



# PYGMY RABBIT POPULATION MONITORING

PINEDALE ANTICLINE PROJECT AREA  
and  
BOULDER REFERENCE AREA, 2010



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# Monitoring Requirements

- Wildlife Monitoring and Mitigation Matrix, 2008 ROD:
- “3 consecutive years of decline in presence or absence of a species,  
or  
an average of 15% decline in numbers of individuals each year over 3 years”
- **Site-occupancy analysis** (MacKenzie et al. 2006)

# Site-Occupancy Analysis (MacKenzie et al 2006)

- “Most powerful tool available for monitoring presence/absence” (UW Coop Fish and Wildlife review)
- Occupancy will be correlated with population size
- Accounts for effect of detection probability
- Generates unbiased estimates of occupancy

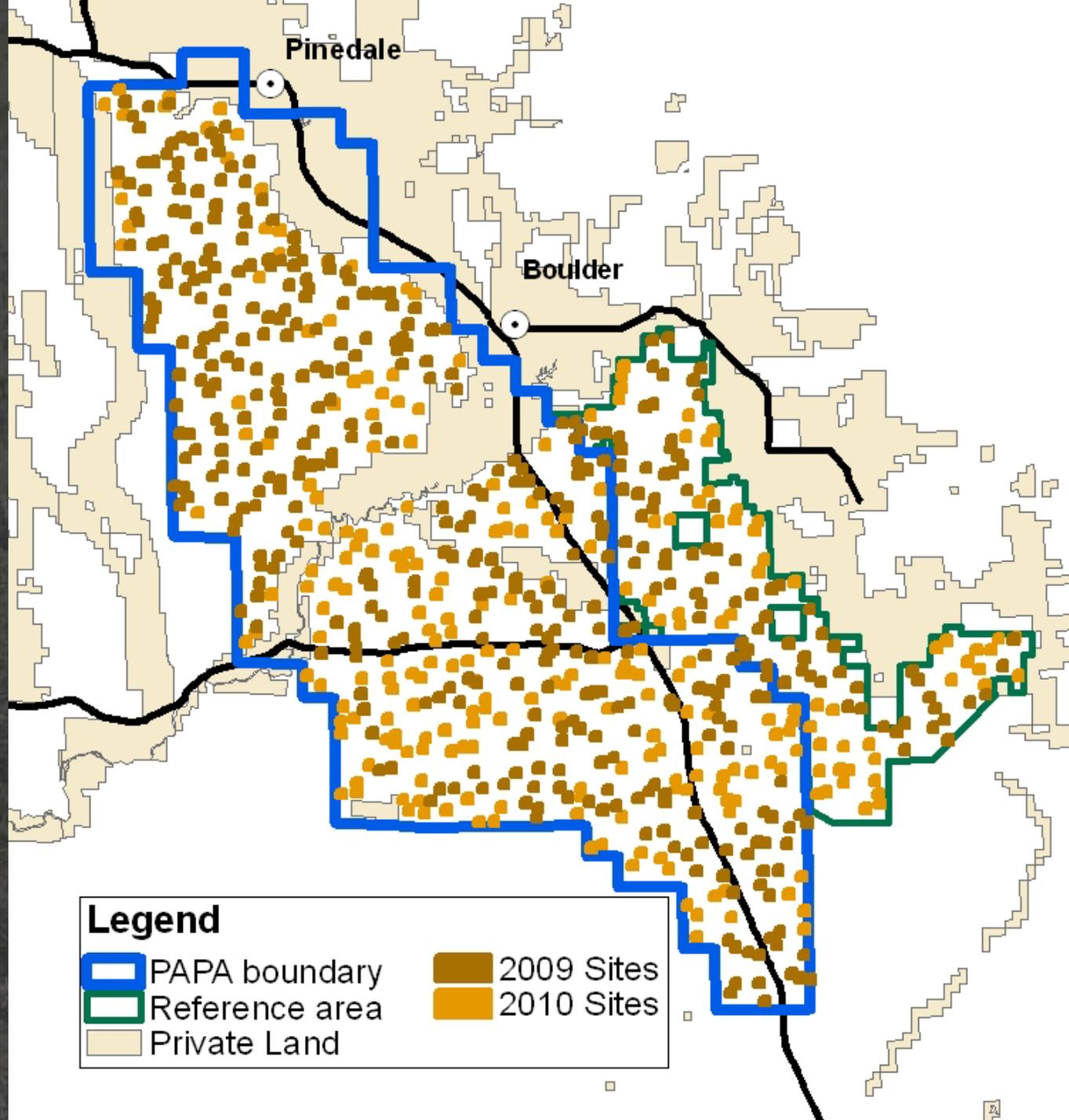
# Monitoring Objectives:

- Document pygmy rabbit burrow complexes within survey sites
- Determine pygmy rabbit occupancy
- Suggest recommendations for monitoring in 2011 and beyond

# METHODS

## Sampling Design

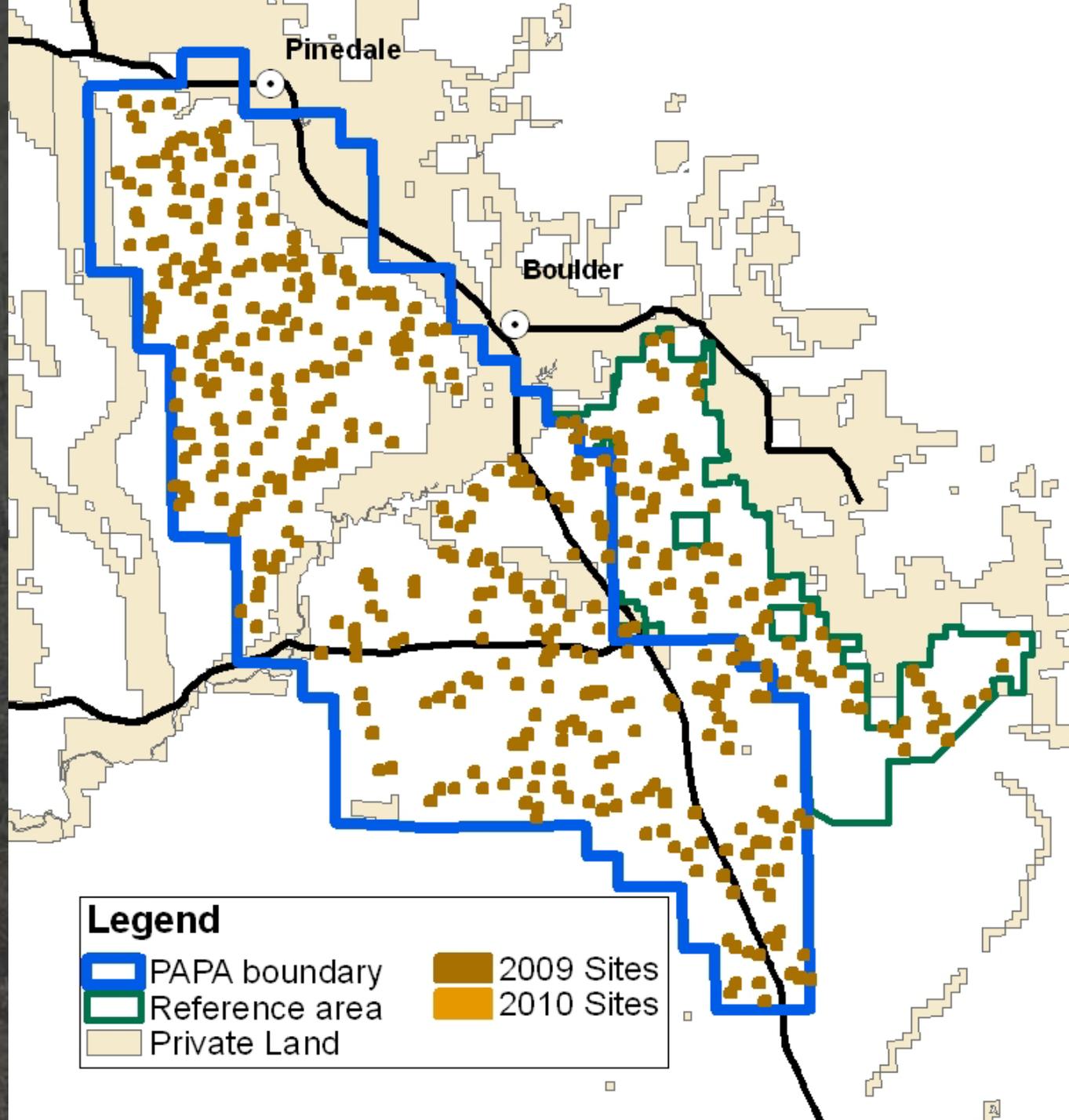
- 696 sites
- 582 in PAPA
- 114 in Boulder Reference Area



# METHODS

## Sites Surveyed 2009

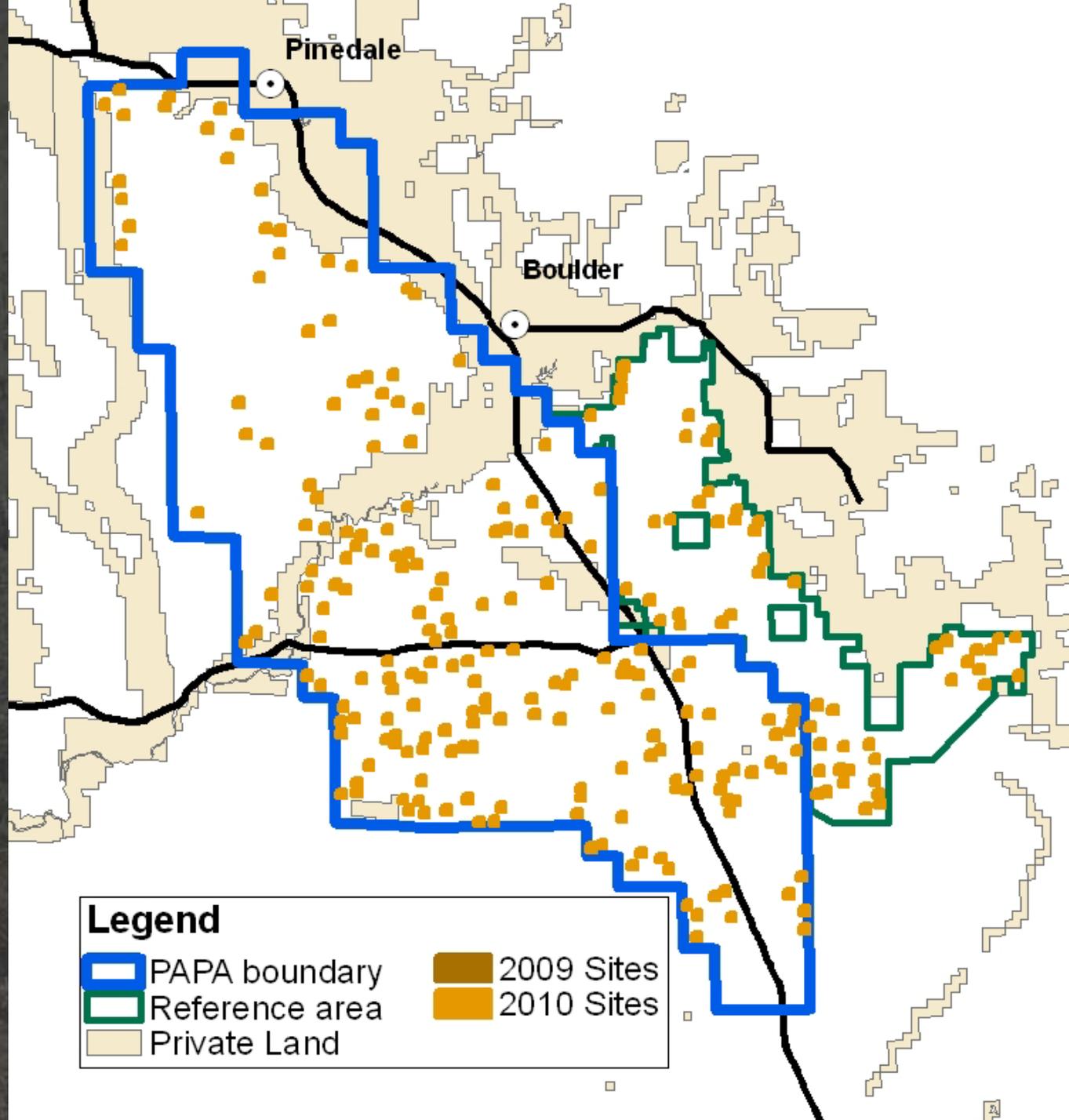
- WYNDD surveyed 444 sites
- (1 visit each site)



# METHODS

## Sites Surveyed 2010

- HWA surveyed the remaining 252 sites
- (2 visits each site)

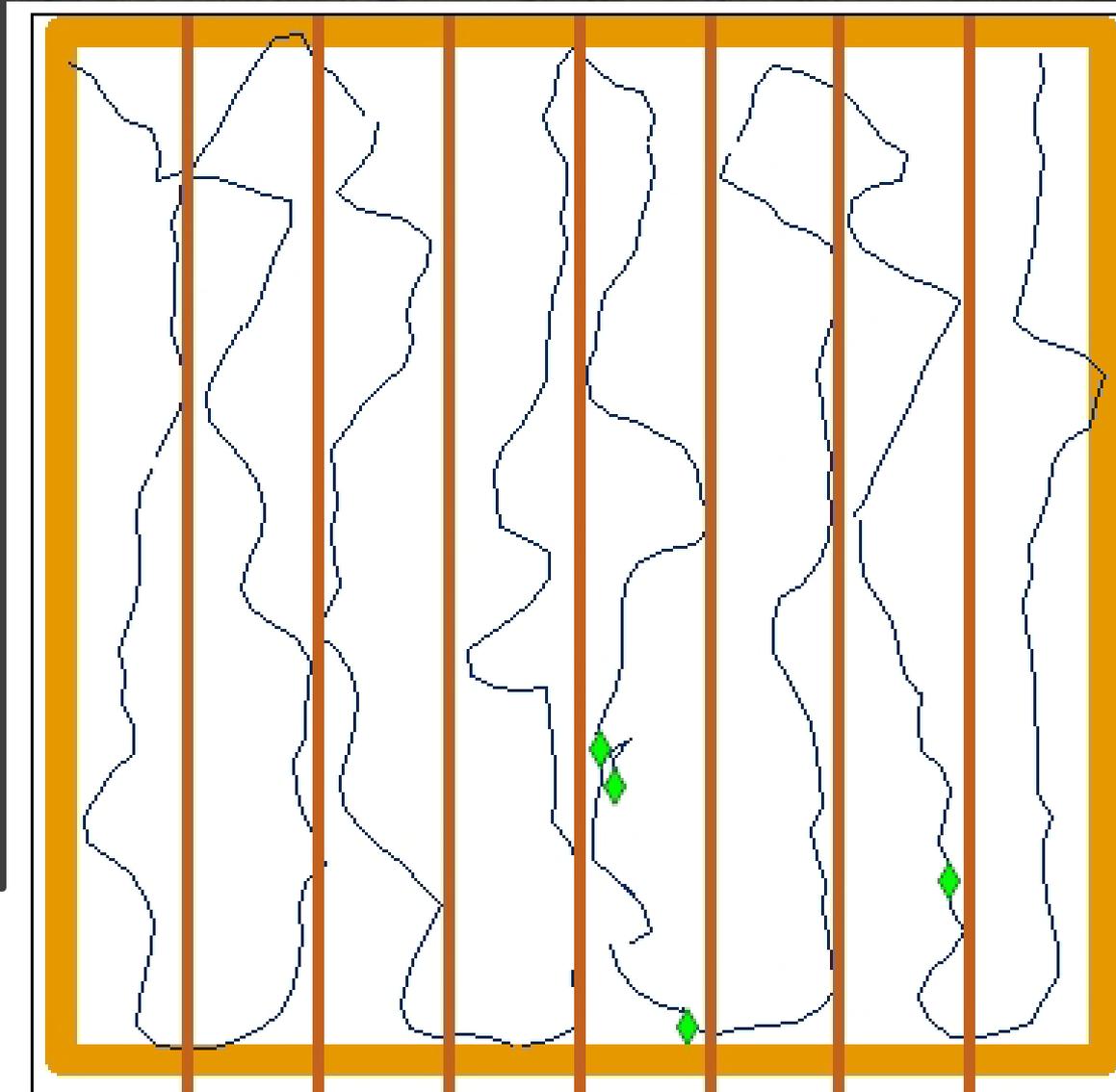


# METHODS: Survey Protocol 2010

- Each site 400 m x 400 m
- 8 Belt transects, 50 m wide
- Survey Visit 1:
  - Document complexes
  - Record presence/absence

## Legend

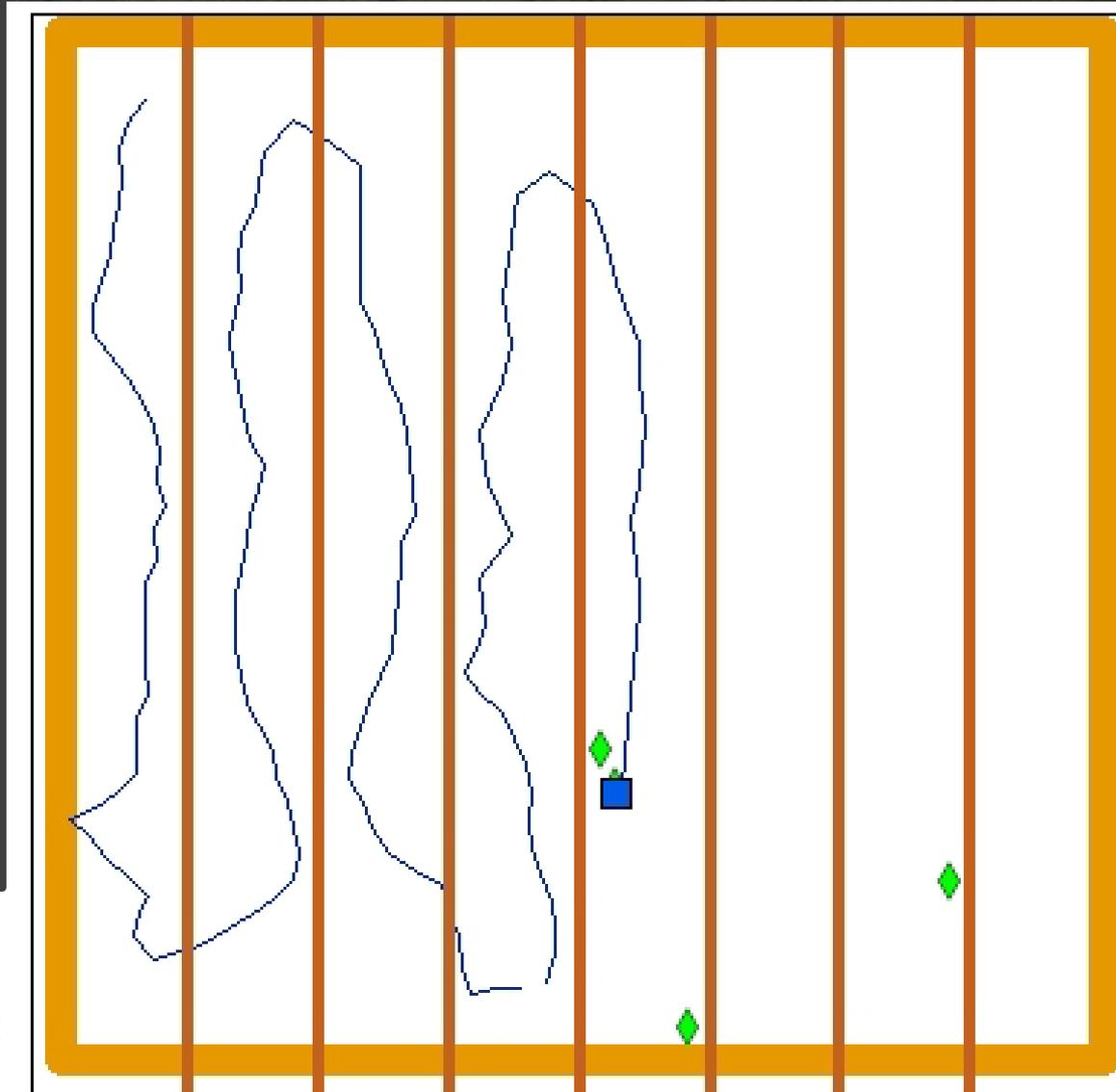
- Survey Route
- ◆ Pygmy Rabbit Complex



# METHODS: Survey Protocol 2010

- Each site 400 m x 400 m
- 8 Belt transects, 50 m wide
- Survey Visit 2:
  - Record presence/absence

- Survey Route
- ◆ Pygmy Rabbit Complex
- Presence/Absence Point



# Identification of pygmy rabbit presence



# Identification of pygmy rabbit presence

- Use Fresh sign (positively < 1 year)
- Don't use Old sign (possibly > 1 year)



# Methods: Occupancy Analysis

- Occupancy Estimation (MacKenzie et al. 2002)
- Program MARK (White & Burnham 1999)
- Detection may or may not vary among groups, surveys, date...so
- Evaluated 9 a priori models with AICc (Burnham & Anderson 2002)
- Separate occupancy estimates for PAPA & Reference
- Allowed survey date to influence detection and occupancy

# Methods: Power Analysis

- Determine sample size for multi-year analysis (MacKenzie and Royle 2005)
- Meet criterion in 2008 ROD
- 95% probability of detecting a 15% decline in occupancy in PAPA relative to Reference Area

# Results: documentation of pygmy rabbit complexes

- 907 total complexes
- 68% active in PAPA ; same in Reference Area
- PAPA avg 2.22 complexes per site
- Reference avg 2.59 complexes per site



# Results: Occupancy Model Comparison

	Model <sup>1</sup>	AIC <sub>c</sub>	ΔAIC <sub>c</sub> <sup>2</sup>	AIC <sub>c</sub> w <sup>3</sup>	K <sup>4</sup>	Deviance
1:	{Ψ(group, date) p(survey)}	542.98	0.00	0.546	6	530.64
2:	{Ψ(group, date) p(survey, date)}	543.60	0.61	0.401	8	527.00
3:	{Ψ(group) p(survey, date)}	549.18	6.20	0.025	6	536.84
4:	{Ψ(group) p(survey)}	550.13	7.15	0.015	4	541.97
5:	{Ψ(group, date) p(group, survey, date)}	551.09	8.11	0.009	12	525.79
6:	{Ψ(group) p(group, survey)}	553.14	10.16	0.003	6	540.80
7:	{Ψ(group) p(group, survey, date)}	556.57	13.59	0.001	10	535.66
8:	{Ψ(group) p(.)}	579.11	36.13	0.000	3	573.01
9:	{Ψ(group) p(group)}	580.91	37.93	0.000	4	572.75

# Results: Occupancy and Detection

- OCCUPANCY:
  - 79% in PAPA (95% CI = 73-85%)
  - 82% in Reference Area (95% CI = 68-91%)
- DETECTION:
  - 75% during survey visit 1 (95% CI = 68%-81%)
  - 95% during survey visit 2 (95% CI = 89-98%)

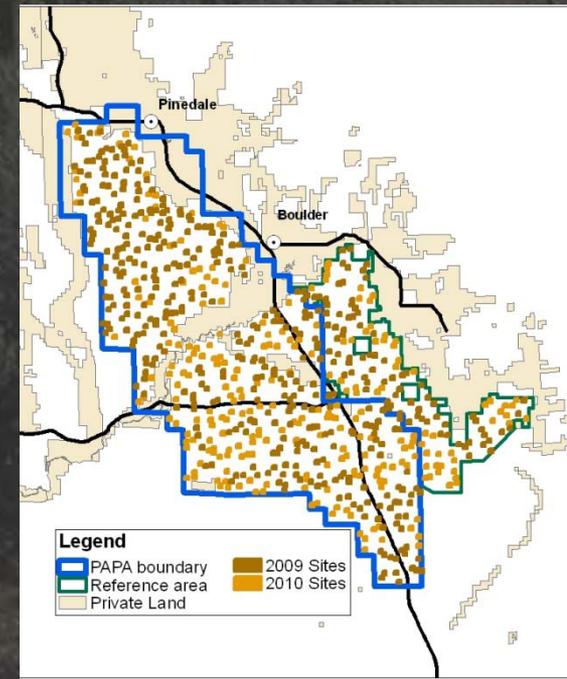
# Results: Importance of Survey Date

- Plots surveyed later in season had higher occupancy
- 2-week difference in date led to difference in Occupancy of 9% in PAPA & 38% in Reference Area

Parameter	Estimate ( $\beta$ )	SE	95% CI	
			Lower	Upper
PAPA $\Psi$ Intercept	-7.122	5.363	-17.635	3.390
PAPA Date effect on $\Psi$	0.034	0.022	-0.008	0.077
Reference $\Psi$ Intercept	-38.586	14.803	-67.599	-9.573
Reference Date effect on $\Psi$	0.163	0.061	0.044	0.282
Survey 1 $p$ Intercept	2.104	3.631	-5.013	9.222
Survey1 Date effect on $p$	-0.004	0.015	-0.034	0.026
Survey 2 $p$ Intercept	-17.203	10.747	-38.267	3.861
Survey 2 Date effect on $p$	0.082	0.044	-0.005	0.169

# Discussion & Recommendations: Sample Size

- Power Analysis: 390 sites sufficient
- Best design: balanced (195 each area)
- Size of current reference area limits to 114 sites
- Adequate design: all 114 Reference sites  
and  
276 PAPA sites



# Discussion & Recommendations: Date Effect & Juvenile Dispersal

- Occupancy increased as season progressed (Aug 4-  
Sep 13)
- Field observations suggest juvenile dispersal



# Discussion & Recommendations: Survey Date Implications

- Survey Season
  - Late Summer: dispersal...but still best?...
  - Fall/Winter: best biologically but logistically expensive
  - Spring/early summer: ♀ scat large & confusing, ♂ home ranges large
- BE CONSISTENT
  - Consistency among years
  - Consistency between PAPA and Reference



# Discussion & Recommendations: Other Considerations

- Consistent Observer skill/training
- Consistent Search Effort
- Analysis: MARK, Robust Design Occupancy (Mackenzie et al. 2003)
  - Does not assume independence between years
  - Explicitly accounts for local extinction & colonization rates, and detection
  - Estimates occupancy & change in occupancy

# Review

- Occupancy Analysis accounts for detection: yields unbiased Occupancy estimates.
- Occupancy = 79% in PAPA & 82% in Reference
- Maintain consistent survey dates among years & between study areas.
- Sampling design can be reduced from 696 sites to 390 sites



# Questions?



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