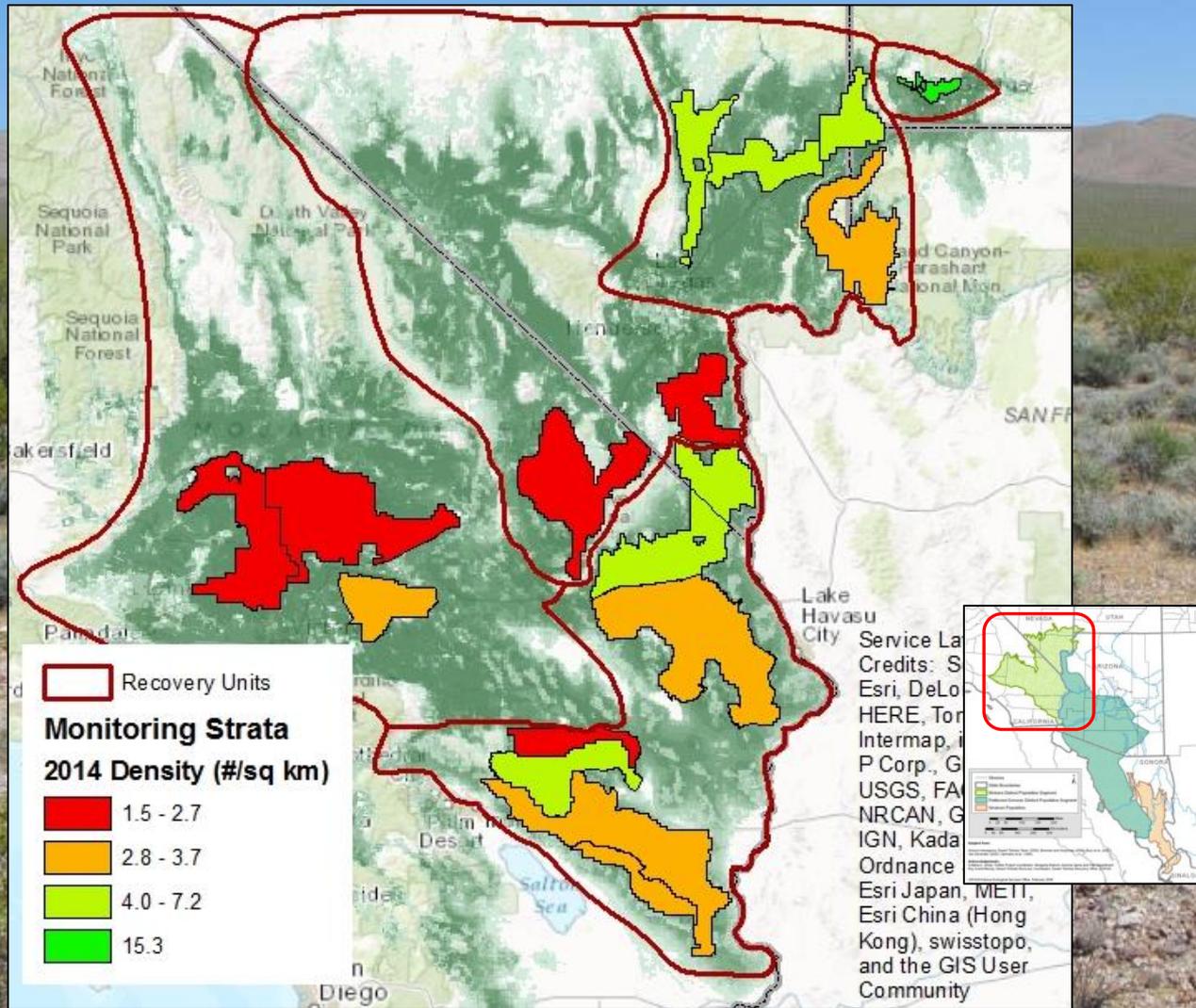


Protect existing populations and habitat

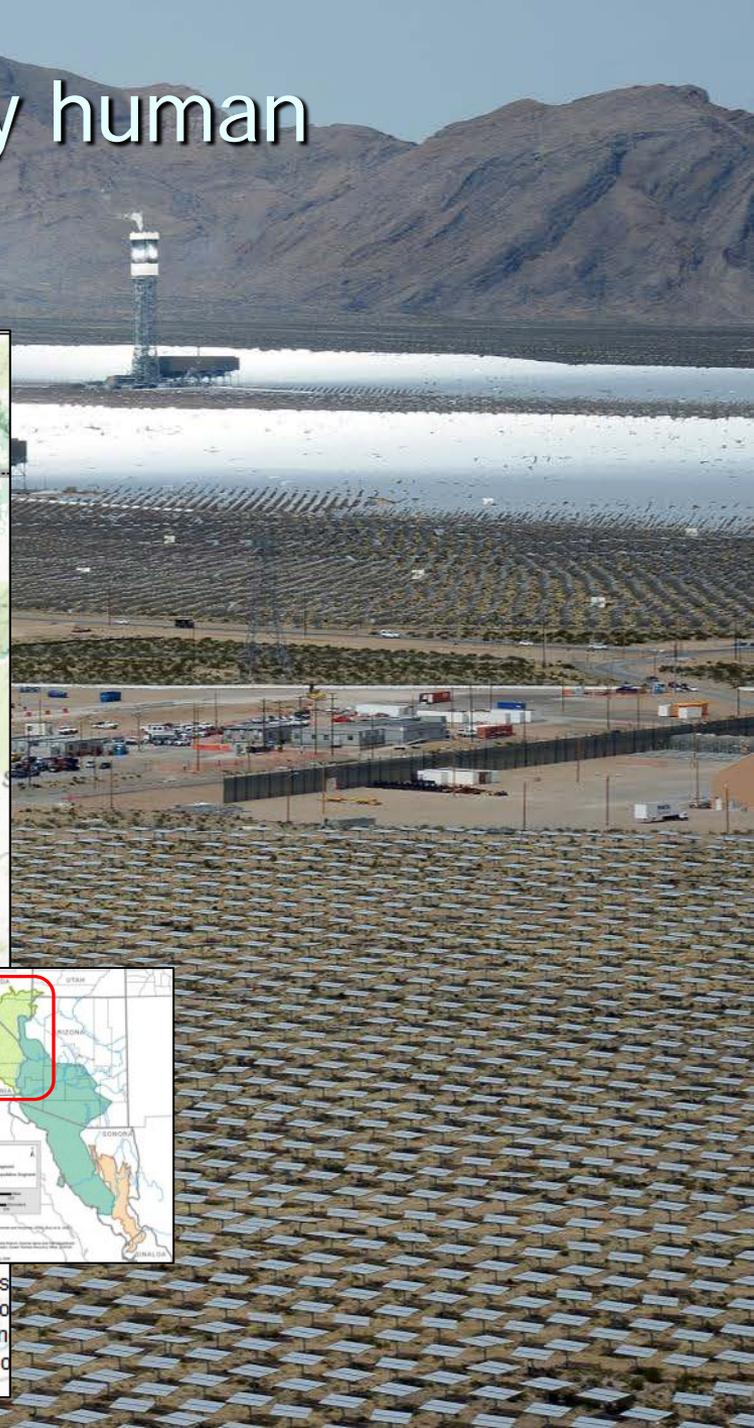
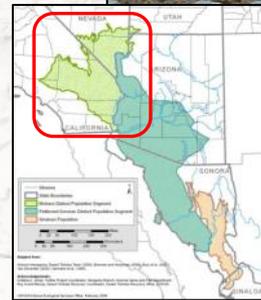
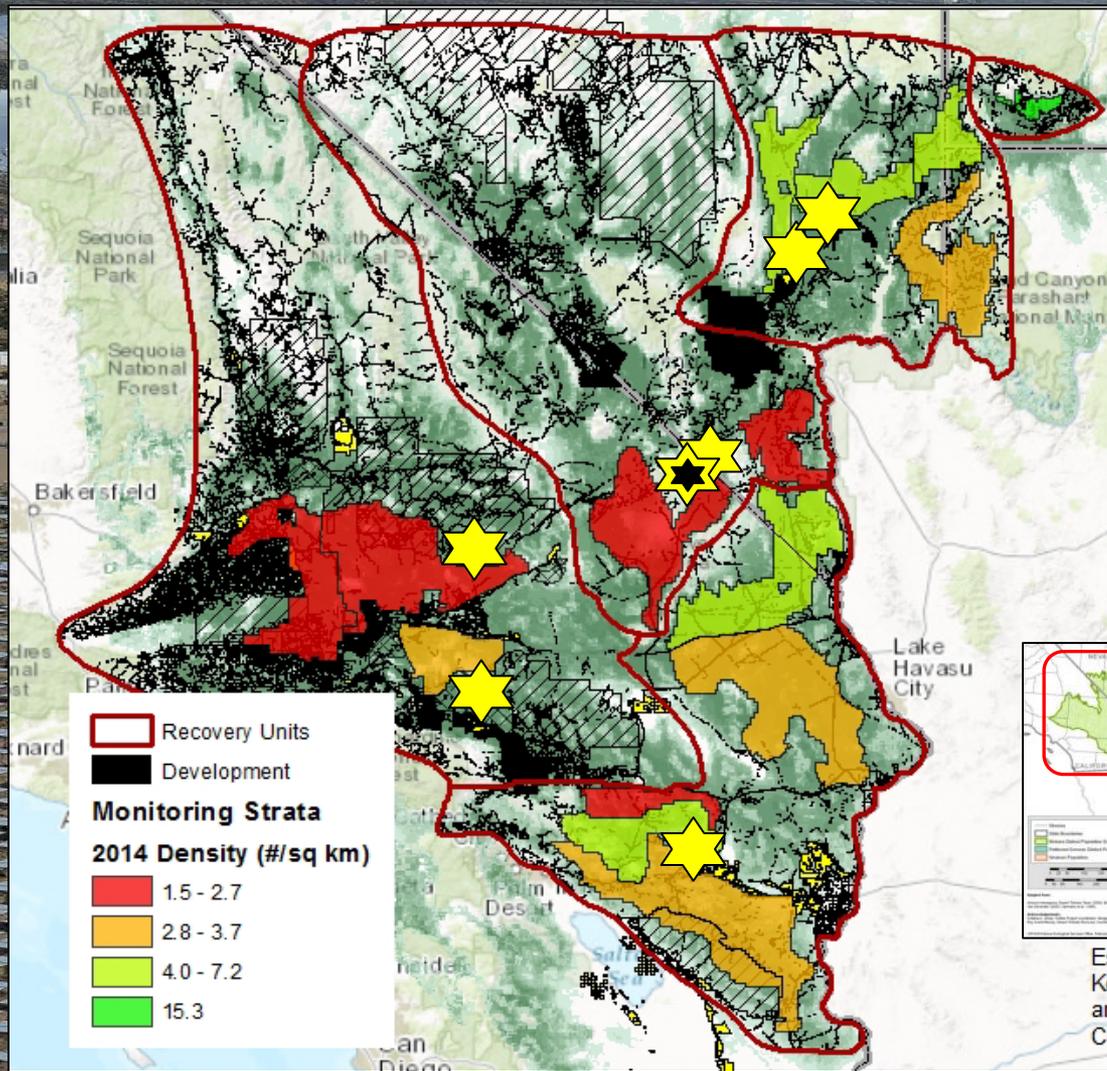


Service Layer Credits: S
Esri, DeLorme, Geo
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NRCAN, GEBCO, IGN, Kada
Ordnance Survey, Esri Japan, METI,
Esri China (Hong Kong), swisstopo,
and the GIS User Community

Many populations contain LOW tortoise densities



Tortoises are still displaced by human development





Historically, tortoises were moved from harm's way into nearby habitat



Desire to let individuals live out their lives in the wild

The Recovery Plan also recommends to ...

U.S. Fish & Wildlife Service

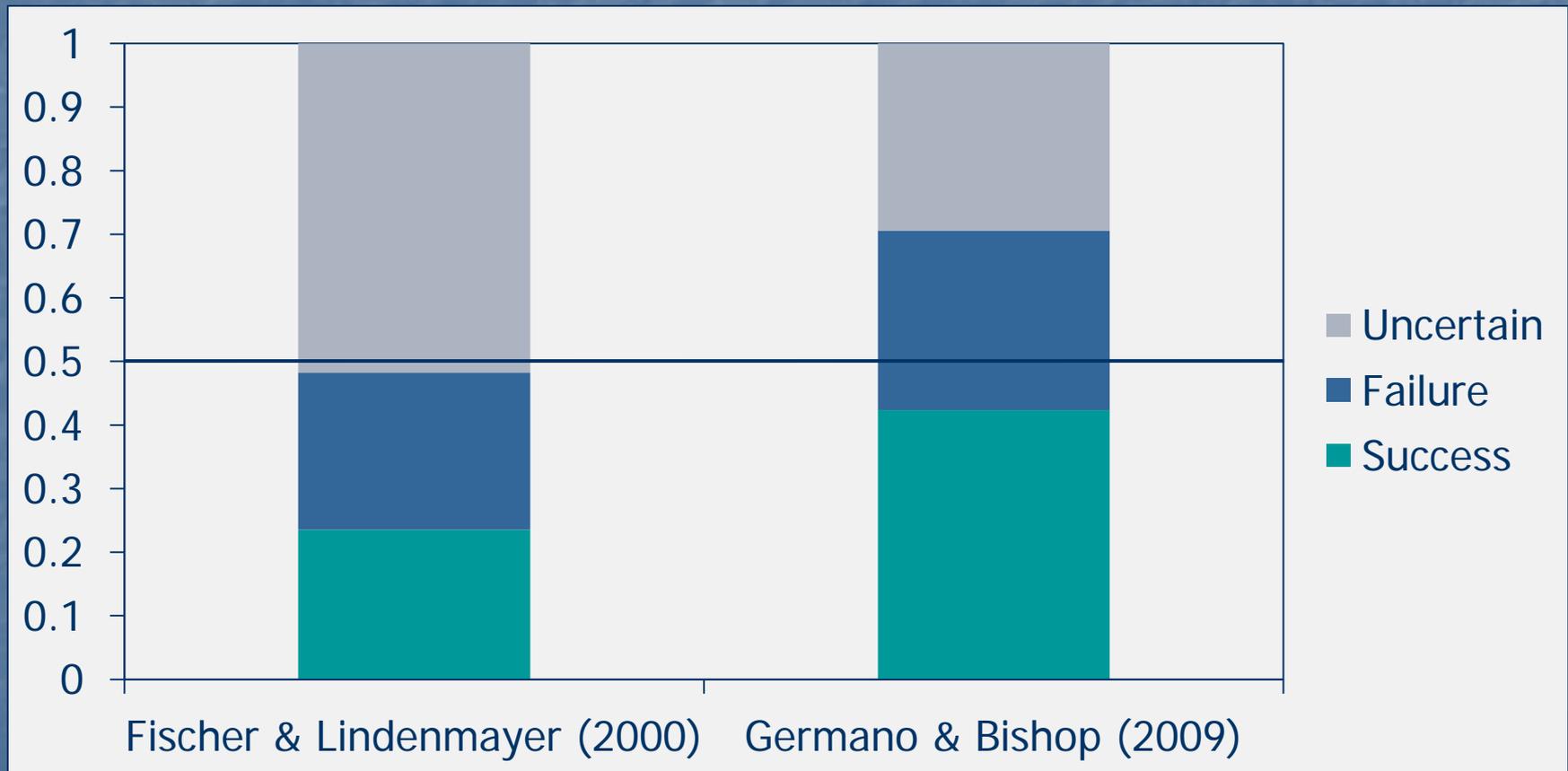
**Revised Recovery Plan
for the Mojave Population
of the Desert Tortoise
(*Gopherus agassizii*)**



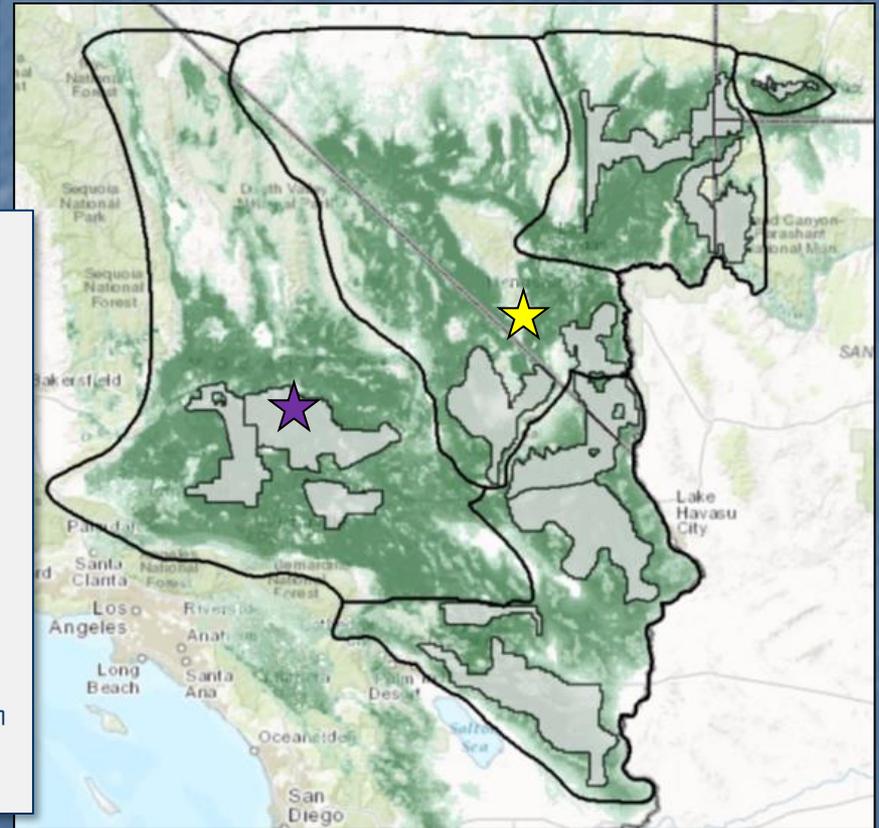
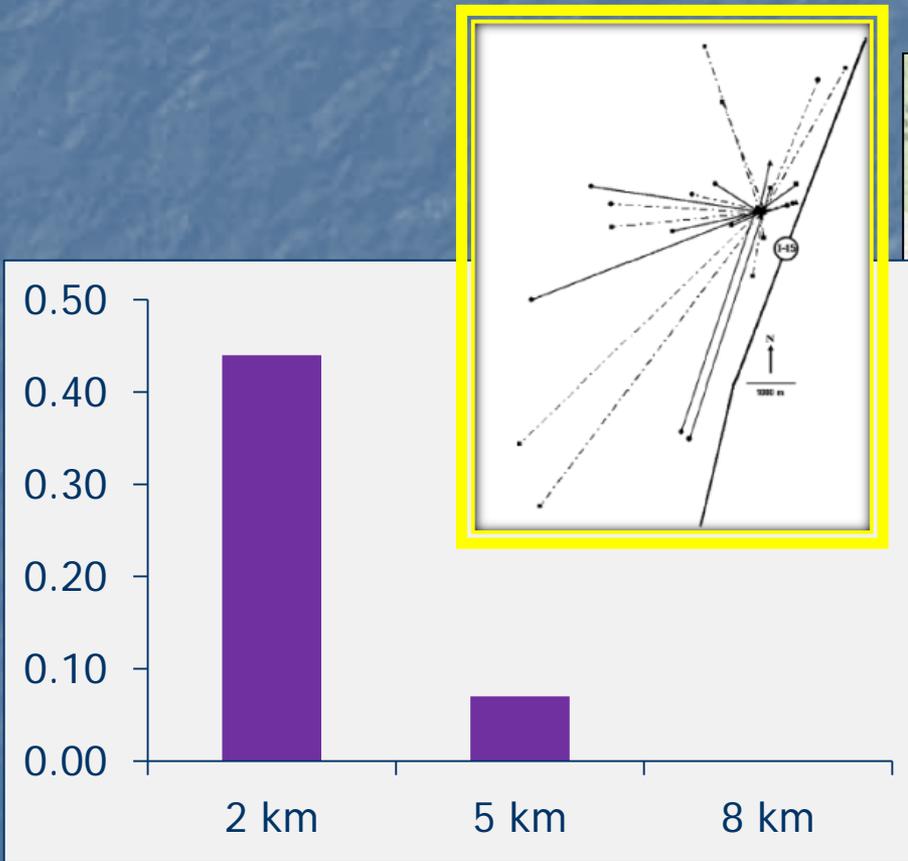
*Augment depleted populations
through a strategic program*



A broad literature questions the effectiveness of translocation

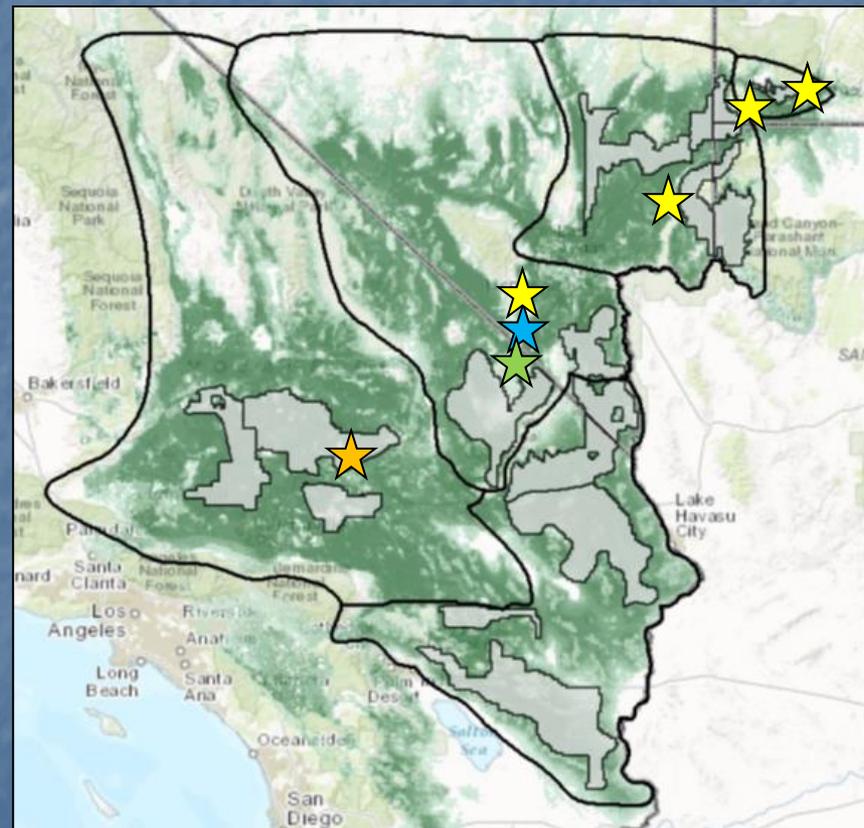
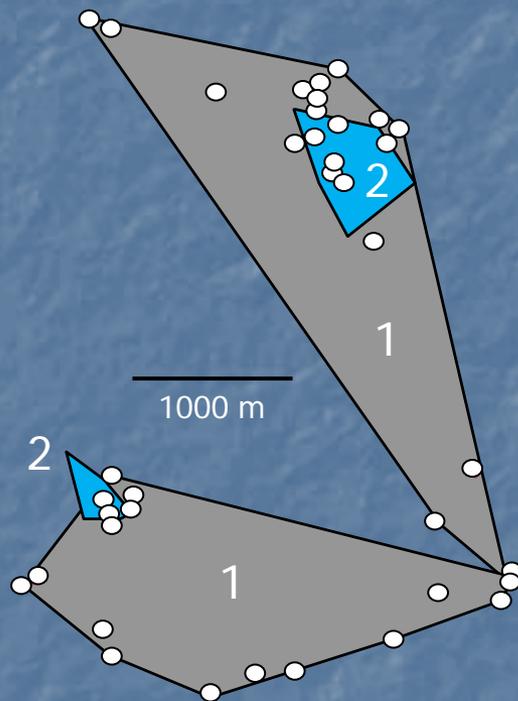
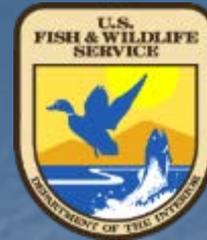


Tortoises moved ≥ 5 km show little to no homing tendency



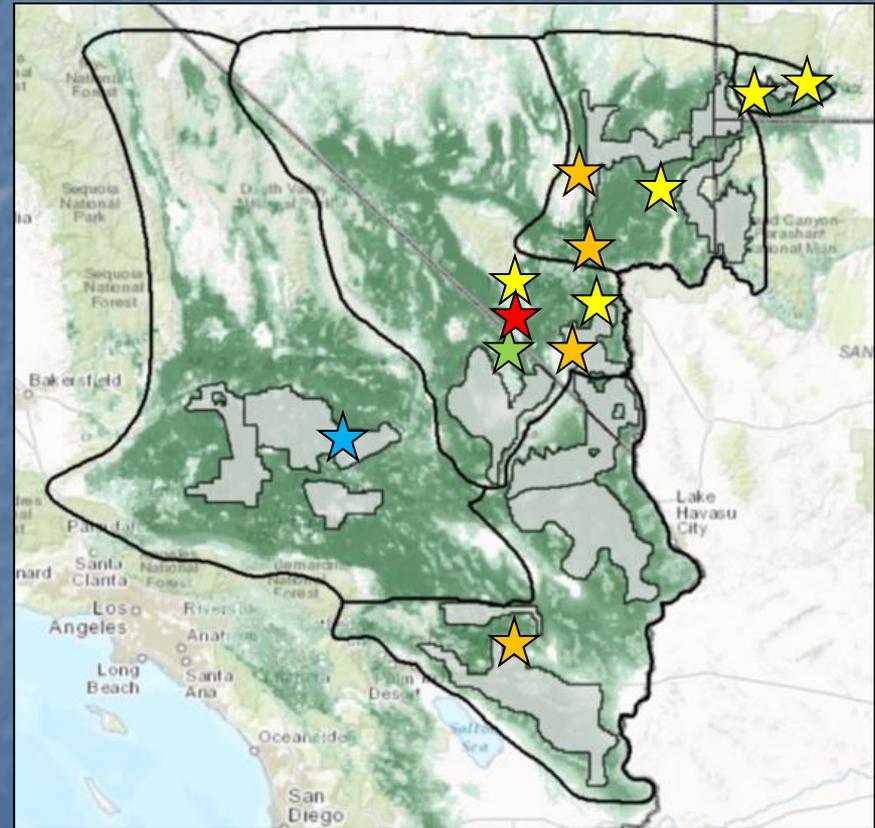
- Field et al. 2007
- Hinderle et al. 2015

Movements & home ranges reach "normal" levels by the 2nd year



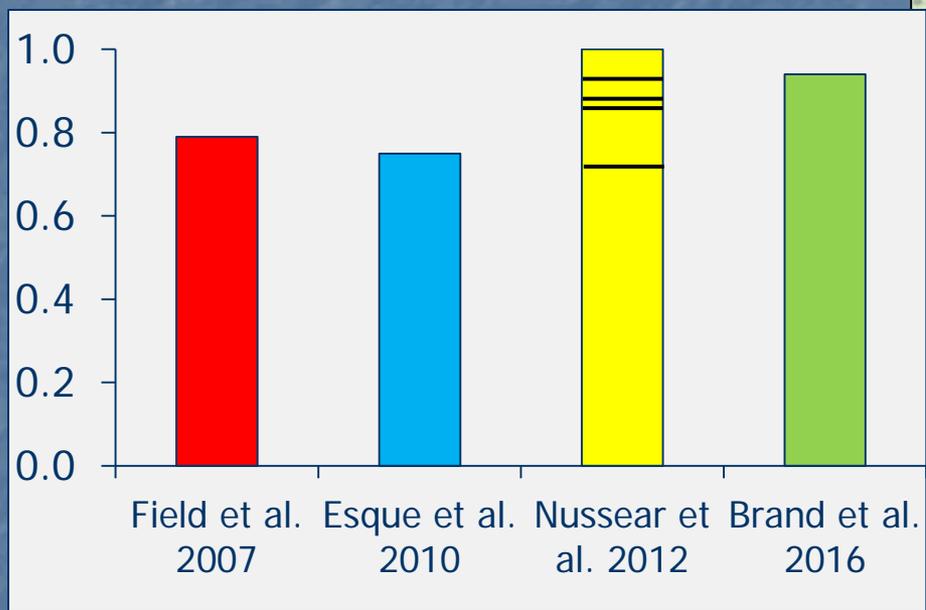
- Field et al. 2007
- Nussear et al. 2012
- Farnsworth et al. 2015
- Unpublished

Translocated tortoises show appropriate behavior comparable to residents

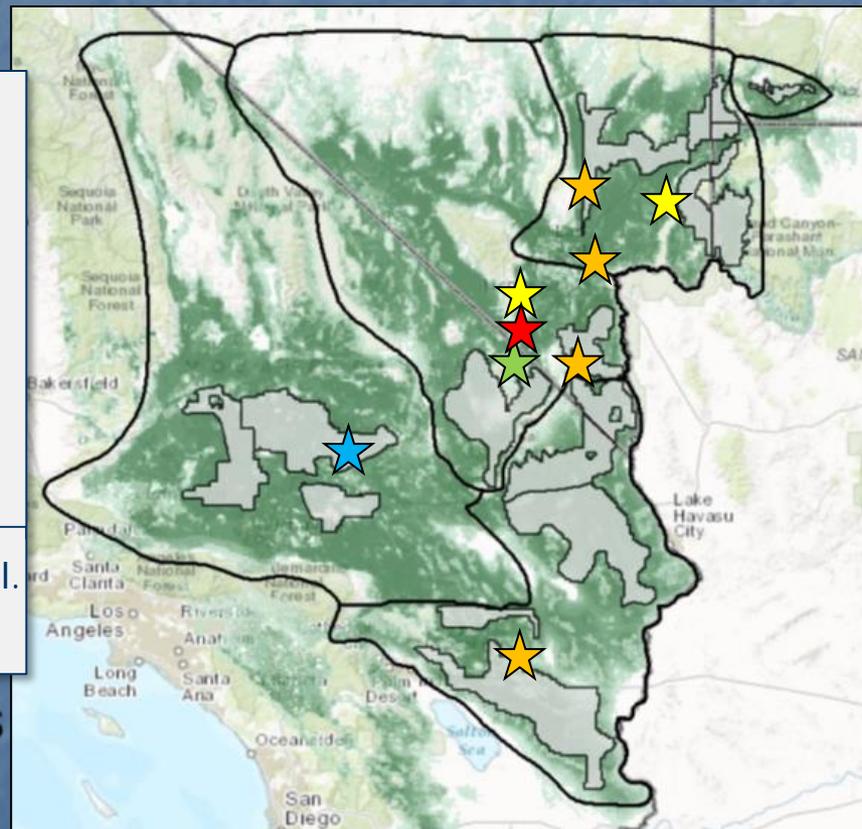


- Field et al. 2007
- Esque et al. 2010
- Nussear et al. 2012
- Brand et al. 2016
- Unpublished

Survival is equivalent between translocated and resident tortoises

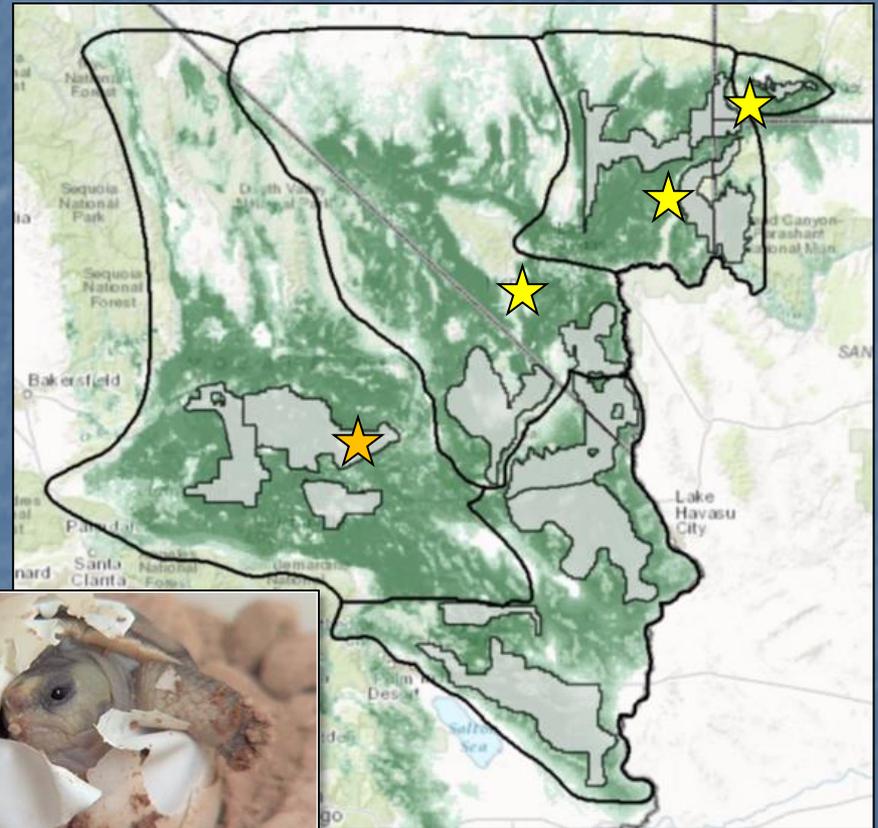


1st-year survival of translocated tortoises



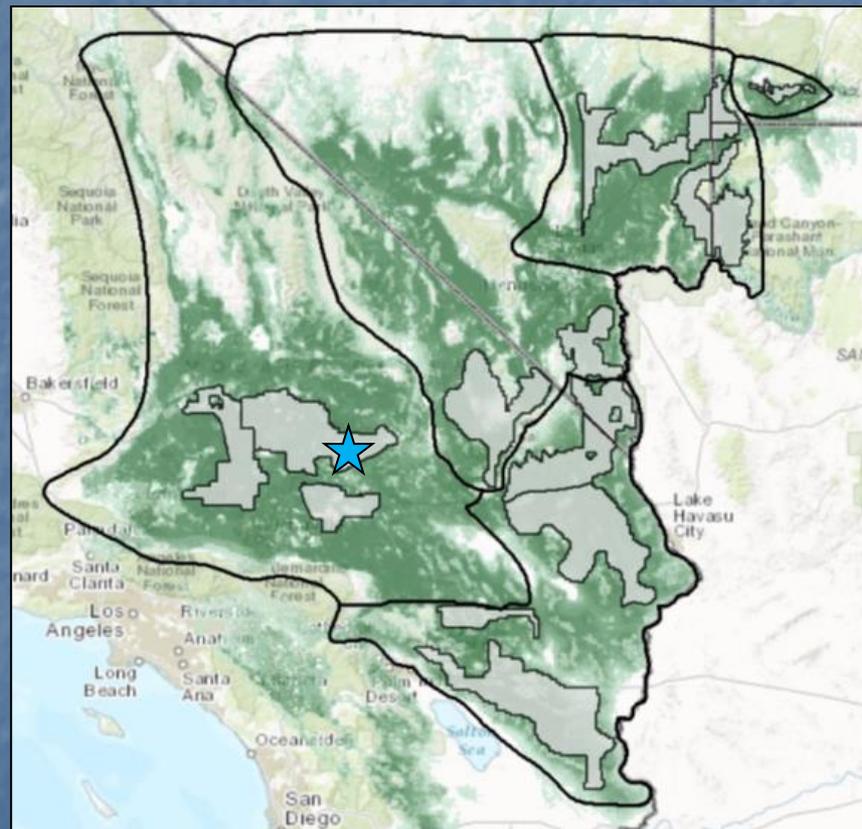
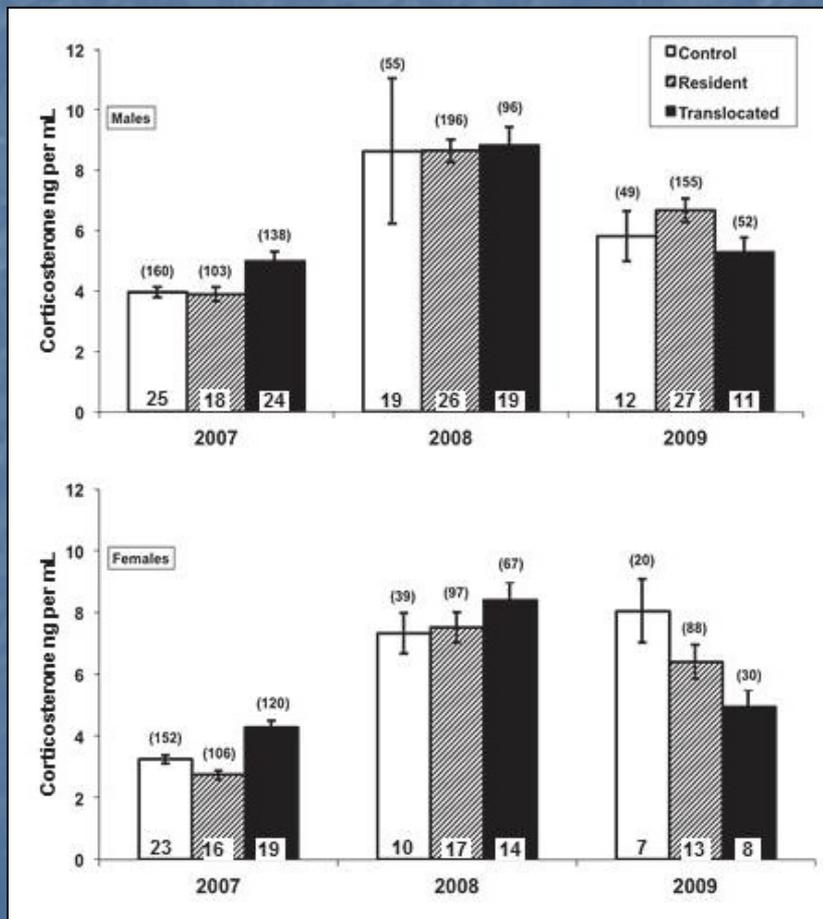
■ Unpublished at intermediate levels

Reproductive output is equivalent between translocated & resident tortoises by the 2nd year

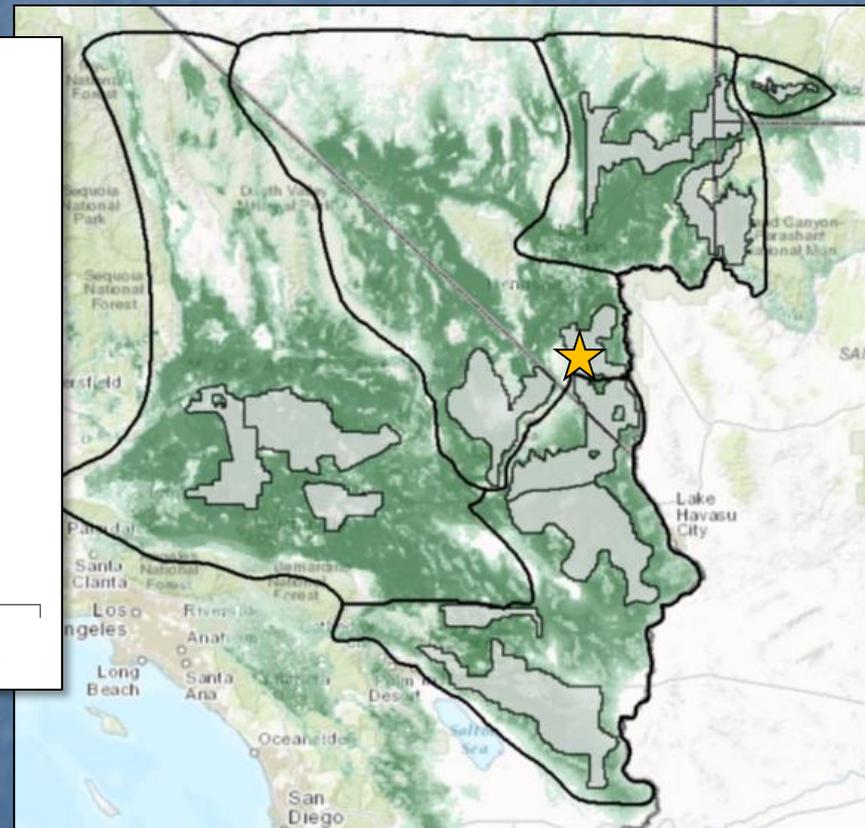
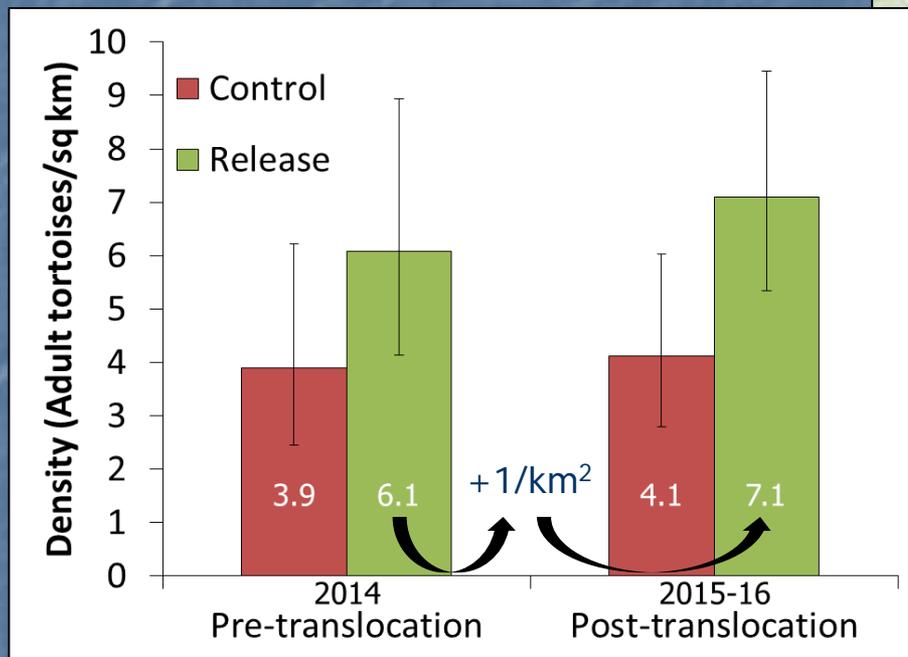
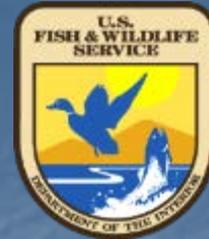


- Nussear et al. 2012
- Unpublished

Stress is equivalent between translocated and resident tortoises



Adult tortoise density remains elevated in short term following translocation



Specific metrics of success are necessary to evaluate effectiveness

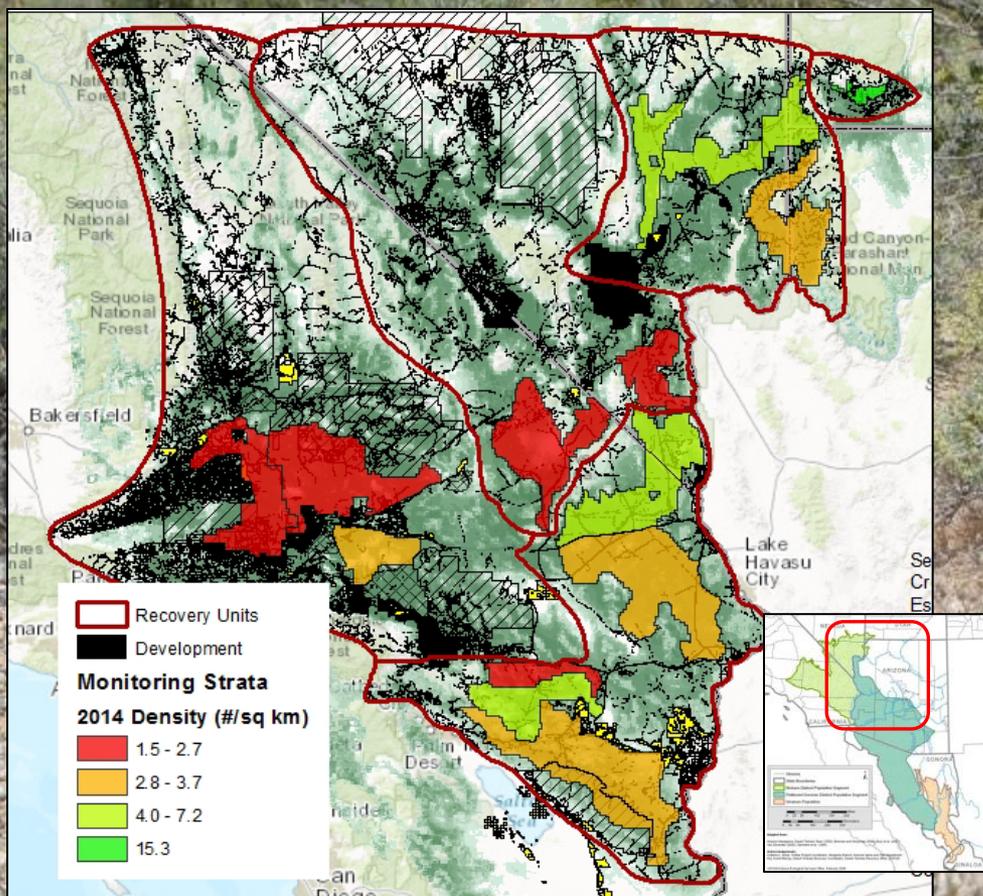


Stage	Indicators/metrics	Time frame
1. Survival & growth of released individuals	a. Disease vs. controls b. Survival vs. controls c. 50% recaptures d. Growth vs. controls	a. 5 years b. 5-10 years c. 5-10 years d. 5-10 years
2. Evidence of reproduction	a. Repro output vs. controls b. % Juveniles increasing	a. 5 years b. 10-15 years
3. Population growth	Increasing trend in adult population	15-20 years
4. Self-sustaining population	Adult density $\gg 4/\text{km}^2$ + $>25\%$ juveniles + founders decreasing % of adults	20-30 years

Miller et al. 2014. Conservation Biology 28:1045-1056.

Bell and Herbert. 2017. Journal of Herpetology 51:37-46.

Strategic population augmentation can build a bridge between mitigation translocations and species recovery



Questions?