Desert Tortoise
(*Gopherus agassizii*) Monitoring
2005-FWS-585A-P

Tortoise Monitoring Poses Difficulties

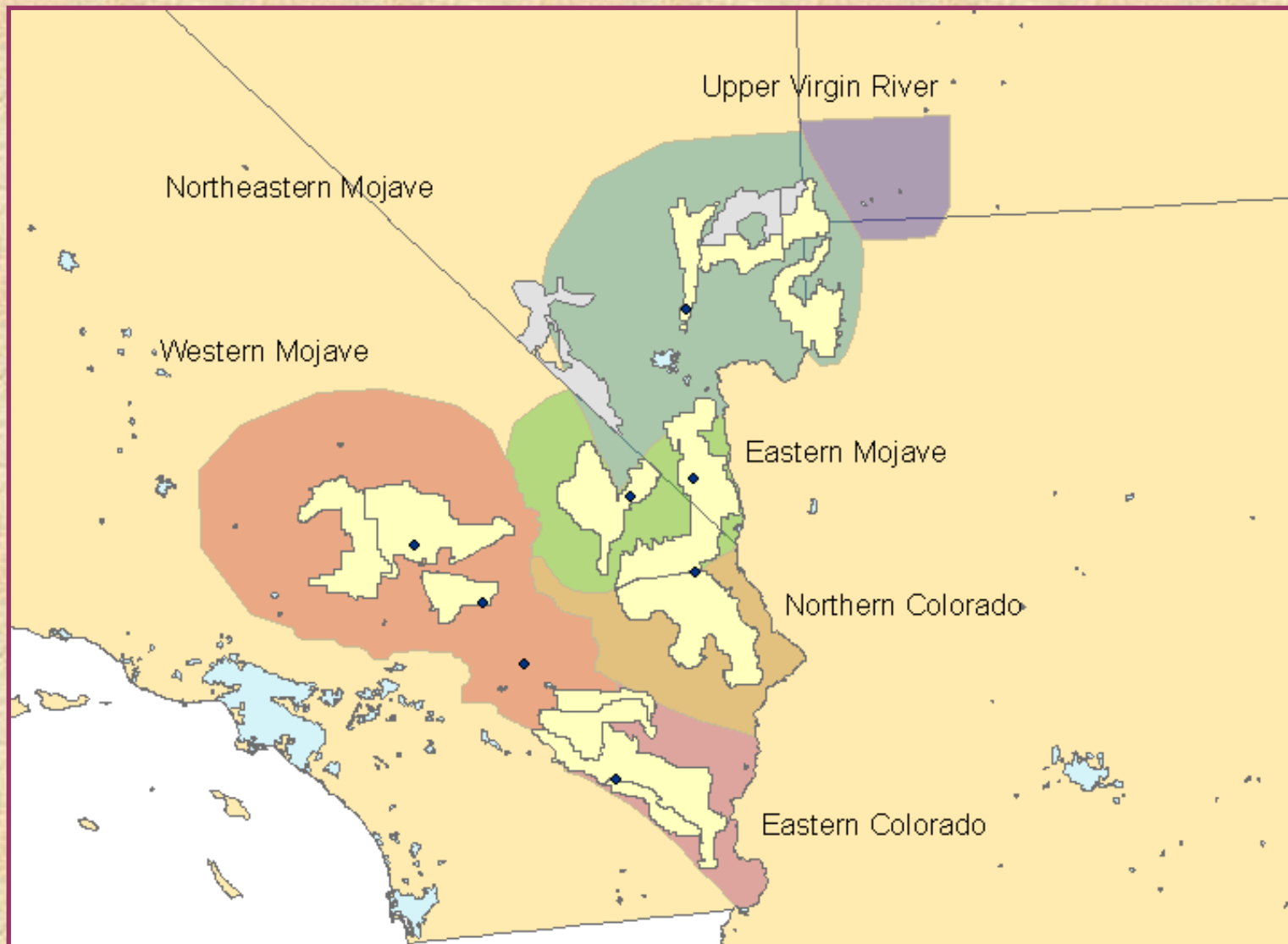# Tortoise Monitoring Poses Difficulties

- Often hidden in burrows

- Cryptic when on the surface

- Thinly spread across large areas of the desert

How to find enough to develop a reputable monitoring program?

Range-wide Monitoring Program

Benefits to the 2007-2008 Monitoring Effort

- **Interstate, interagency cooperators – the Management Oversight Group – adopted this approach in 2001**

- **Designed for desert tortoises (Anderson and Burnham 1996)**

- **Body of experience for**
  - **field data collection**
  - **independent quality control**
  - **database management**
  - **analysis**

- **2001-2005 data (USFWS 2006) provide a context**

- **Coordination**

Range-wide Monitoring Program

Transect placement 2007
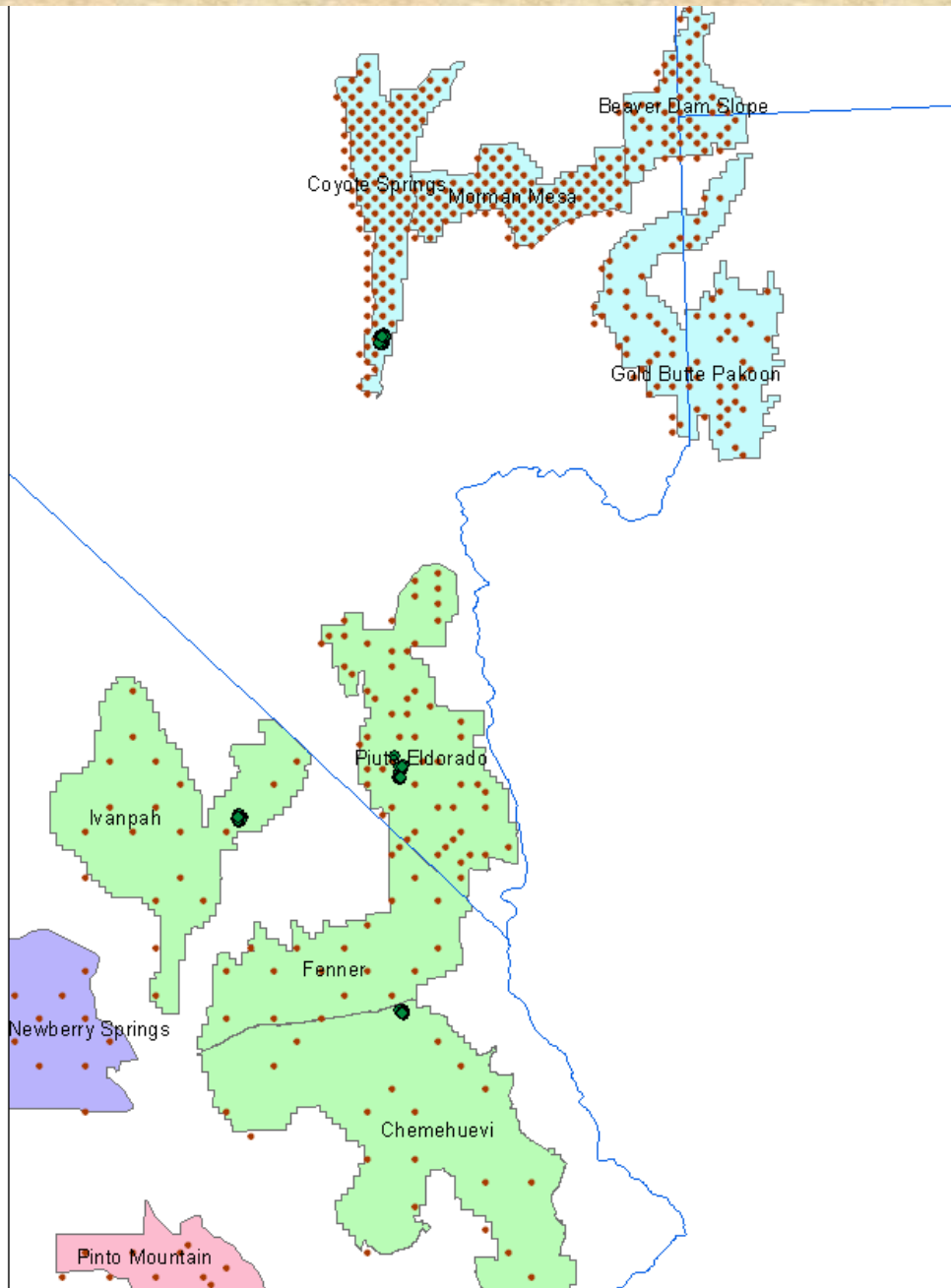
Goals

1. Training improvement

2. QAQC improvement

3. Enhance effectiveness and/or reduce cost of tortoise monitoring

4. Description of tortoise density, distribution, and habitat quality

Approach

1. Use the range-wide monitoring program to provide consistent quality control and assurance

2. Use existing data to identify efficient changes to improve precision of density estimate

3. Use supplemental data collected on monitoring transects to describe the spatial association between tortoises and sources of threat (roads, invasive grasses, etc.)

Goal 1: Training to improve data collection

Goal 1:
Training Modules

- Working on Public Lands
- Line Distance Sampling Theory
- Desert Tortoise Handling
- Navigation and Compass Use on Transects
- Electronic Data Collection
- Line Distance Sampling Field Methods
- G_0: Estimating Above-Ground Activity
- Database Forms and Fields
- Field Data Quality Control

Goal 2:
Quality Assurance / Quality Control

- Training to standards (UNR and FWS)

- Constraining data entry through design of collection database (UNR)

- Data verification (Great Basin Institute – field data crews for FWS)

- Weekly data validation (UNR)

- Final data validation (Mojave Desert Ecosystem Program – separate part of range-wide program)
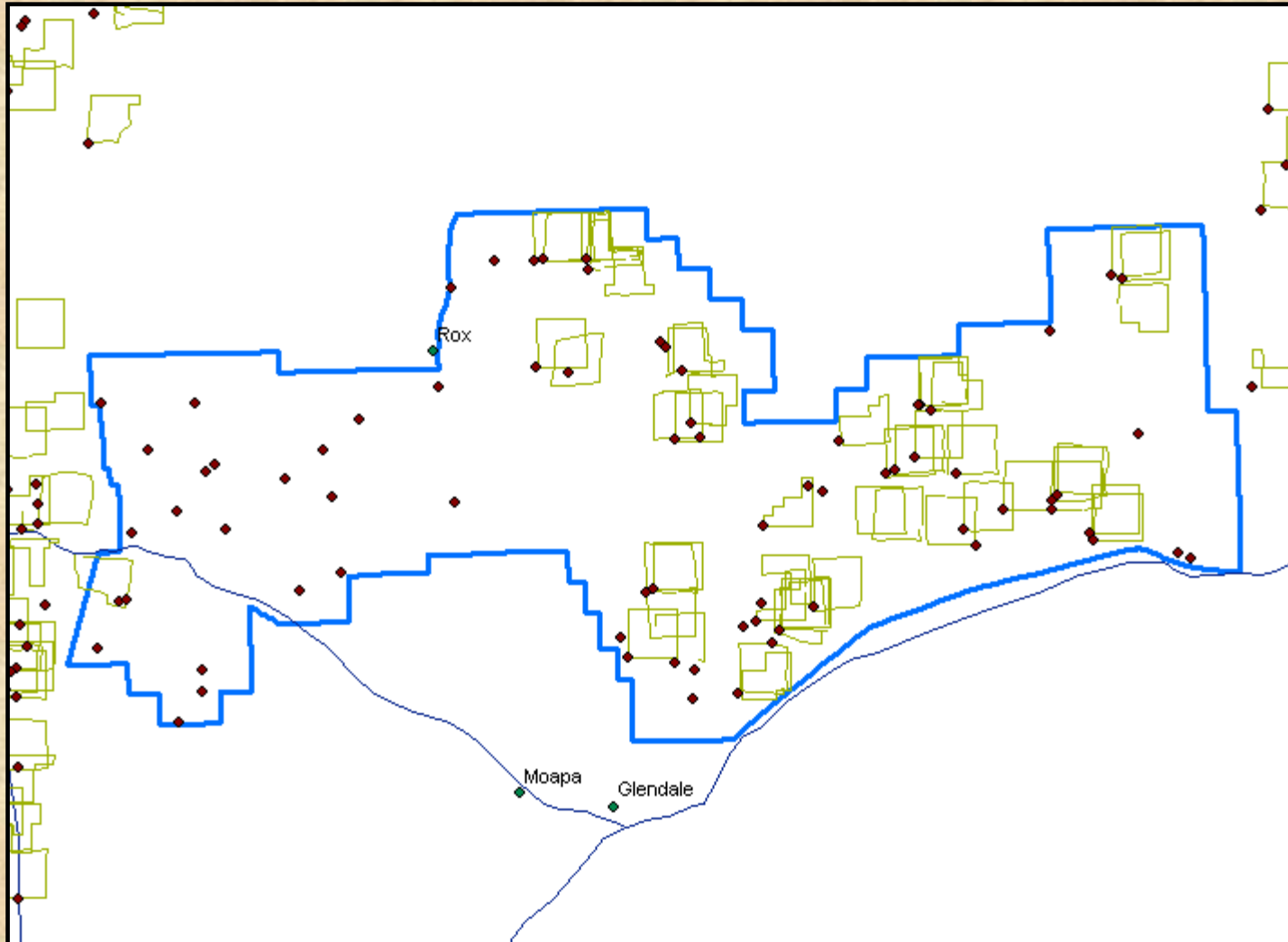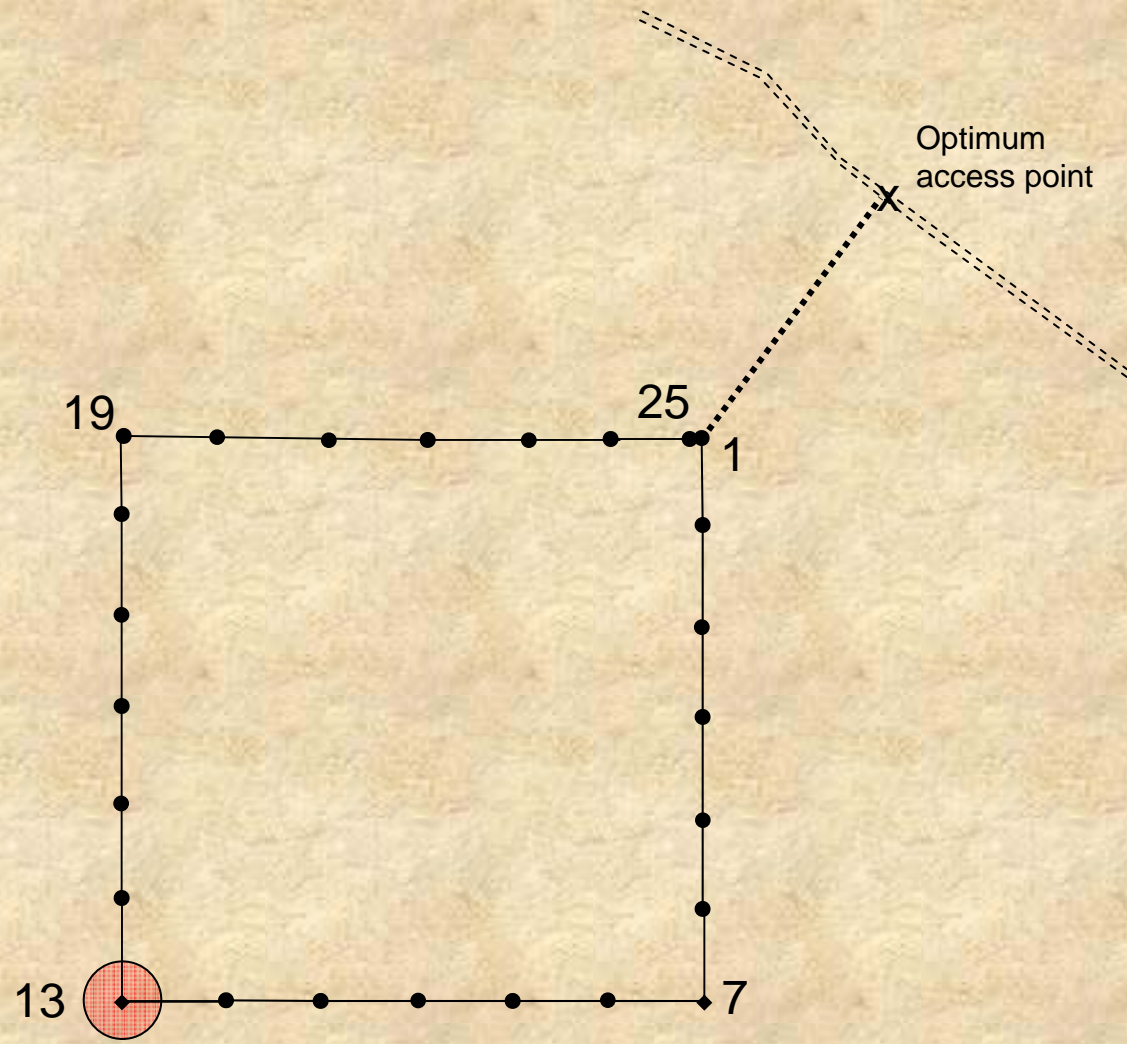
- Data analysis and usability (UNR)

Mormon Mesa 2004
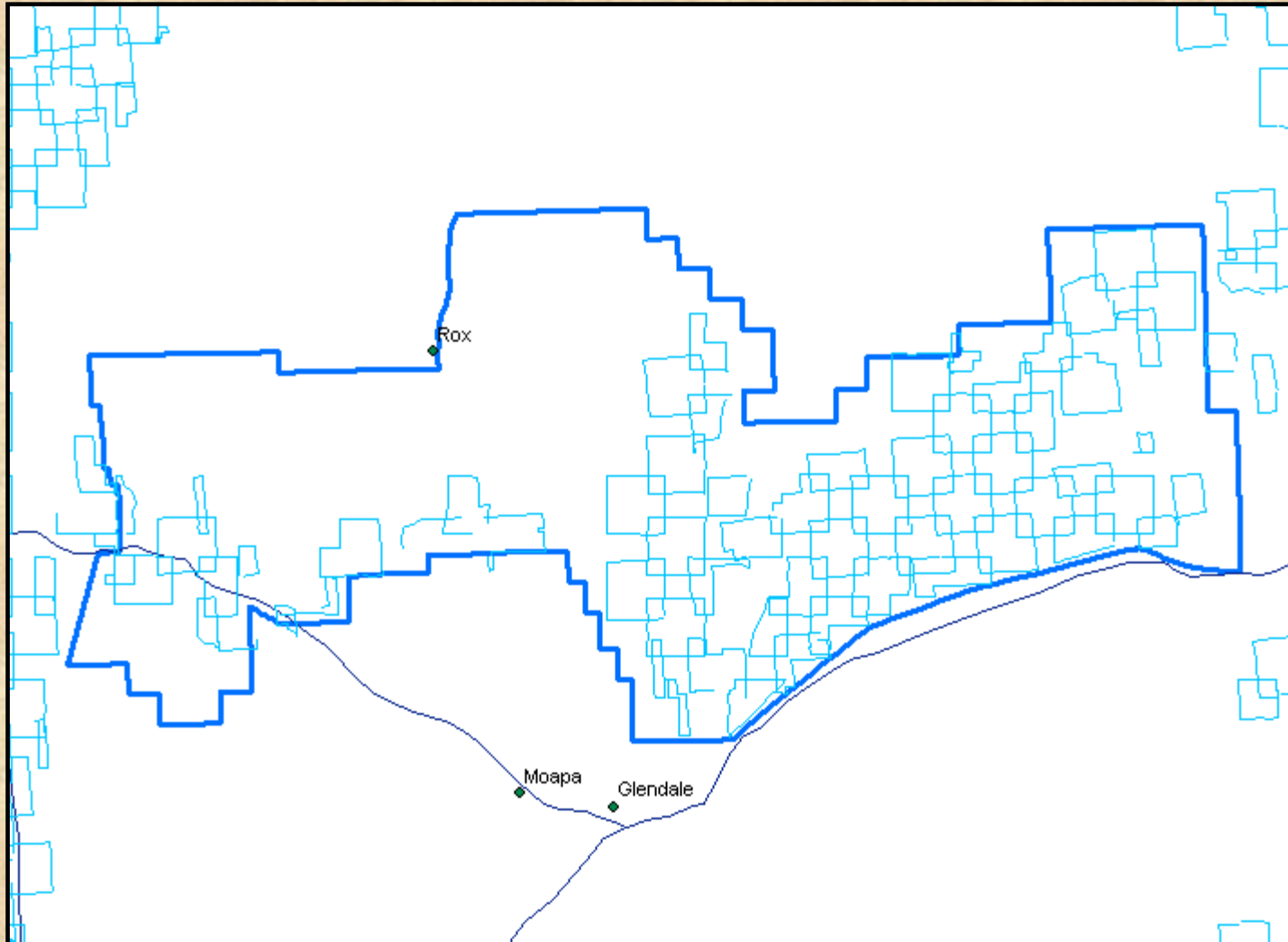## *Assigned*
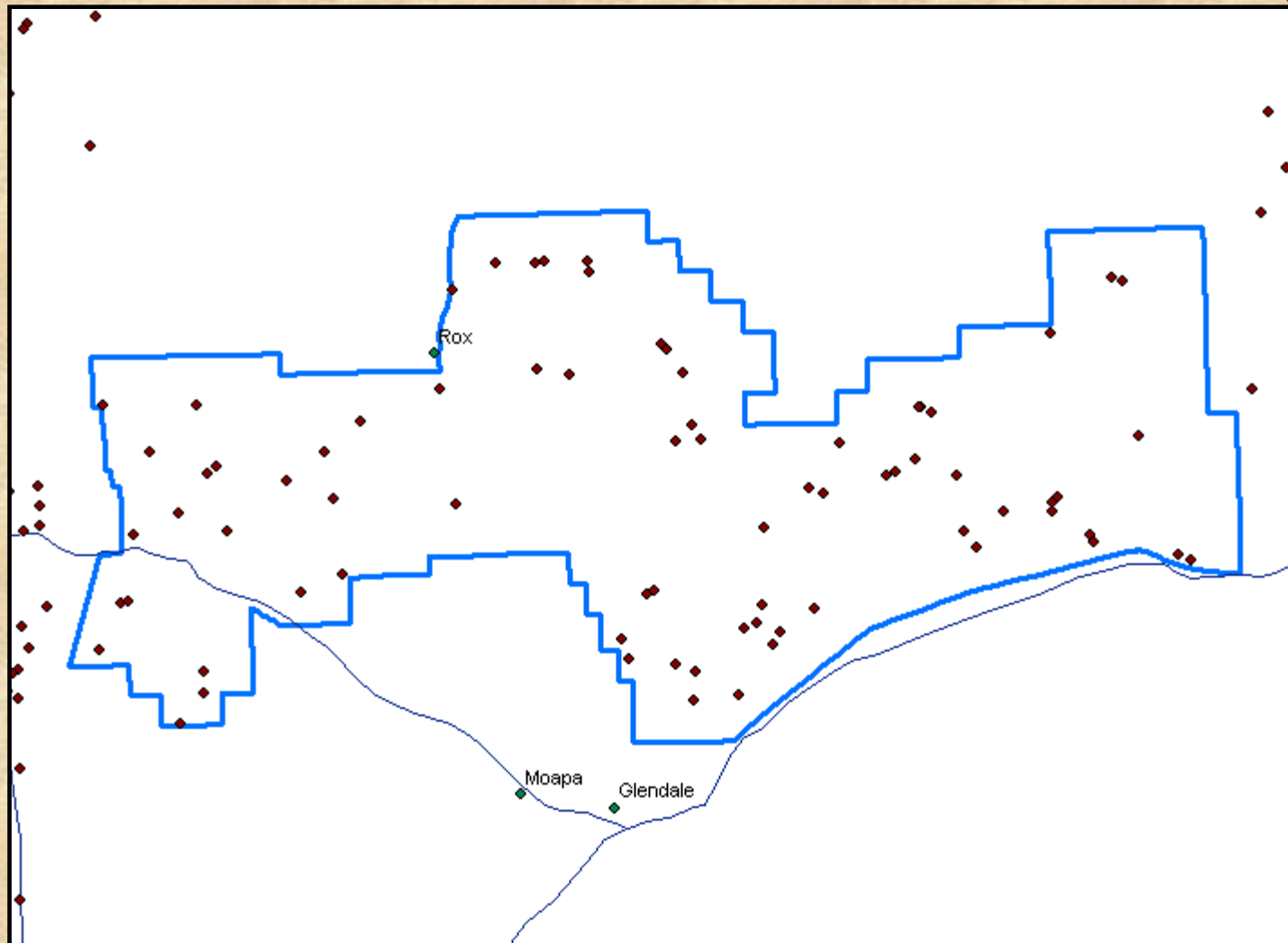
Mormon Mesa 2004
Assigned and Walked

Standard Transect

Optimum access point

19

25

1

13

7

Mormon Mesa 2007
## *Walked*

Goal 3: Cost effectiveness
Access in Roadless Areas

- Planning routes into difficult areas is time intensive

- Repeating transects from past years allows us to build on past-year experience

- In 2007, we first collected paper data on transect access and completion

- In 2008

  – moved to electronic format

  – Used base-camping in select areas to improve coverage

Mormon Mesa 2008
Walked
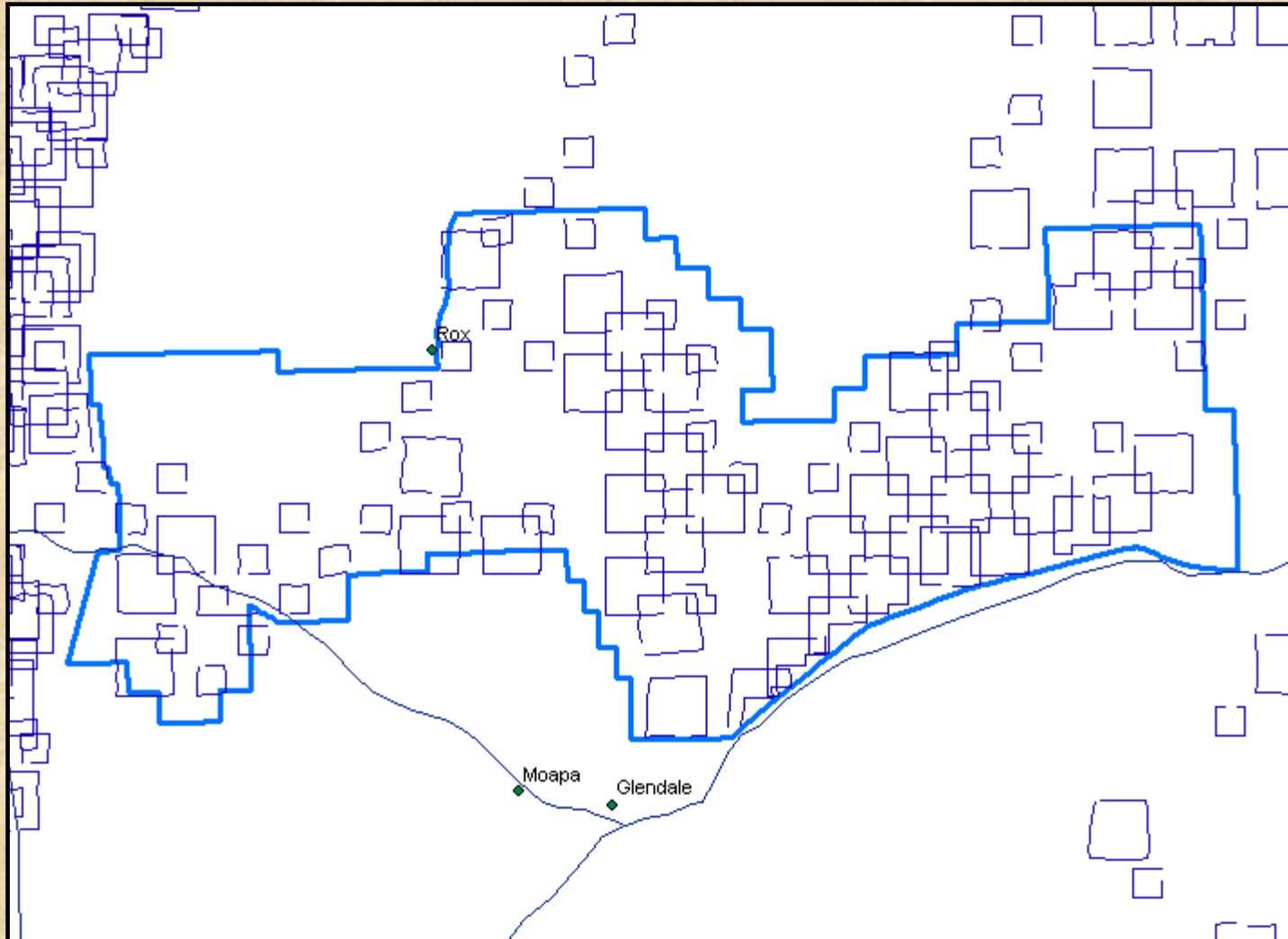
Goal 3: Effectiveness
Power to detect trends

Actual change per year	CV	Total Years	Power to detect change
-12%	0.15	4	0.78
+2%	0.15	25	1.00
+1%	0.15	25	0.86
+2%	0.35	25	0.72

Anderson and Burnham (1996)

Contributions to variability in 2005 density estimates

Detection probability	4.6%
Encounter rate	34.7%
G_0 (availability to count)	60.7%
	Total = 100%

Tortoise Burrows
What is "G0"?

Photograph: Eric White
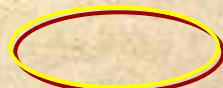
G_0 2005
Can we improve precision?

Recovery Unit	G_0 (mean)	G_0 (sd)*	Days
Eastern Colorado	0.66	0.16	52
Eastern Mojave	0.88	0.16	52
Northeastern Mojave	0.92	0.21	52
Northern Colorado	0.68	0.20	52
Western Mojave	0.91	0.10	52

Transect Completion by Area

Transects completed in one window of time

★ Tortoise above-ground activity monitoring area
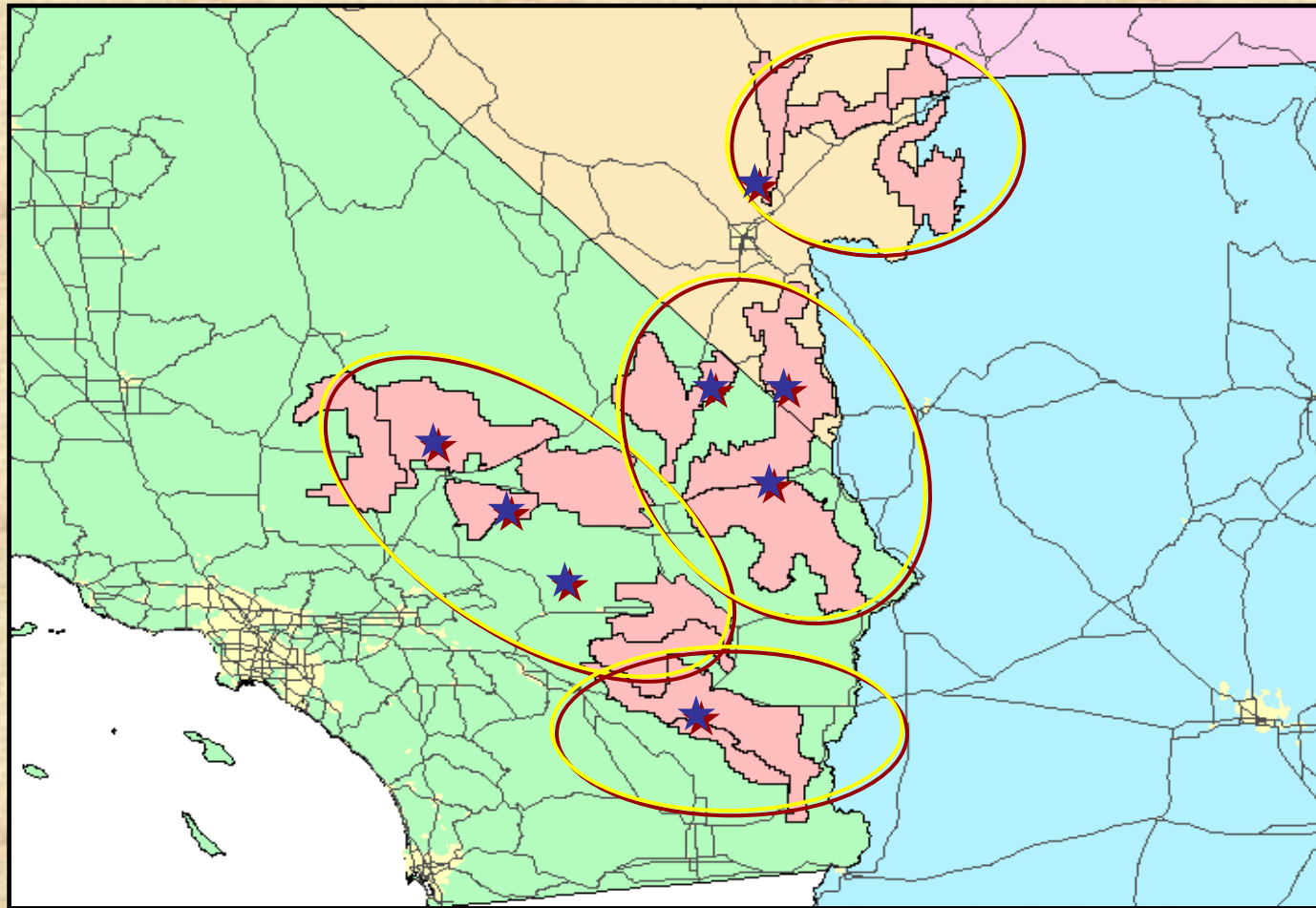
G_0 2007 and 2008
Did we improve precision?
Yes.

| Recovery Unit	2005	2007	2008	Days in 07, 08
Eastern Colorado	0.16	0.05	0.07	5
Eastern Mojave	0.16	0.13	0.07	12
Northeastern Mojave	0.21	0.12	0.13	37
Northern Colorado	0.20	0.10	0.37	3
Western Mojave	0.10	0.13	0.13	12

Goal 4: Estimate tortoise density and distribution, spatial description of threats

FWS role: Hire crews, oversee field data collection
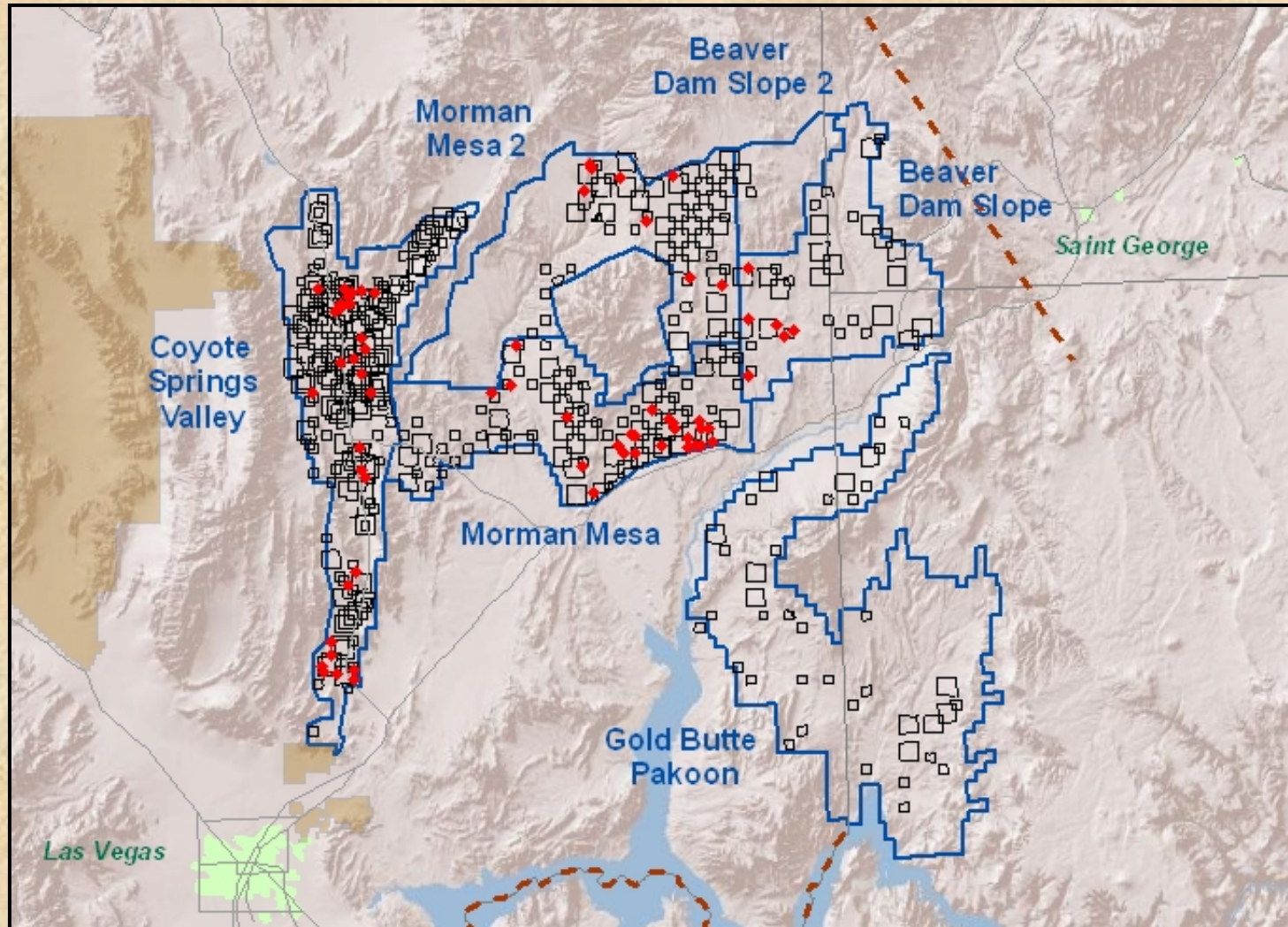UNR role: Analyze all data

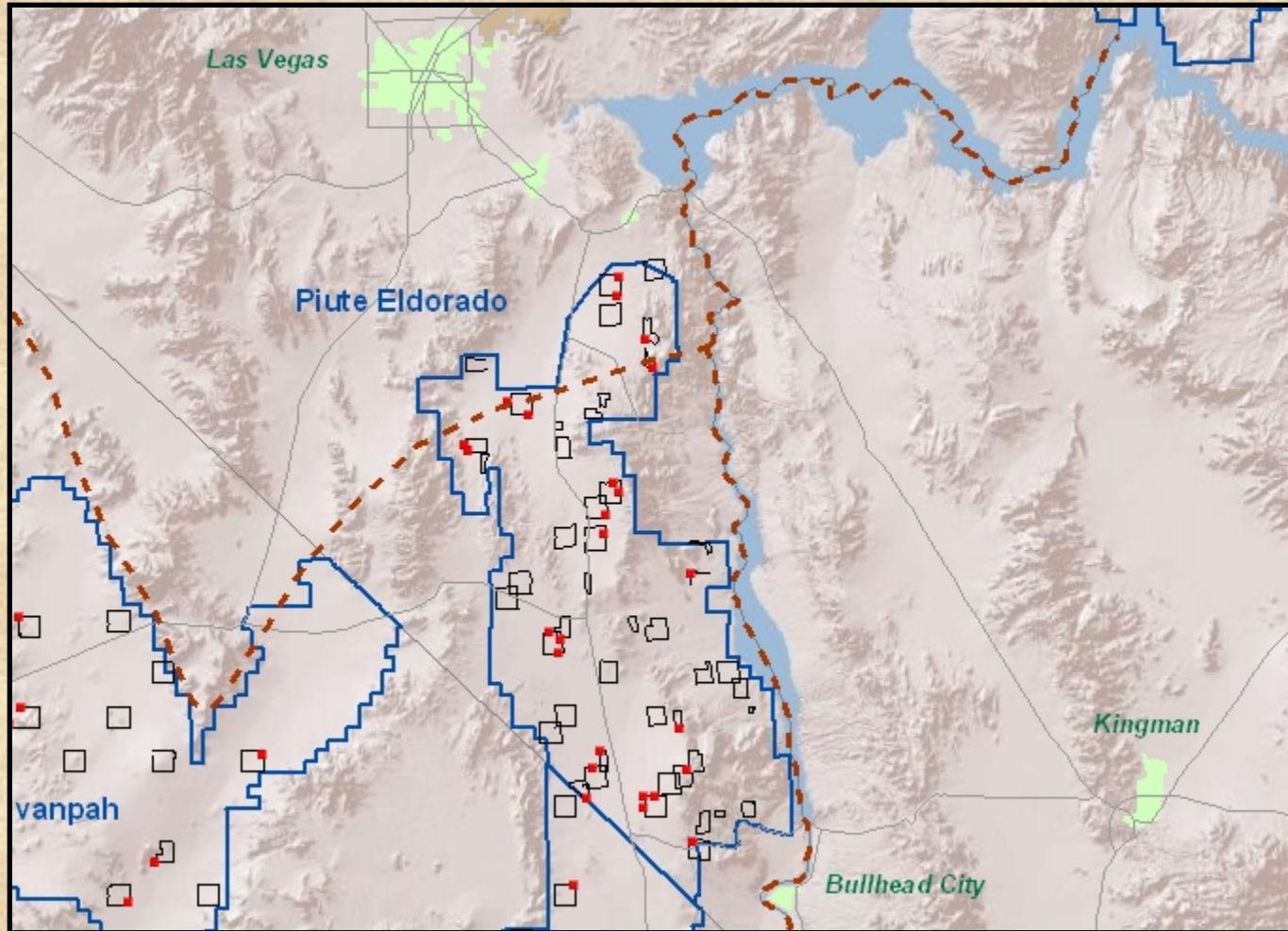# Transects and tortoises 2007
Northeastern Mojave
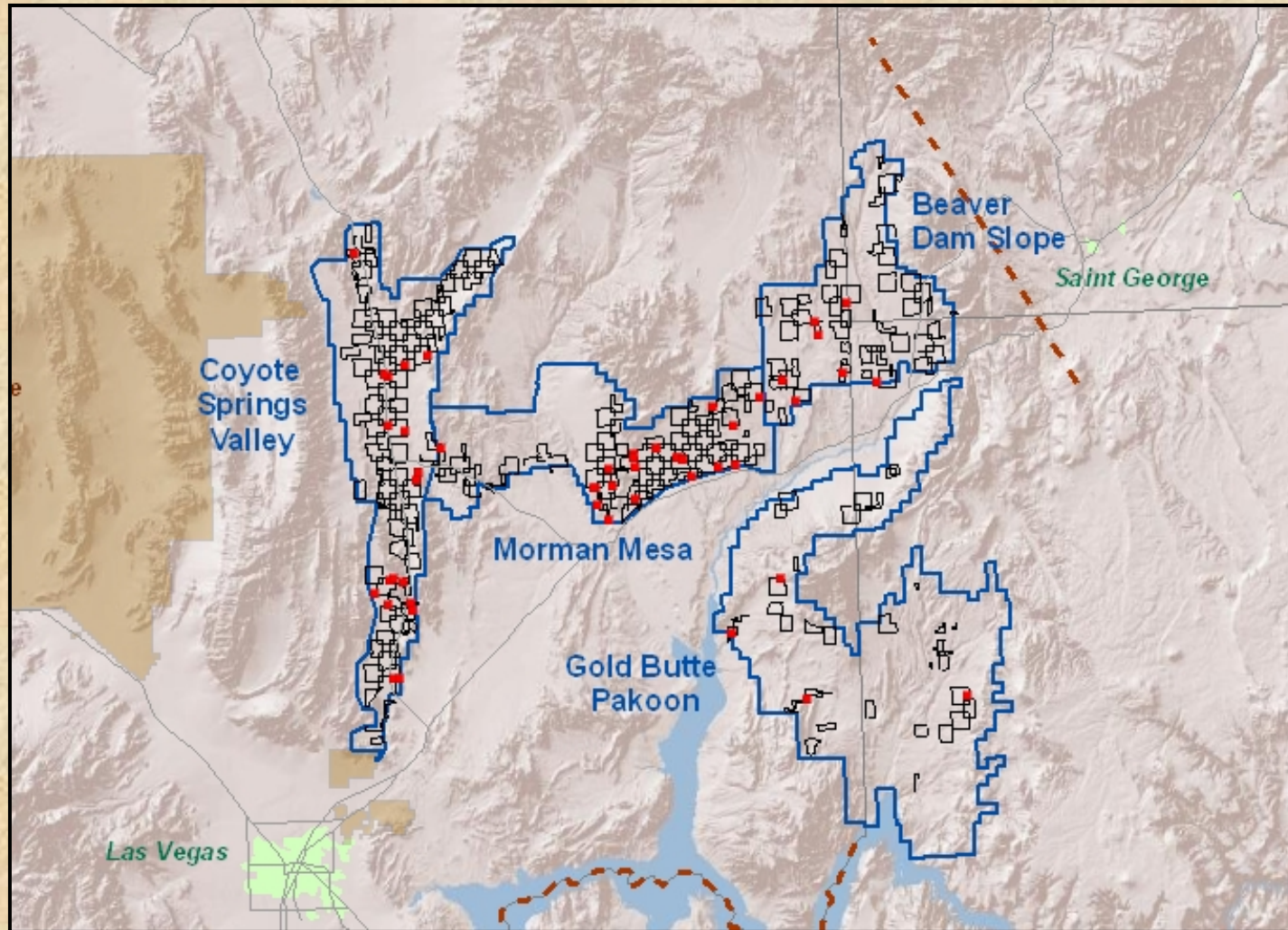
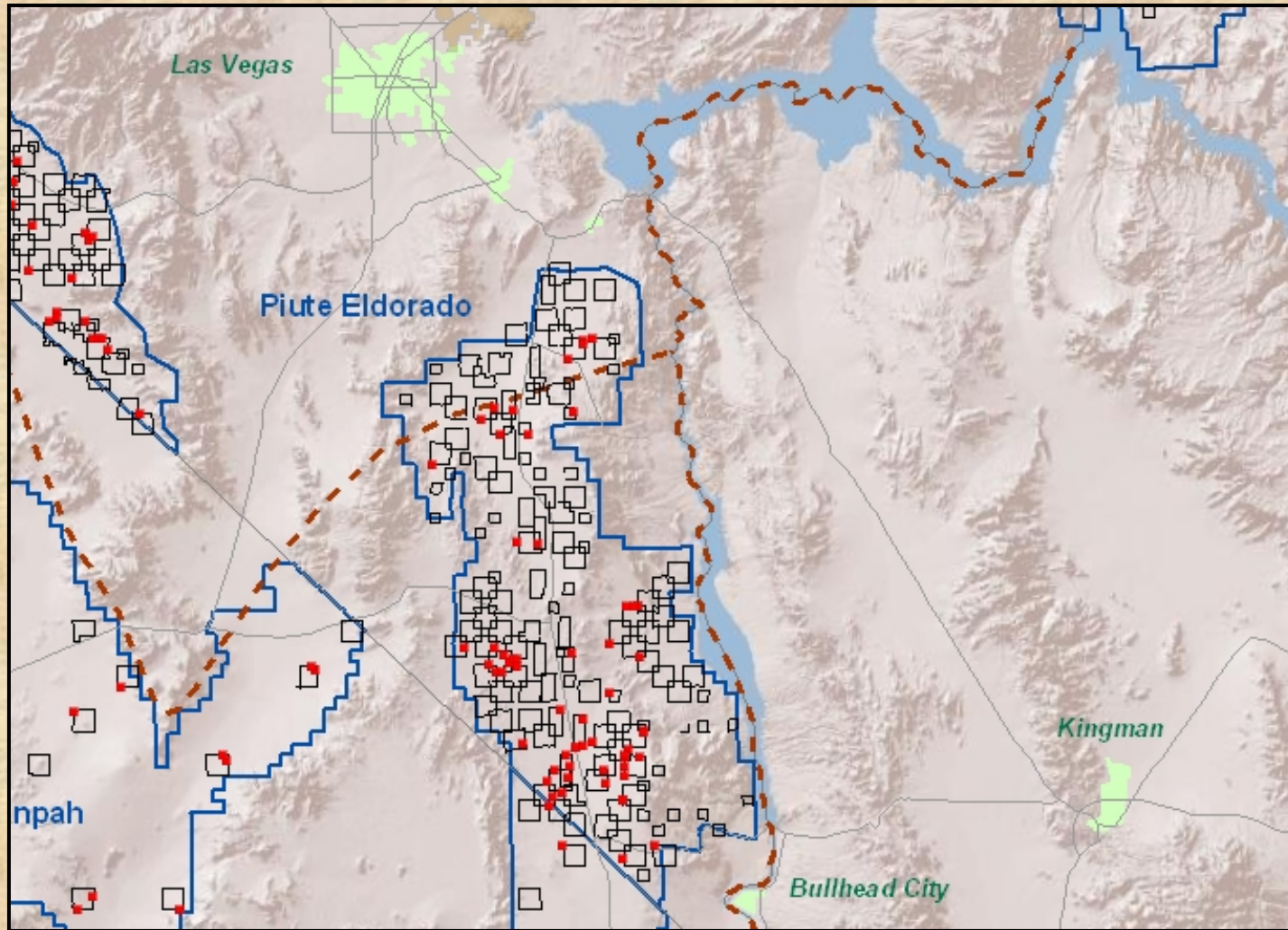# Transects and tortoises 2008
Northeastern Mojave

Transects and tortoises 2007
Piute-Eldorado Valleys

Transects and tortoises 2008
Piute-Eldorado Valleys

Results – 2007

http://www.fws.gov/nevada/desert_tortoise/reports

Monitoring Stratum		Kilometers walked	Tortoises	Tortoises per km^2	%CV	LL	UL
Northeast Mojave		2316.1	46	1.9	26.5	1.12	3.11
Beaver Dam Slope	BD	478	6	1.3	35	0.52	3.26
Coyote Springs	CS	917.9	14	1.6	23	0.88	2.85
Gold Butte-Pakoon	GB	299.7	4	1.4	33	0.58	3.29
Mormon Mesa	MM	620.5	22	3.7	20	2.23	6.09
Eastern Mojave		803.9	34	5.3	24.7	3.32	8.61
Fenner	FE	178.2	10	7.1	21	3.78	13.64
Ivanpah	IV	180.1	4	3.5	48	4.12	12.25
Piute-Eldorado	PI	445.6	20	4.6	22	2.69	7.87

Nevada Monitoring Strata 2008

Recovery Unit	Long-term Monitoring Stratum	One-year monitoring stratum	County
Northeast Mojave	Beaver Dam Slope (BD)	[Supplemental transects]	Clark (partial)
	Coyote Springs (CS)		Clark (partial)
	Gold Butte/Pakoon (GB)		Clark (partial)
	Mormon Mesa (MM)		Clark (partial)
		Beaver Dam Slope 2 (BD2)	Lincoln
		Mormon Mesa 2 (MM2)	Lincoln
Eastern Mojave	Piute-Eldorado (PI)		Clark
		Pahrump North (PN)	Nye
		Pahrump South (PS)	Nye
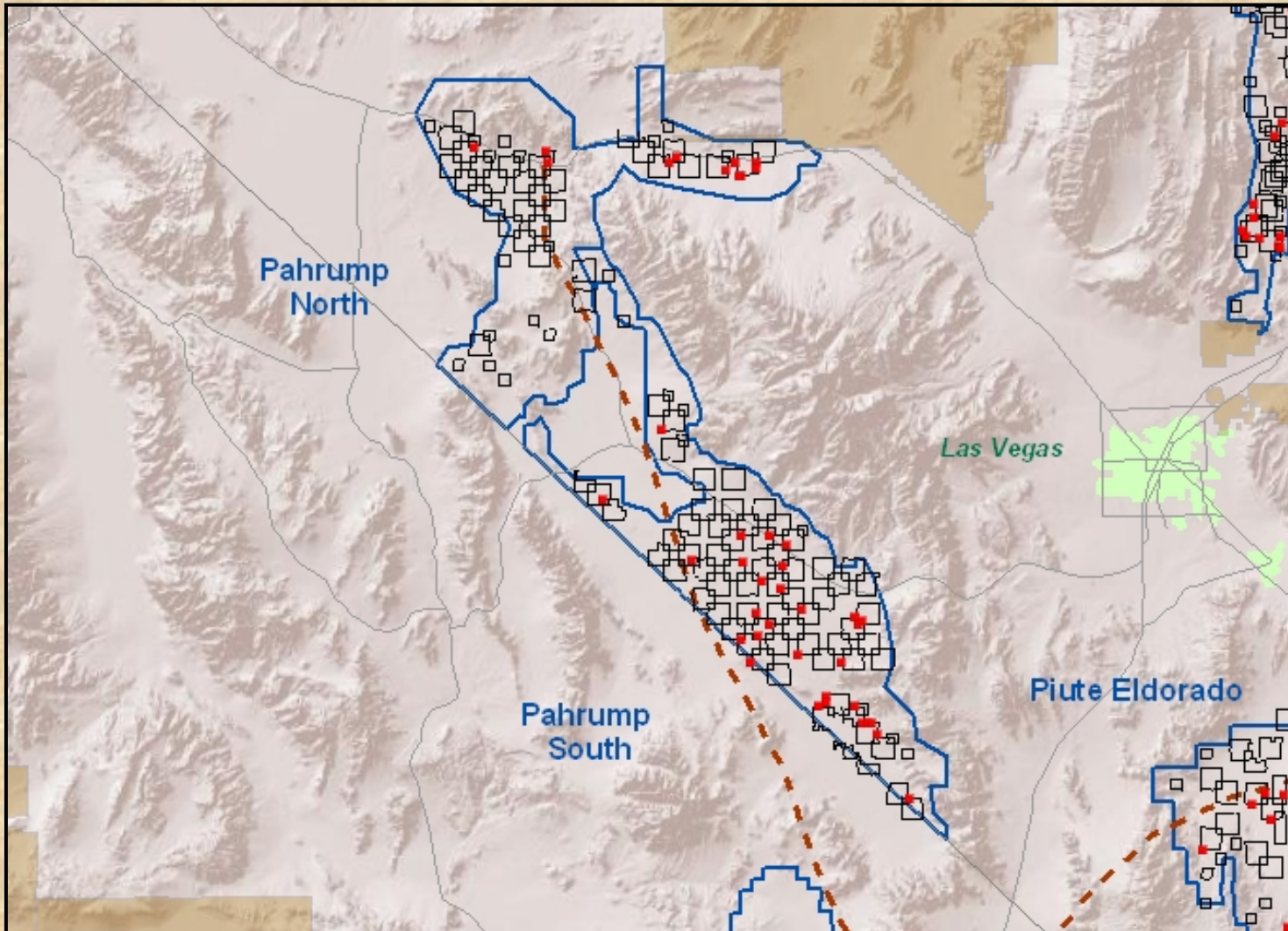
Deliverables/Milestones completed 2007

- Field Season Summary Report

- Range-wide QAQC and database completed

- Range-wide density analysis completed

Deliverables/Milestones
Completed in 2008 and 2009

- Contract mobilization
- Pre-field season inventory
- Development of Monitoring Handbook
- All permits in place
- Training of field monitors
- Monitoring season
- Post-field season inventory

- 2008 data products
- Report on 2008 season
- Density analysis
- Review UNR spatial assessment of threats and tortoises
- Review UNR predictive tortoise activity model
- Final Project Report

Progress on Goals

- Improve training

    – **Objective-driven training and practice**

- Improve QAQC

- Enhance effectiveness and/or reduce cost of tortoise monitoring

- Describe tortoise density, distribution, and habitat quality

Progress on Goals

- Improve training

- Improve QAQC

  – **Adopt quality assurance measures (training, weekly data evaluation, field season debriefings)**

- Enhance effectiveness and/or reduce cost of tortoise monitoring

- Describe tortoise density, distribution, and habitat quality

Progress on Goals

- Improve training

- Improve QAQC

- Enhance effectiveness and/or reduce cost of tortoise monitoring

  – **Reduce bias through training, completion strategies, access planning**

  – **Improve precision by completing transects in a narrow time window to tighten estimate of tortoise activity levels**

- Describe tortoise density, distribution, and habitat quality

Progress on Goals

- Improve training

- Improve QAQC

- Enhance effectiveness and/or reduce cost of tortoise monitoring

- Describe tortoise density, distribution, and habitat quality

  - **Clark County 2007 and 2008 tortoise densities (UNR)**

  - **Research on tortoise distribution in association with threats, tortoise activity modeling (UNR)**

  - **Sub-stratum collected for Coyote Springs Valley and burned/unburned areas of Lincoln County**

Work Plan
for Project Completion

- Our final report has been submitted!

How Future Related Projects Will Be Affected

- Full-team field season debriefings each year

- Data management planning involving all levels of data handlers

- Objective-driven training – training and competency can be evaluated

- Potential to integrate annual research projects

- Transect layout carries over year to year to improve access planning