



Ecology of Montezuma Quail in the Davis Mountains of Texas

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Introduction

Montezuma quail (*Cyrtonyx montezumae*) are one of 4 quail species found in Texas. They are a desert quail species and an indicator species for pine-oak woodlands. Little information is known about the life history. Much of the information known on Montezuma quail is anecdotal and outdated. Only 2 other studies have been conducted using radio telemetry on this species.



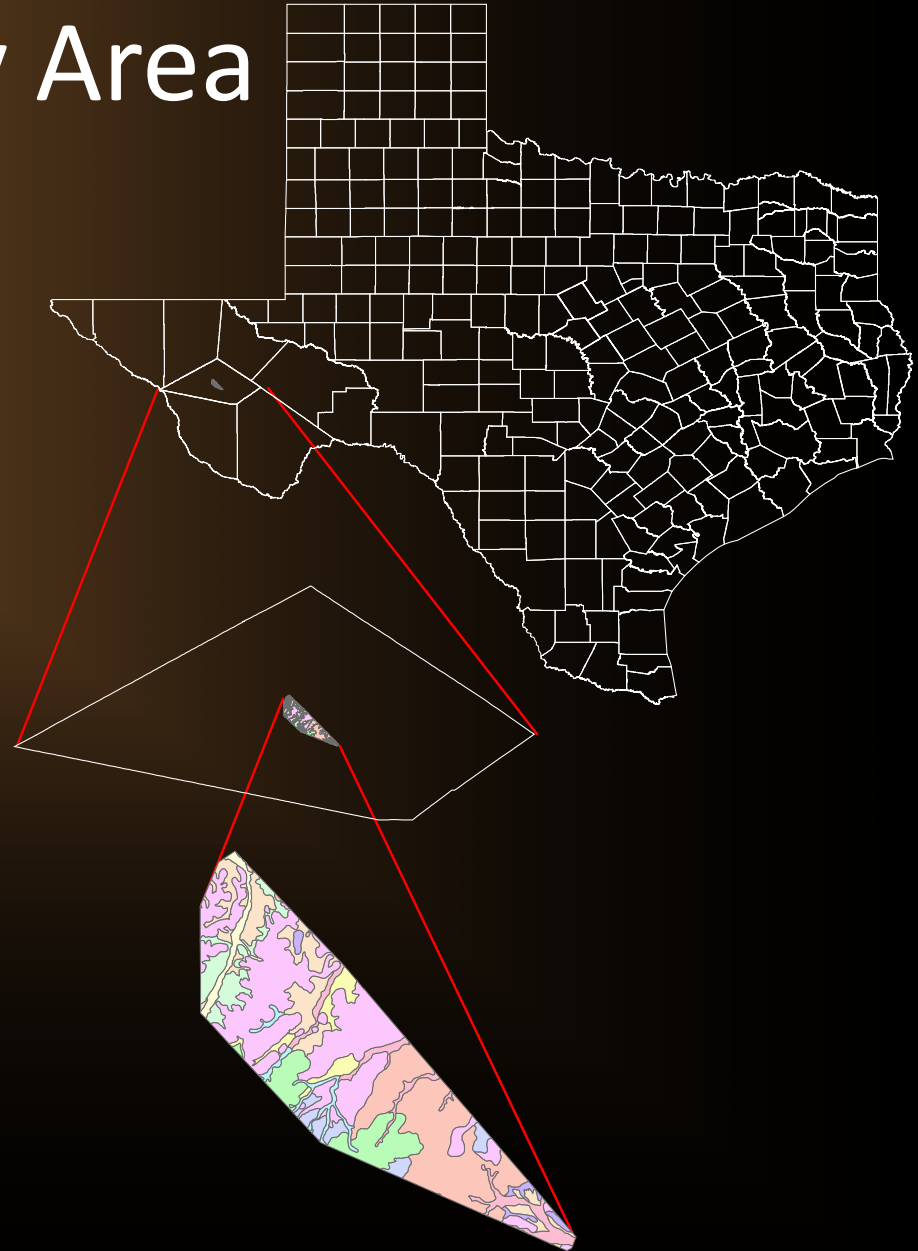
Introduction (Cont...)

Montezuma quail are ground dwelling birds that are cryptic in nature and rarely fly even when approached. Problems in the past for researching Montezuma quail includes capturing them as well as keeping them alive with a transmitter on them. A night capture technique using bird dogs and hoop nets has shown to be effective. New styles for transmitters reduce mortalities from transmitters.



Study Area

The Davis Mountains Preserve owned by The Nature Conservancy was the base location in Jeff Davis County, TX. Located in the Chihuahuan Desert, this site has pristine habitat and possibly the highest population of Montezuma quail in the Trans-Pecos region of Texas. Oak savannah vegetation dominates the lower landscapes. The study area is relatively easily accessible and provides the ideal habitats known to be used by Montezuma quail.





Trapping and Handling

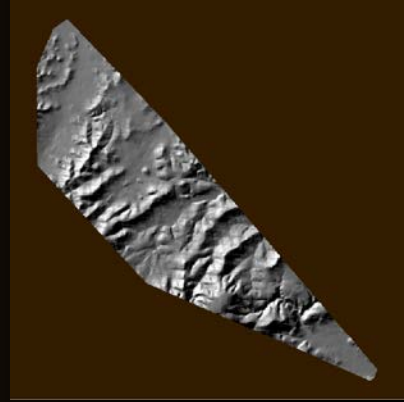


- Trained pointing dogs were used late in the evening to locate coveys and then pursued at least 30 minutes after sunset.
- Trapping techniques included the use of throw nets and hoop nets.
- Backpack style radio transmitters were fitted for each bird.
- Birds captured were aged, sexed, sampled for DNA, and morphological features measured.

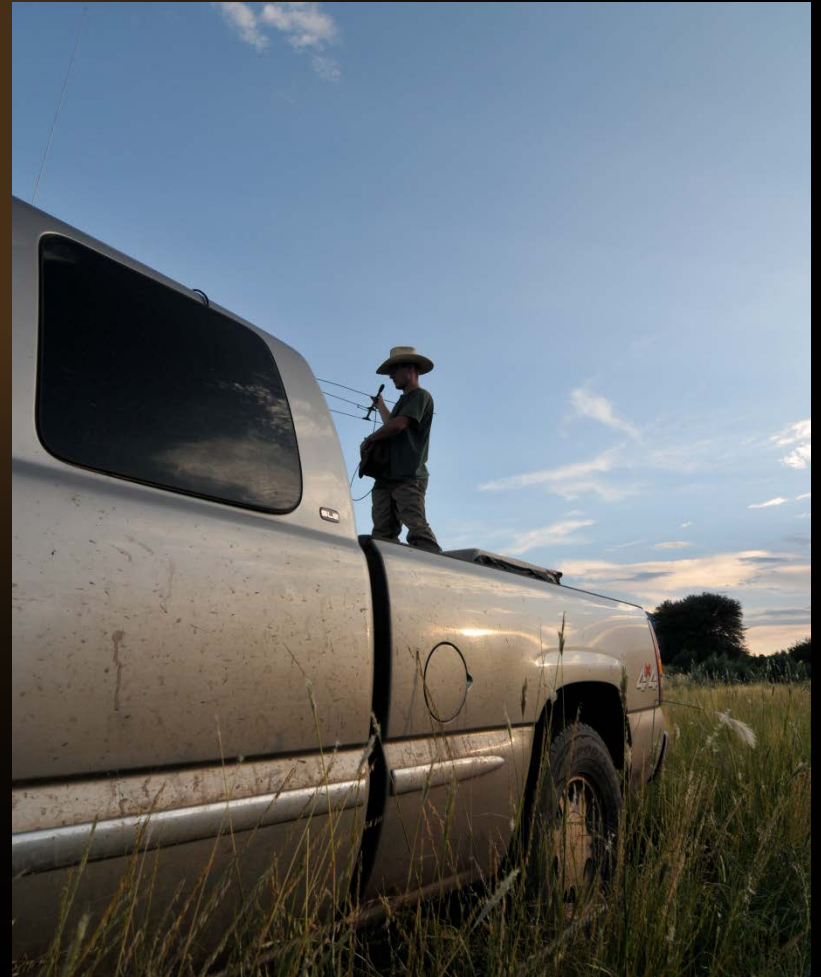




Methods

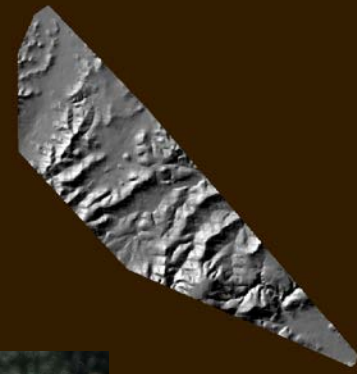


- Radio telemetry with Locate III on palm pilot
- Locations were only acceptable with an area of error ellipse $\leq 30,000 \text{ m}^2$
- ArcGIS used for all analyses





Methods

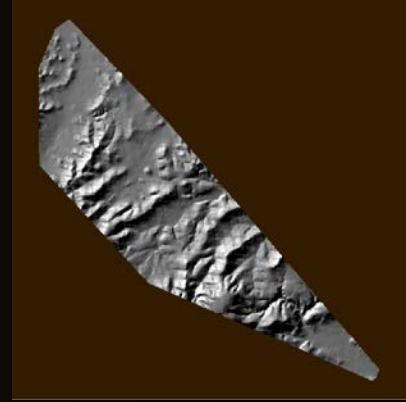


- Home Range
 - 95% Minimum Convex Polygon (MCP)
 - 95% Fixed Kernels
- Movements
 - Hawth's tools function distance matrix between points was ran





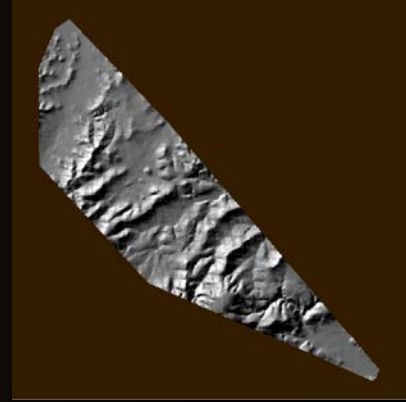
Methods (Cont...)



- Habitat Selection Analysis
 - Soil data for Jeff Davis County along with ecological site data from NRCS
 - Intersect tool in ArcToolbox to pull data from soils shapefiles into locations and home range shapefiles



Methods (Cont...)



- Habitat Selection Analysis
 - Habitat selection was looked at in 3 spatial scales
 - First-order selection- point to study area
 - Second-order selection- range to study area
 - Third-order selection- point to range
- A Selection Ratio (S statistic) was used to determine preference

Selection Ratio

$$S^* = U^{\alpha} / A^{\alpha}$$

*Selection Ratio

α Use

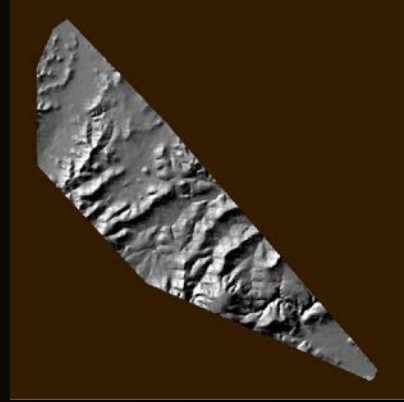
α Availability

$S \geq 1$ represents preferred





Methods (Cont...)



- Survival Data
 - Program MARK
 - Known Fate





Results

- Home Range Analysis
- Movements
- First-order selection
- Second-order selection
- Third-order selection
- Survival Estimates





Results

- 72 captured, banded, and released
- 68 Montezuma quail radio-marked
- 13 individuals with >25 locations



Home Range Analysis

95% MCP

- 356.8 ha with a SD of 454.4 ha

95% Fixed Kernel

- 2,149.4 ha with a SD of 4,736.8

Bird	Number of Locations	95% Kernel (ha)	95% MCP (ha)
13	29	41.14	32.65
21	45	21.50	24.68
22	30	16.79	11.49
23	82	38.86	31.72
47	30	38.51	19.82
48	41	62.79	29.36
50	36	298.54	651.10
52	27	19.41	37.97
54	28	166.45	1,486.60
61	37	96.98	406.27
62	50	8,540.90	732.68
63	49	2,848.51	360.10
65	27	15,751.36	813.66
Average		2,149.37	356.78
SD		4,736.78	454.44

Legend

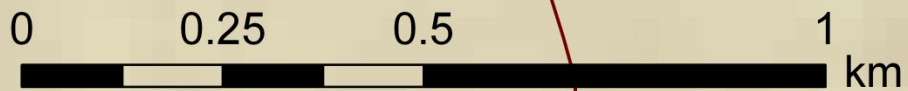
• M21

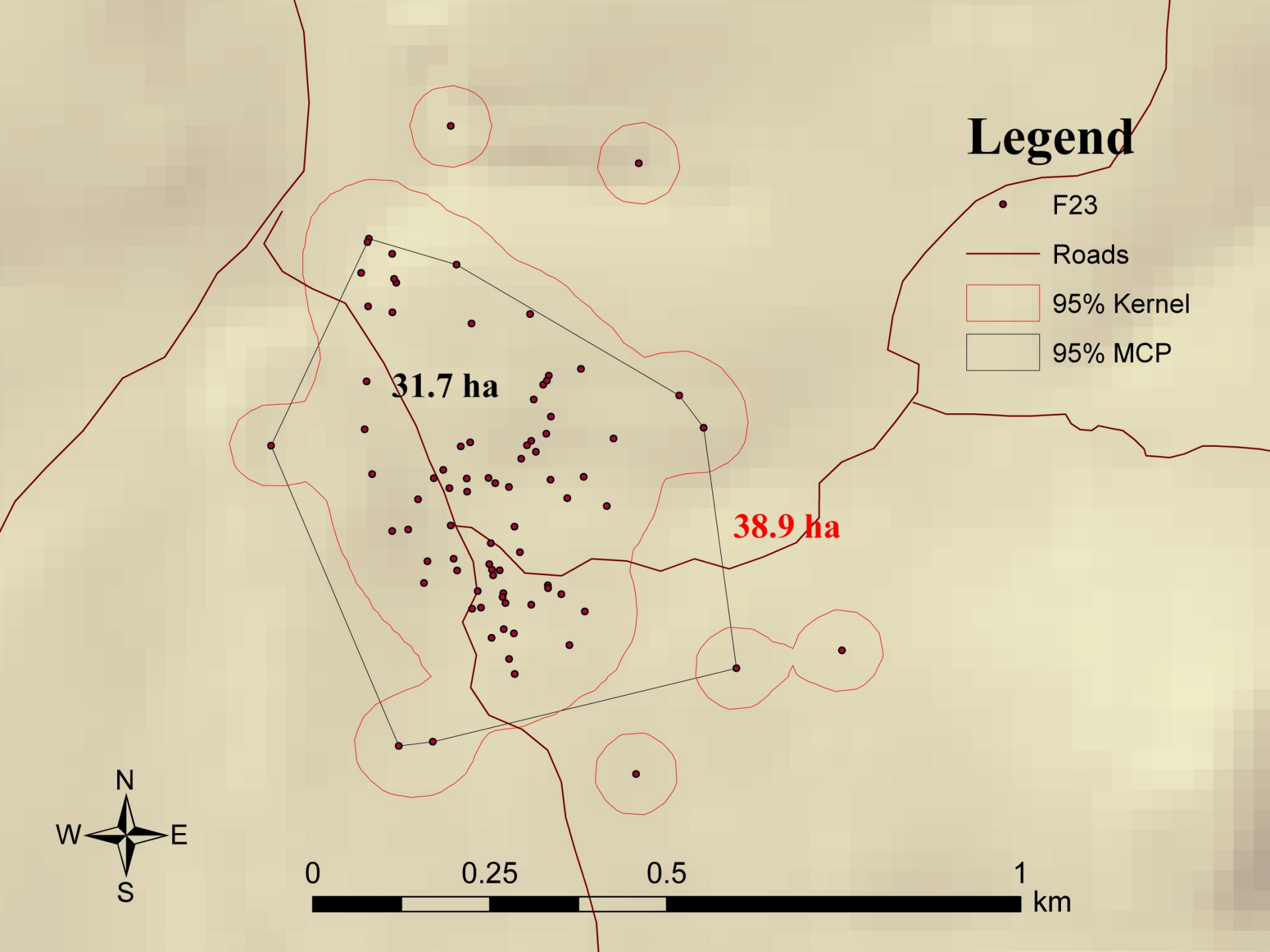
95% Kernel

95% MCP

24.7 ha

21.5 ha





Legend

• M50

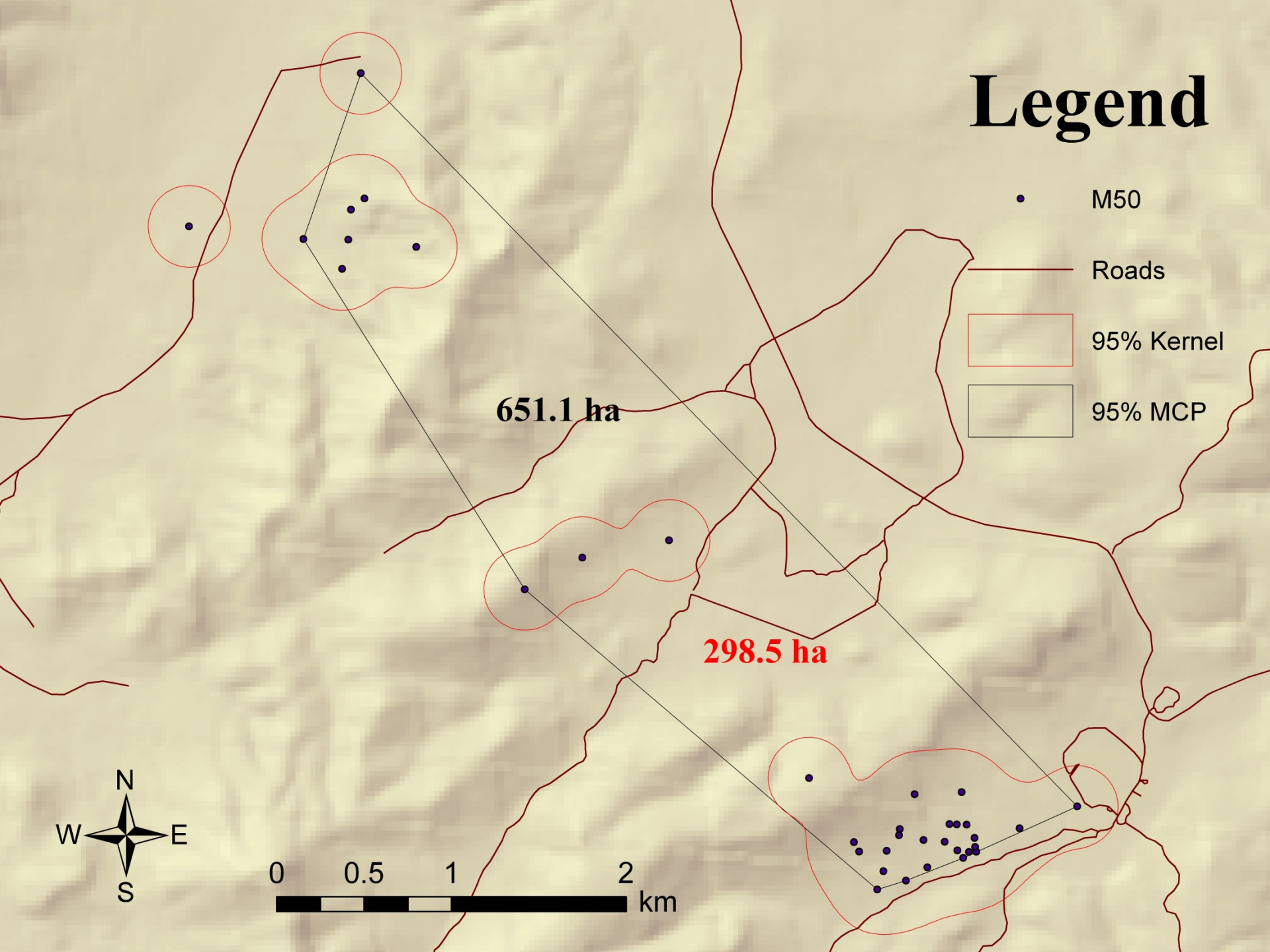
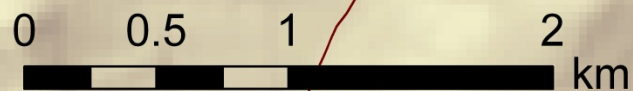
— Roads

95% Kernel

95% MCP

651.1 ha

298.5 ha



Legend

• F65

— Roads

95% Kernel

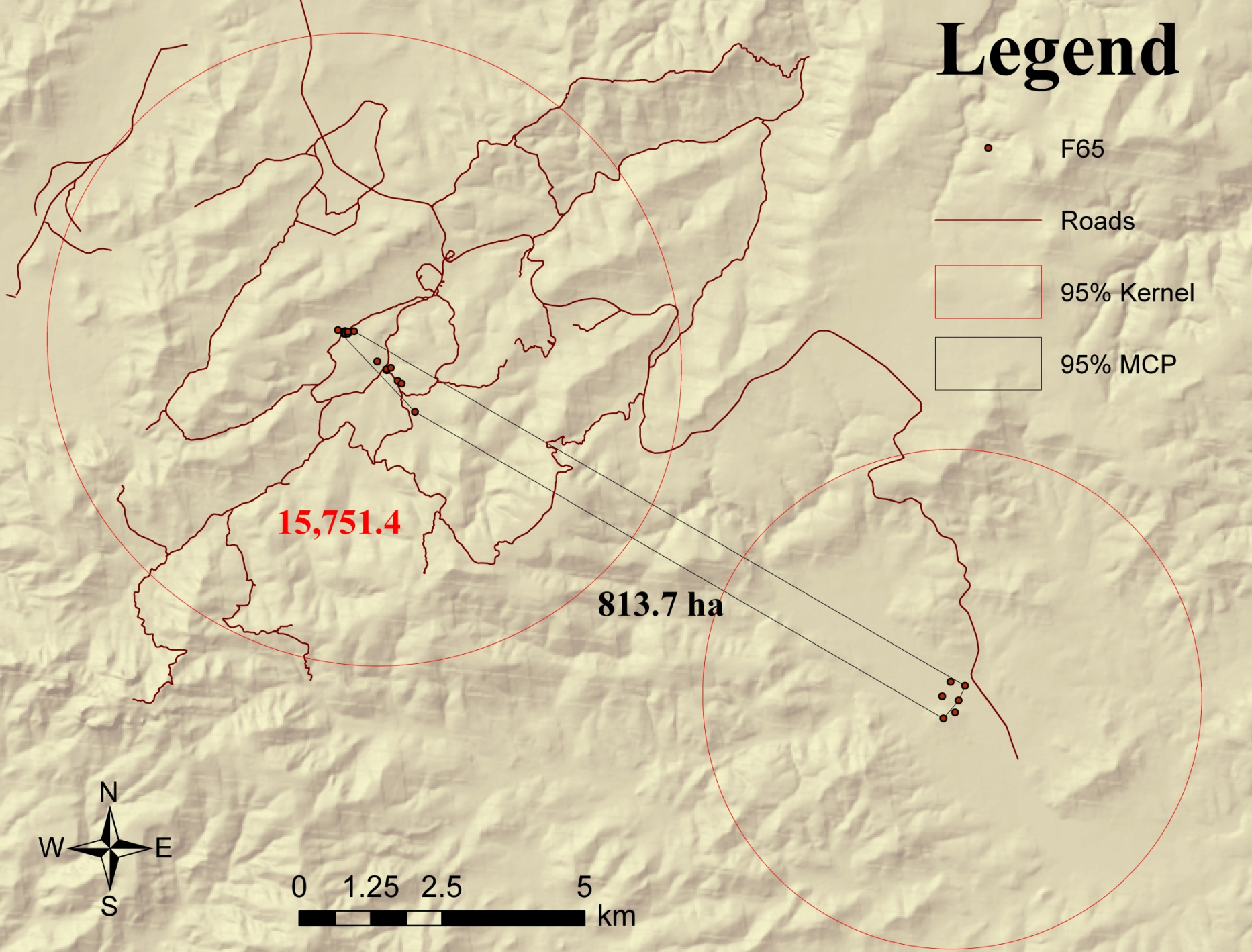
95% MCP

15,751.4

813.7 ha



0 1.25 2.5 5 km

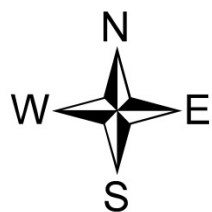


Legend

— Roads

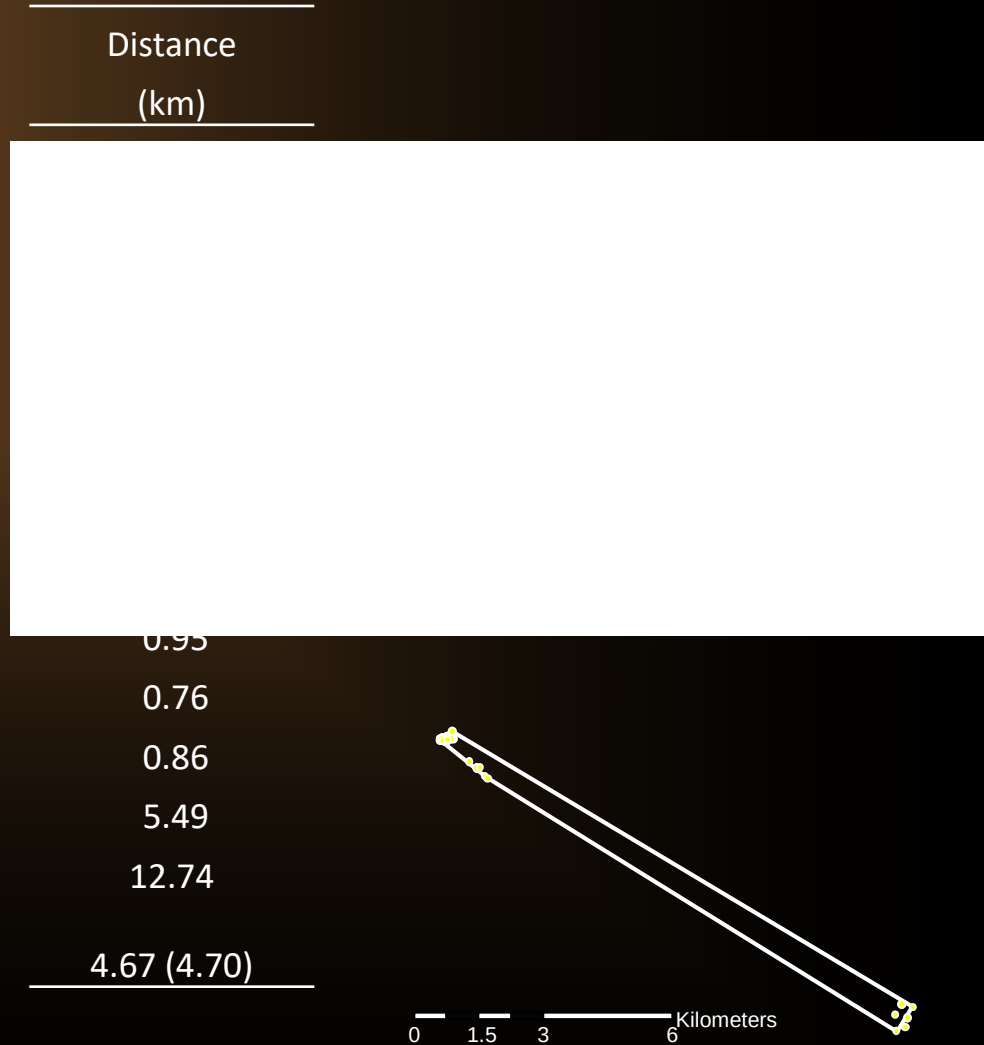
Area (ha)

	16.8
	19.4
	21.5
	38.5
	38.9
	41.1
	62.8
	97.0
	166.5
	298.5
	2,848.5
	8,540.9
	15,751.4

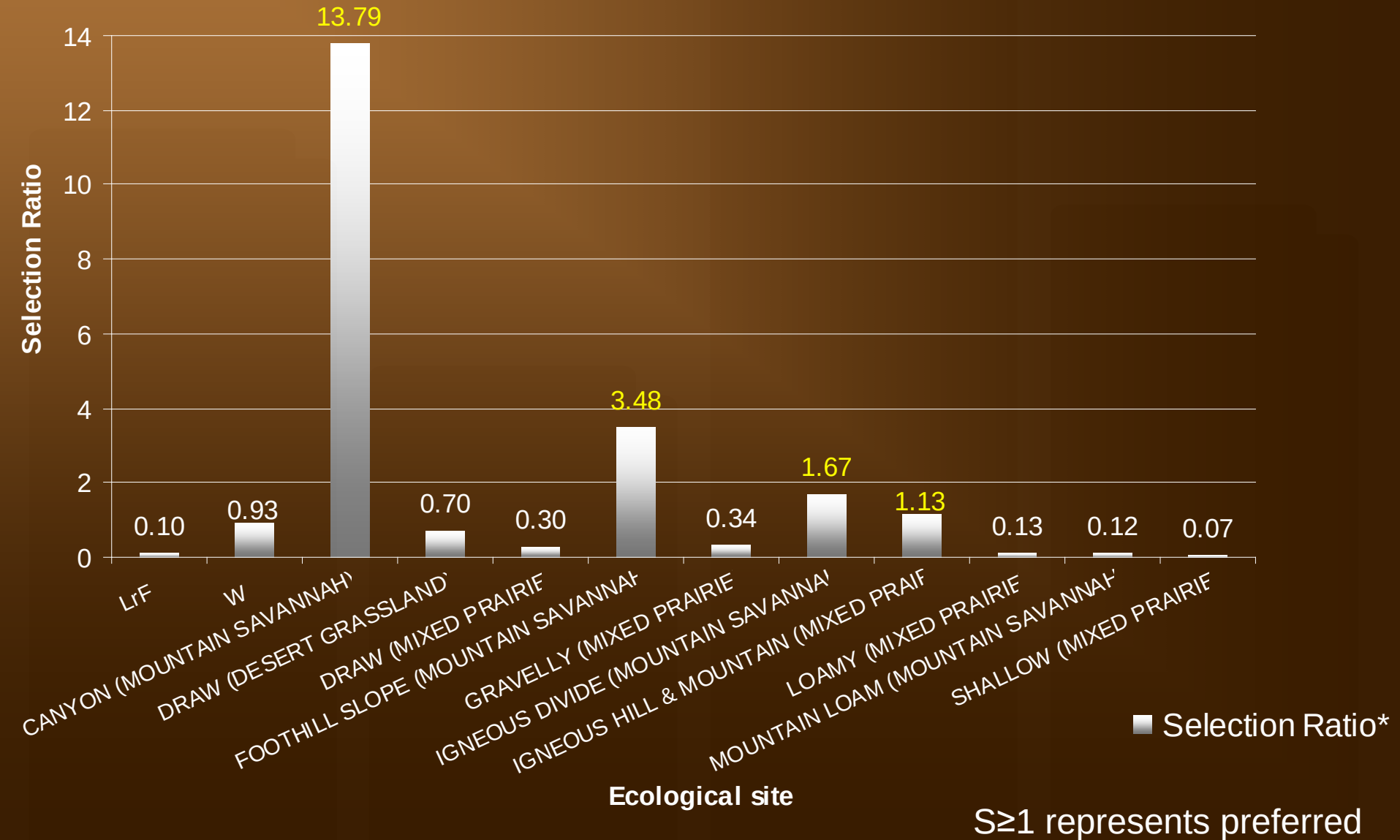


Movements

- Movements vary widely among different individuals
- Mean Distances of 4.67km (SD = 4.70km)
- Longest movement across ranges is 12.74 km made by a pair



First-Order Selection



Second-Order Selection (Range to Study Area)

	13	21	22	23	47	48	50	52	54	61	62	63	65
LrF	-	-	-	-	-	-	-	-	-	-	0.034	-	0.221
CANYON (MOUNTAIN SAVANNAH)	1.518	2.071	2.245	3.007	0.090	0.450	2.012	2.808	0.425	0.115	4.605	1.746	3.492
DRAW (DESERT GRASSLAND)	0.044	-	-	-	-	0.008	0.035	0.031	0.052	0.028	0.099	-	0.174
DRAW (MIXED PRAIRIE)	-	-	-	-	-	-	-	-	0.014	7.701	-	0.940	-
FOOTHILL SLOPE (MOUNTAIN SAVANNAH)	0.037	-	-	-	1.010	1.224	6.098	0.099	37.939	0.058	63.604	1.273	36.450
GRAVELLY (MIXED PRAIRIE)	-	-	-	-	-	-	0.300	-	0.025	-	-	0.794	-
IGNEOUS DIVIDE (MOUNTAIN SAVANNAH)	-	-	-	0.104	-	-	-	0.227	-	-	-	-	0.564
IGNEOUS HILL & MOUNTAIN (MIXED PRAIRIE)	0.931	0.706	0.456	0.566	-	0.319	0.691	0.242	0.002	1.042	2.373	0.666	2.074
LOAMY (MIXED PRAIRIE)	-	-	-	-	-	-	0.010	-	0.003	0.005	0.408	-	0.509
MOUNTAIN LOAM (MOUNTAIN SAVANNAH)	-	-	-	-	-	-	0.018	-	-	0.021	1.713	1.505	1.953
SHALLOW (MIXED PRAIRIE)	-	-	-	-	-	-	-	-	-	-	0.032	-	0.034

$S \geq 1$ represents preferred



Third-Order Selection (Point to Range)

	13	21	22	23	47	48	50	52	54	61	62	63	65
LrF	-	-	-	-	-	-	-	-	-	-	0.003	-	0.003
CANYON (MOUNTAIN SAVANNAH)	1.609	1.754	2.190	2.781	3.094	1.525	0.022	2.417	0.425	0.026	32.454	8.445	27.135
DRAW (DESERT GRASSLAND)	0.044	-	-	-	-	0.564	0.035	0.031	0.052	0.028	0.432	-	0.642
DRAW (MIXED PRAIRIE)	-	-	-	-	-	-	-	-	0.994	-	-	3.411	-
FOOTHILL SLOPE (MOUNTAIN SAVANNAH)	1.326	-	-	-	0.977	0.991	5.789	0.559	28.464	7.055	0.337	0.917	0.318
GRAVELLY (MIXED PRAIRIE)	-	-	-	-	-	-	0.859	-	0.025	1.627	-	0.986	-
IGNEOUS DIVIDE (MOUNTAIN SAVANNAH)	-	-	-	0.104	-	-	-	0.227	-	-	-	-	0.564
IGNEOUS HILL & MOUNTAIN (MIXED PRAIRIE)	0.862	0.793	0.480	0.616	-	8.089	0.651	0.353	0.139	1.008	0.927	0.276	1.530
LOAMY (MIXED PRAIRIE)	-	-	-	-	-	-	0.549	-	0.334	0.005	0.232	-	0.482
MOUNTAIN LOAM (MOUNTAIN SAVANNAH)	-	-	-	-	-	-	0.515	-	-	0.582	0.006	0.007	0.005
SHALLOW (MIXED PRAIRIE)	-	-	-	-	-	-	-	-	-	-	0.032	-	0.034

$S \geq 1$ represents preferred



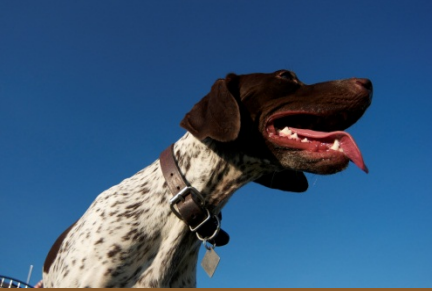


Population Dynamics



- Annual Survival 12.8%
95% CI 5.5% to 23.8%
- 3 of 4 Nests
Successful
- 12 Eggs/Nest
- Mortality Factors
 - Raptors (n=10)
 - Mammalian (n=6)
 - Many Unknown





Discussion



- Home Range
 - Even the smallest home range of individuals with ≥ 25 locations is larger than previously thought
 - Stromberg (1990) used 100% MCP
 - Largest home range 50.65 ha
 - Average 10.34 ha
 - Fixed kernel
 - The occurrence of large movements along with daily movements created some massive home ranges



Discussion



- Movements
 - Transmitted birds moved greater distances than expected
 - Movements carried birds over mountains and across draws that have above marginal habitat
 - Previously thought that Montezuma quail may be born and die within a fraction of the area found to be covered in this study



Discussion



- Habitat Selection
 - Across three different spatial scales trends have developed as to the preferred areas of canyon and foothill slope mountain savannah habitats
 - Mixed prairie was rarely selected for and grassland habitats were never preferred in this study





Discussion



- Population Dynamics
 - Survival Estimates
 - Consistent with other telemetry studies for other species of quail
 - Clutch Sizes
 - Consistent with previous findings
 - Mortality Factors
 - Similar to other findings



Management Implications

- Habitat management for Montezuma quail should be considered on a larger scale than previously thought
- Mountain savannah ecological sites should be targeted for locating birds or applying management practices
- Further research on Montezuma quail needs to follow





Acknowledgements



- Technicians
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Questions?

