Determining Potential Environmental and Social Factors Affecting the Success of the Black Rhinoceros in Addo Elephant National Park, South Africa

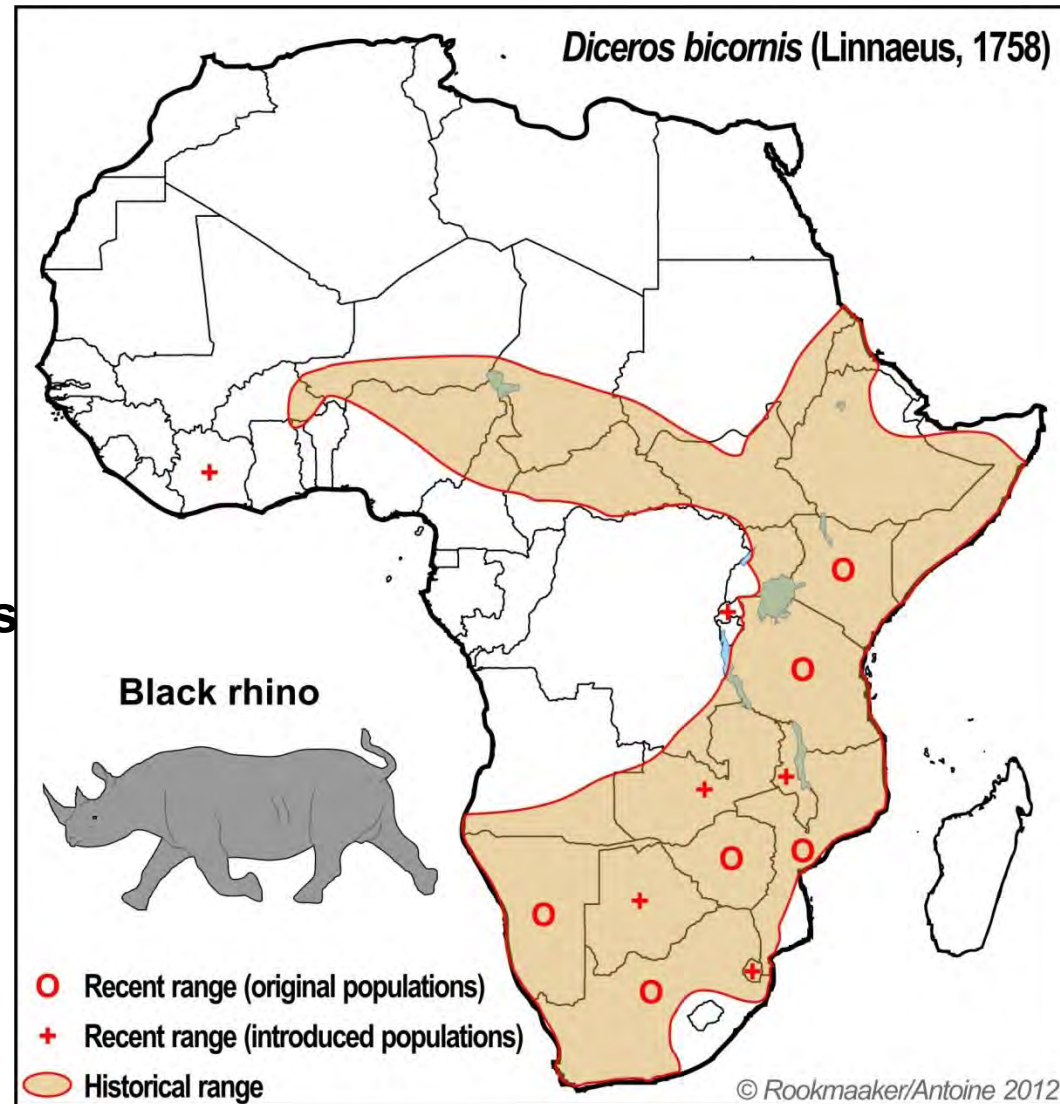**Rachel Santymire, Jordana Meyer, Evan Sorley, Jed Bird, Bruce Schulte, & Elizabeth Freeman**

Lincoln Park Zoo

~65,000

2,000 by 1992

- Due to poaching & habitat loss

- **Now, ~5,000 (IUCN, 2013)**
- **Critically endangered**

Diceros bicornis (Linnaeus, 1758)

Black rhino

O   Recent range (original populations)

+   Recent range (introduced populations)

⬭   Historical range

© Rookmaaker/Antoine 2012

Background: Black Rhino Biology

- **Herbivore: Browser (eats shrubs/trees) using prehensile lip**
- **Weigh ~3,000 lbs**
- **Horns (n=2) composed of keratin**
- **In same family as the horse (odd-toed; perissodactyla)**
- **Solitary except female with calves**
- **Use middens to mark territory and for communication**
- **Crepuscular** (active evening/mornings)

What factors are influencing black rhino populations?

What factors are influencing black rhino populations?

What factors are influencing black rhino populations?

HCO ScoutGuard   10.29.2009   4:26:18

What factors are influencing black rhino populations?

- **Rhinos shift their activity patterns in response to elephant presence (Tambling et al. In prep)**

- **Rhinos shift diet in areas where elephants have altered the vegetation (Landman & Kerley In Press; Landman et al. In Press)**

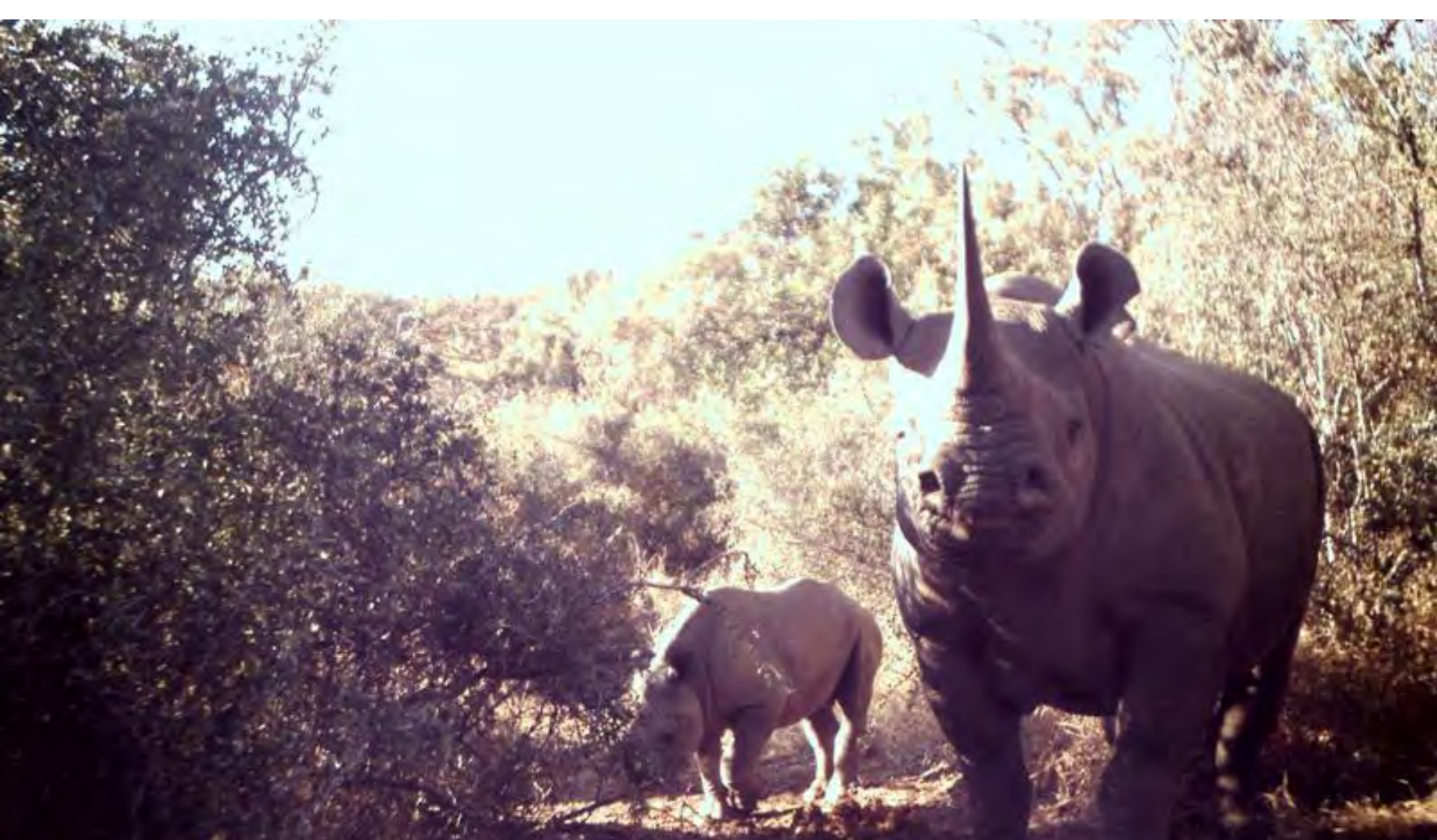# What factors are influencing black rhino populations?

www.SANParks.org addo Aug-26, 2013 - 15:40:15 SAST

Environmental conditions

What factors are influencing black rhino populations?

Anthropogenic activity

So how are all of these factors affecting rhino behavior, physiology and ultimately population success?

Using Endocrinology in the Field

Hormonal analysis provides valuable information about factors influencing free-ranging wildlife population dynamics.

- **Gonadal hormones (for reproduction)**

- **Adrenocortical hormones (for stress physiology)**

- **Monitor the health status of wildlife**

- **Assist with management and conservation decision-making by providing information**
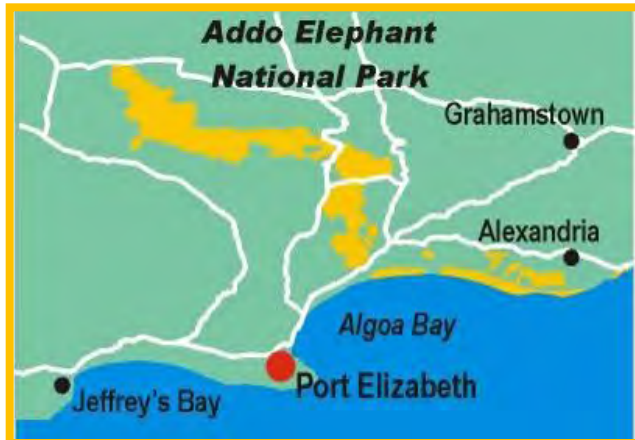

WILDVIEW 08-15-2009 21:28:26

Addo Black Rhino Project

Our goal is to establish a health monitoring program that will investigate the relationship among black rhino hormonal activity and ecological factors that vary between two sections of Addo Elephant National Park (AENP).

Addo Elephant National Park

- In 1931 its goal was to protect the remaining 11 elephant. Now there are >400 individuals!!
- AENP will be the third largest national park in South Africa.

AENP Black Rhino Sub-populations

1995 AENP reintroduced south-western arid subspecies of black rhino (*Diceros bicornis bicornis)*
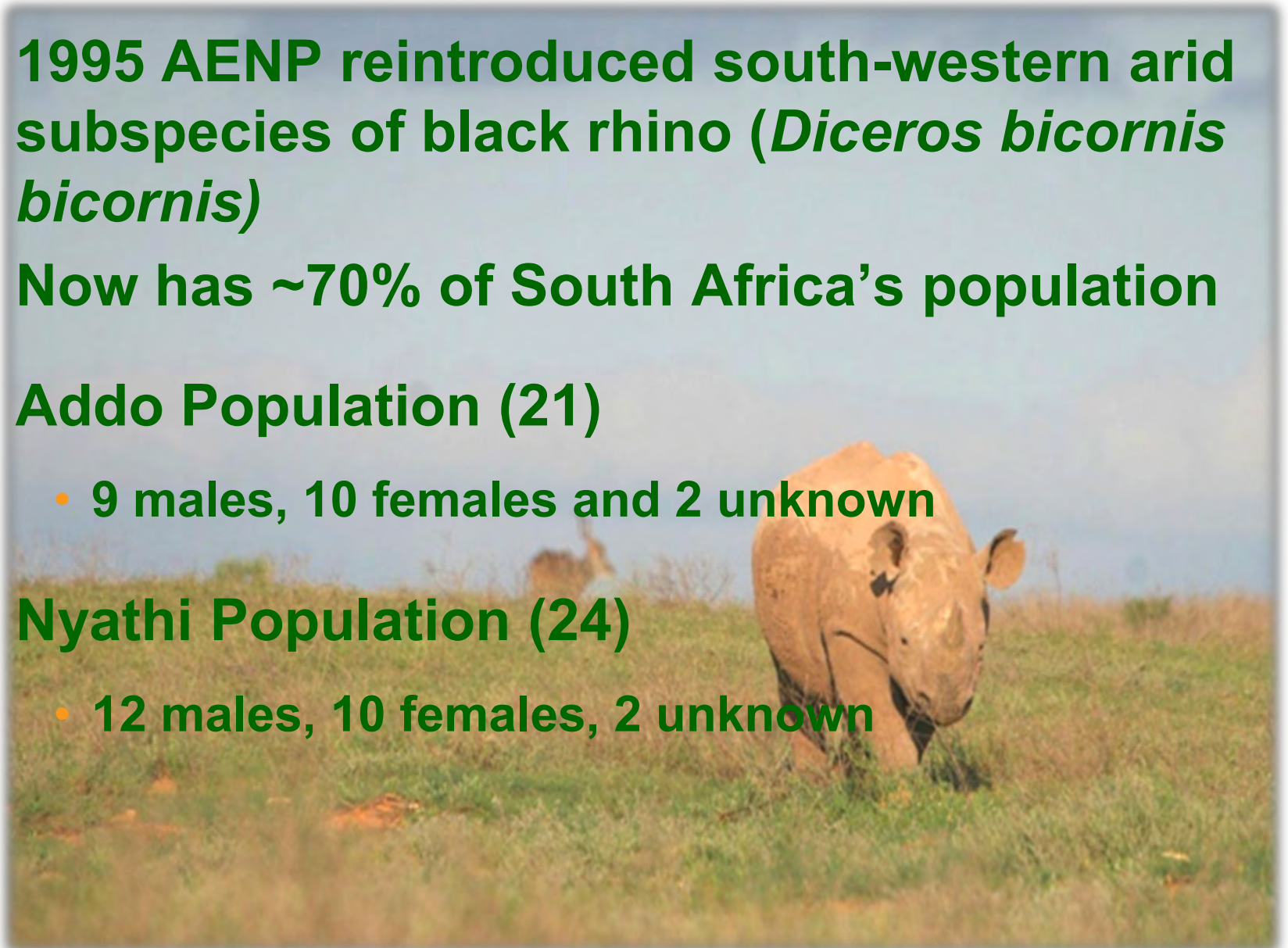
Now has ~70% of South Africa's population

Addo Population (21)

- **9 males, 10 females and 2 unknown**

Nyathi Population (24)

- **12 males, 10 females, 2 unknown**

Factors	Addo	Nyathi
Sex ratio	Female-biased	Male-biased
Elephant density	High (~300)	Moderate (~100)
Predators	Present	Absent
Vegetation	Limited	Abundant
Tourism	High	Low
Size of section	11,500 ha	14,000 ha

Camera traps Set Up on Middens

Identify individuals by:
    ear notch
    horns
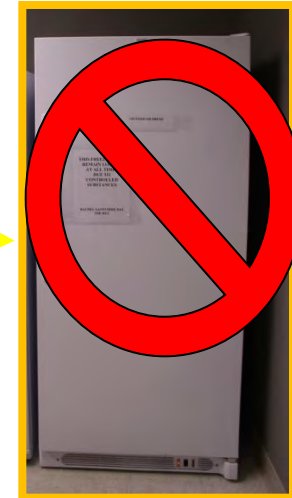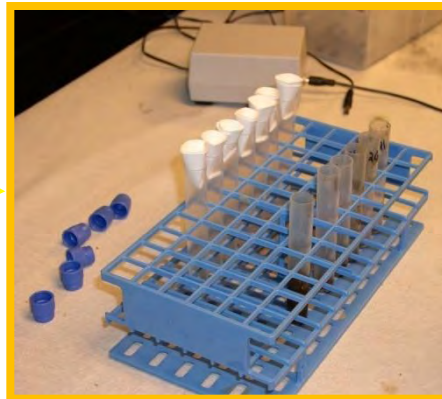
Get sample date and time

Endocrine analysis

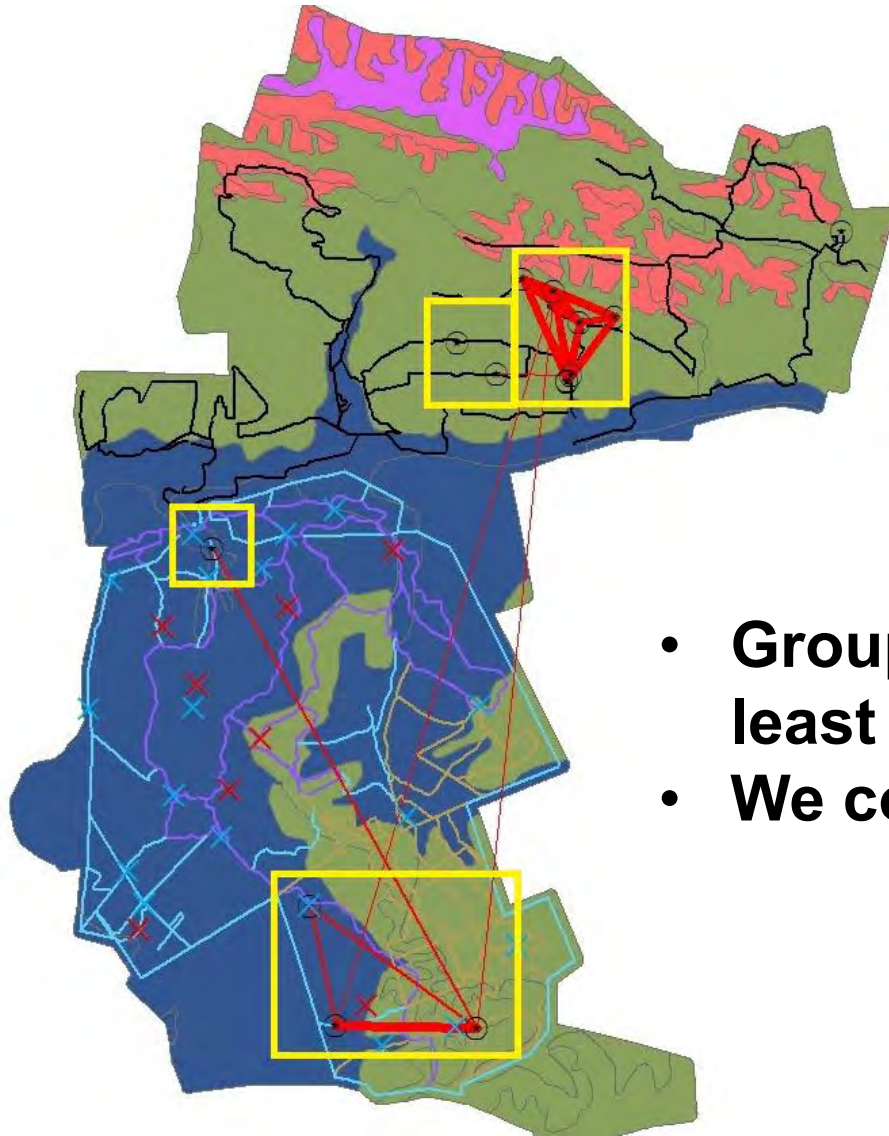Parasite load

LAB

Homogenize

- **All equipment is battery-powered**
- **Very cost effective**
- **Simplifies storage**
- **Simplifies transportation**
- **Simplifies treatment for disease**

(Santymire & Armstrong 2010 in Zoo Biology)
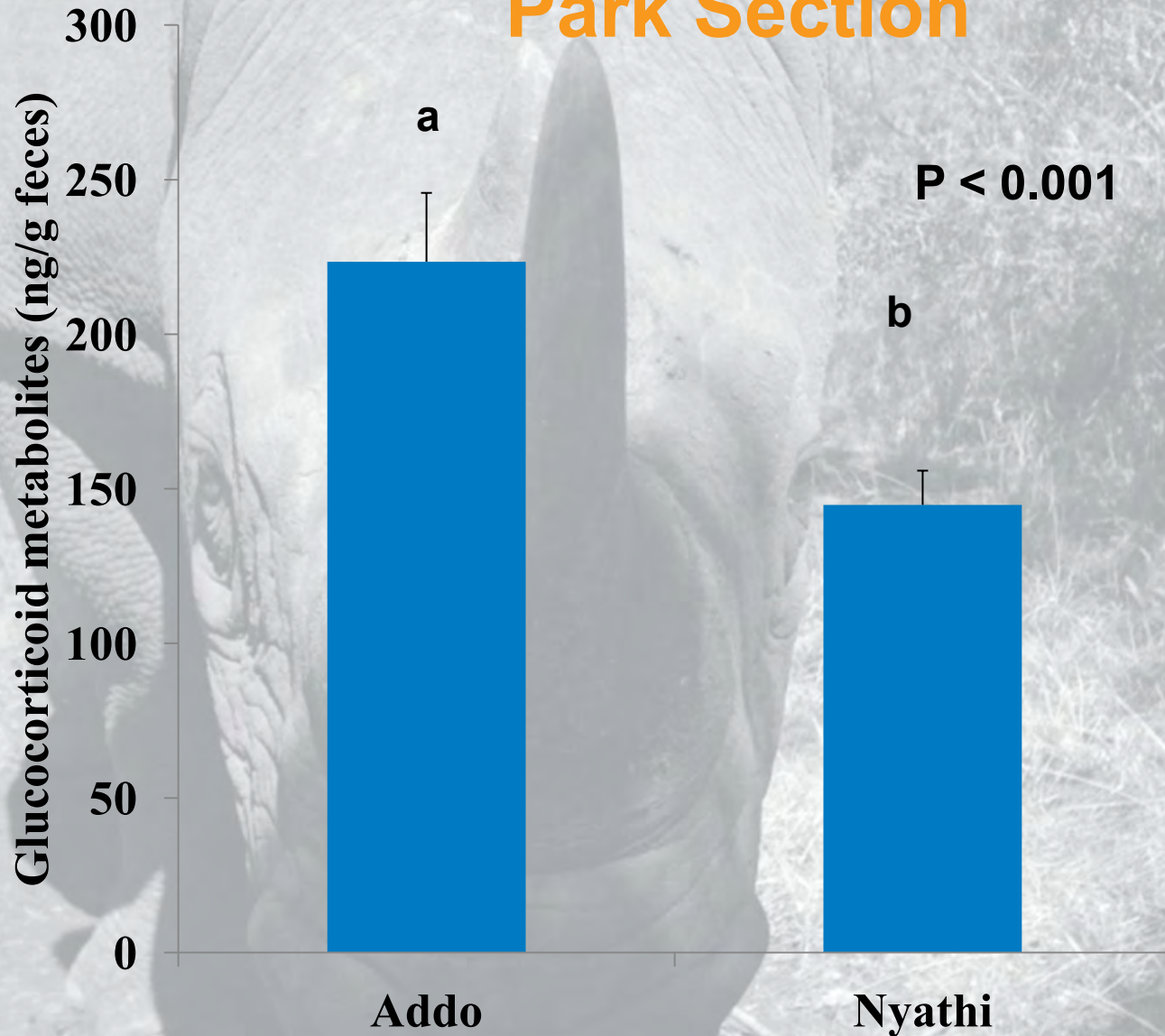
Factors Analyzed

- **Park Section**
  - **Addo**
  - **Nyathi**
- **Type of road**
  - **Staff**
  - **Concession**
- **Landscape cover**
  - **Xeric**
  - **Mesic**
- **Season**
  - **Wet**
  - **Dry**
- **Number of rhinos**

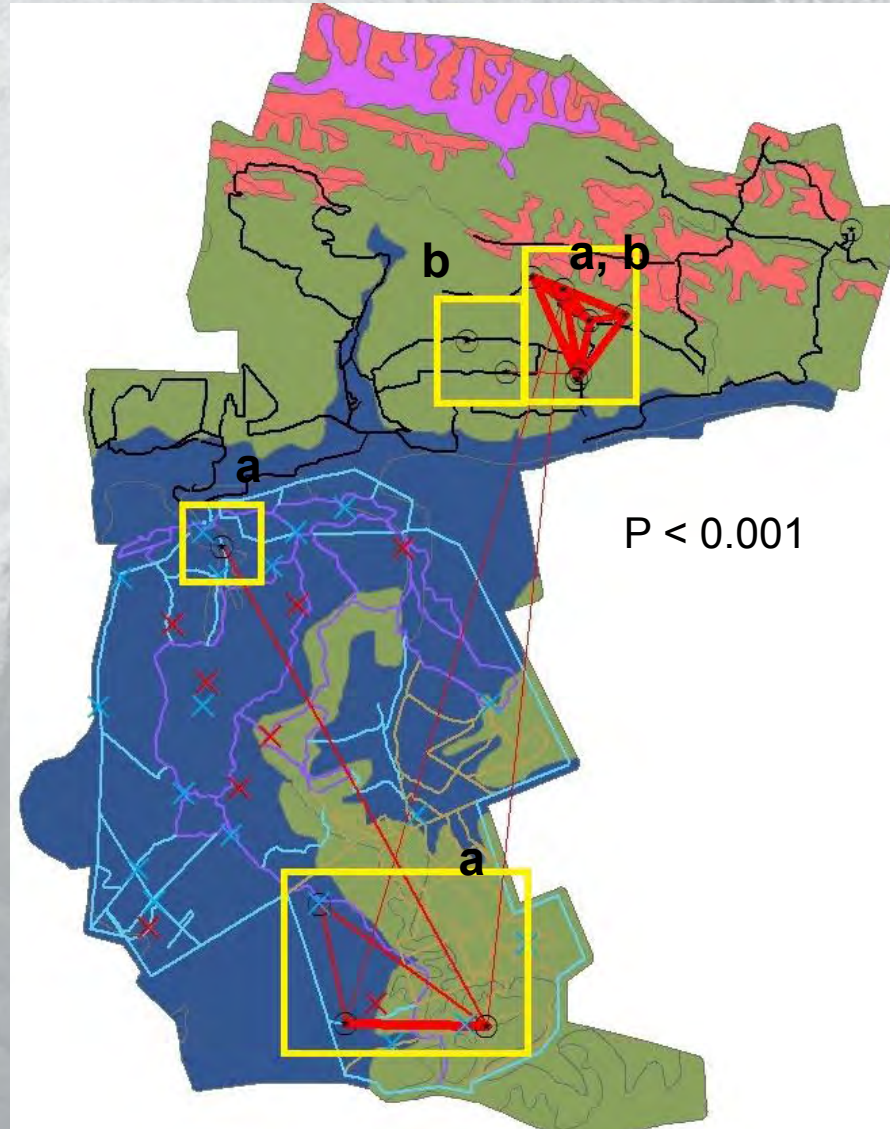- **Grouped our camera traps with at least 10 samples**
- **We collected 167 fecal samples**

Preliminary Stress Results Park Section

P < 0.001

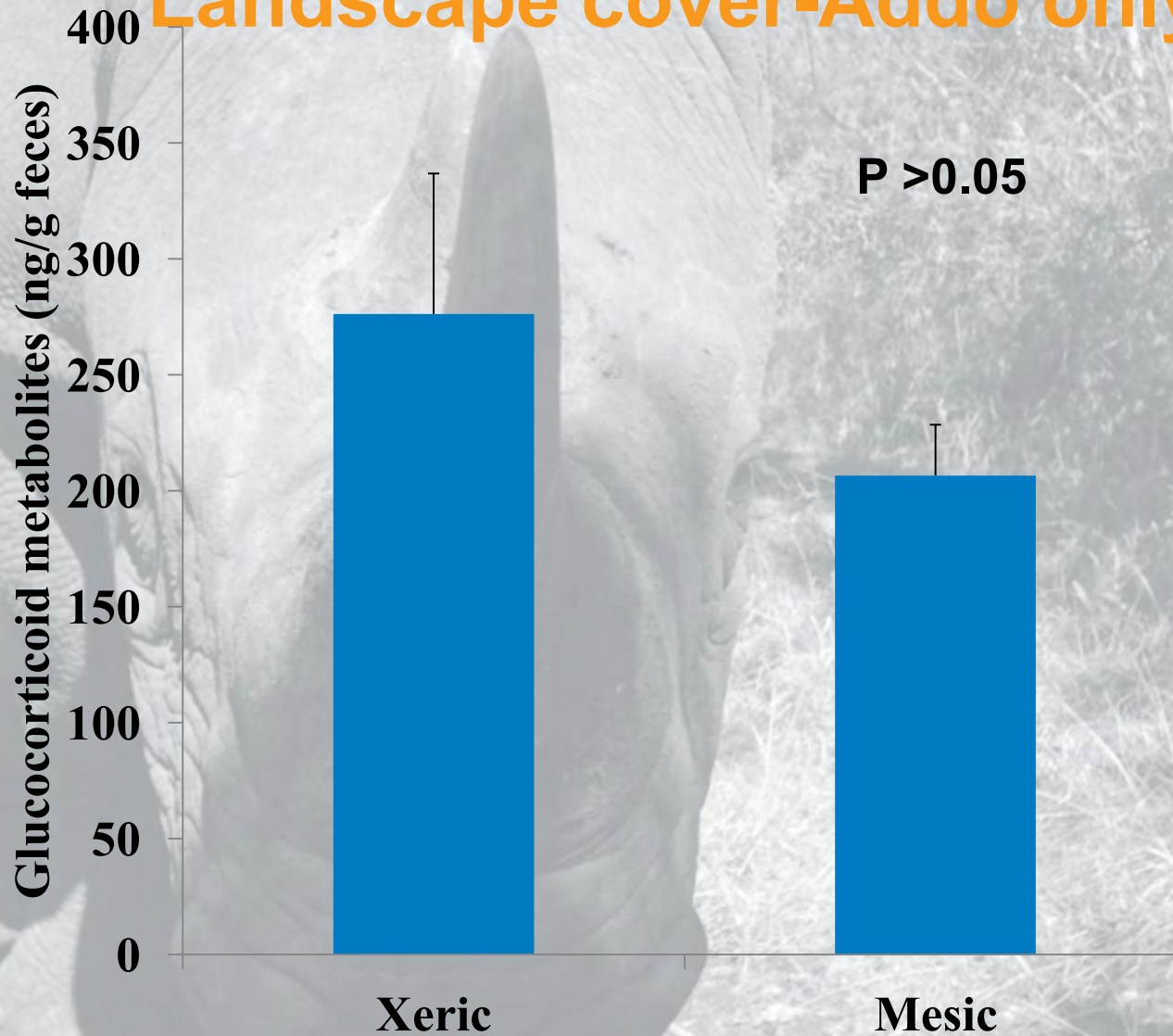# Preliminary Stress Results
Landscape cover-Addo only

P >0.05

Y-axis: Glucocorticoid metabolites (ng/g feces)

X-axis categories: Xeric, Mesic
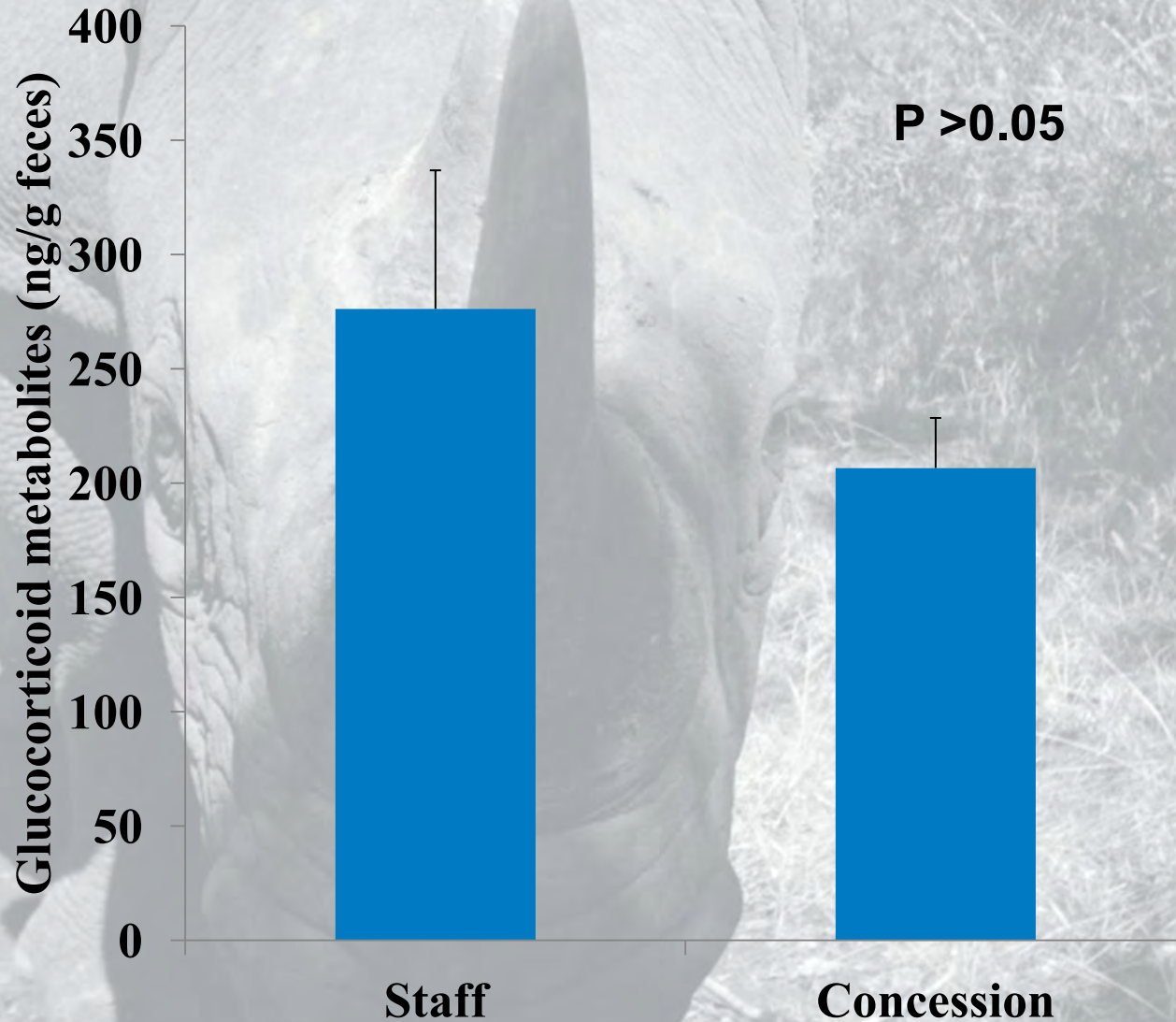
Preliminary Stress Results Season

Preliminary Stress Results
Season and number of rhinos

# of rhinos	C-trap location	Season	Waterhole	FGM (ng/g)
7 (3.4)	N. Addo	Wet	Yes	211.1 ± 20.1
4 (2.2)	S. Addo	Dry	No	179.3 ± 27.1
5 (2.3)	S. Addo	Wet	No	213.4 ± 26.6
9 (4.5)	Nyathi triangle	Dry	No	103.5 ± 21.9
14 (6.8)	Nyathi triangle	Wet	No	212.3 ± 21.9
5 (4.1)	West Nyathi	Dry	Yes	70.1 ± 12.6
4 (3.1)	West Nyathi	Wet	Yes	395.1 ± 68.0

Preliminary Stress Results
Season and number of rhinos

# of rhinos	C-trap location	Season	Waterhole	FGM (ng/g)
7 (3.4)	N. Addo	Wet	Yes	211.1 ± 20.1[a]
4 (2.2)	S. Addo	Dry	No	179.3 ± 27.1
5 (2.3)	S. Addo	Wet	No	213.4 ± 26.6[a]
9 (4.5)	Nyathi triangle	Dry	No	103.5 ± 21.9
14 (6.8)	Nyathi triangle	Wet	No	212.3 ± 21.9[a]
5 (4.1)	West Nyathi	Dry	Yes	70.1 ± 12.6
4 (3.1)	West Nyathi	Wet	Yes	395.1 ± 68.0[a]

Preliminary Stress Results
Season and number of rhinos

# of rhinos	C-trap location	Season	Waterhole	FGM (ng/g)
7 (3.4)	N. Addo	Wet	Yes	211.1 ± 20.1
4 (2.2)	S. Addo	Dry	No	179.3 ± 27.1[a]
5 (2.3)	S. Addo	Wet	No	213.4 ± 26.6
9 (4.5)	Nyathi triangle	Dry	No	103.5 ± 21.9[a]
14 (6.8)	Nyathi triangle	Wet	No	212.3 ± 21.9
5 (4.1)	West Nyathi	Dry	Yes	70.1 ± 12.6[b]
4 (3.1)	West Nyathi	Wet	Yes	395.1 ± 68.0

Preliminary Stress Results
Season and number of rhinos

# of rhinos	C-trap location	Season	Waterhole	FGM (ng/g)
7 (3.4)	N. Addo	Wet	Yes	211.1 ± 20.1
4 (2.2)	S. Addo	Dry	No	179.3 ± 27.1
5 (2.3)	S. Addo	Wet	No	213.4 ± 26.6
9 (4.5)	Nyathi triangle	Dry	No	103.5 ± 21.9[b]
14 (6.8)	Nyathi triangle	Wet	No	212.3 ± 21.9[a]
5 (4.1)	West Nyathi	Dry	Yes	70.1 ± 12.6
4 (3.1)	West Nyathi	Wet	Yes	395.1 ± 68.0

Preliminary Stress Results
Season and number of rhinos

# of rhinos	C-trap location	Season	Waterhole	FGM (ng/g)
7 (3.4)	N. Addo	Wet	Yes	211.1 ± 20.1
4 (2.2)	S. Addo	Dry	No	179.3 ± 27.1
5 (2.3)	S. Addo	Wet	No	213.4 ± 26.6
9 (4.5)	Nyathi triangle	Dry	No	103.5 ± 21.9
14 (6.8)	Nyathi triangle	Wet	No	212.3 ± 21.9
5 (4.1)	West Nyathi	Dry	Yes	70.1 ± 12.6[b]
4 (3.1)	West Nyathi	Wet	Yes	395.1 ± 68.0[a]

- **Rhinos in Addo had higher FGMs than Nyathi rhinos.**

- **In Addo, landscape cover and type of roads did not influence FGM values; however, couldn't test tourist roads.**

- **FGMs were higher in wet versus dry season, but season did not seem to influence the number of rhinos at each site even the two sites with waterholes.**

- **FGM values were not influenced by the number of different individual visitors nor by sex.**

- **We are limited by the c-traps on middens.**
  - **Rhinos may be avoiding the highly disturbed areas**

- **Addo rhinos did have higher FGMs than Nyathi**
  - **Inter-species conflicts (elephants and lions)**
  - **Calving interval longer in Addo by ~1 year**
  - **Addo rhinos have fewer commensal parasites**

- **Results can be used to assist AENP managers with improving the success of their rhino populations.**
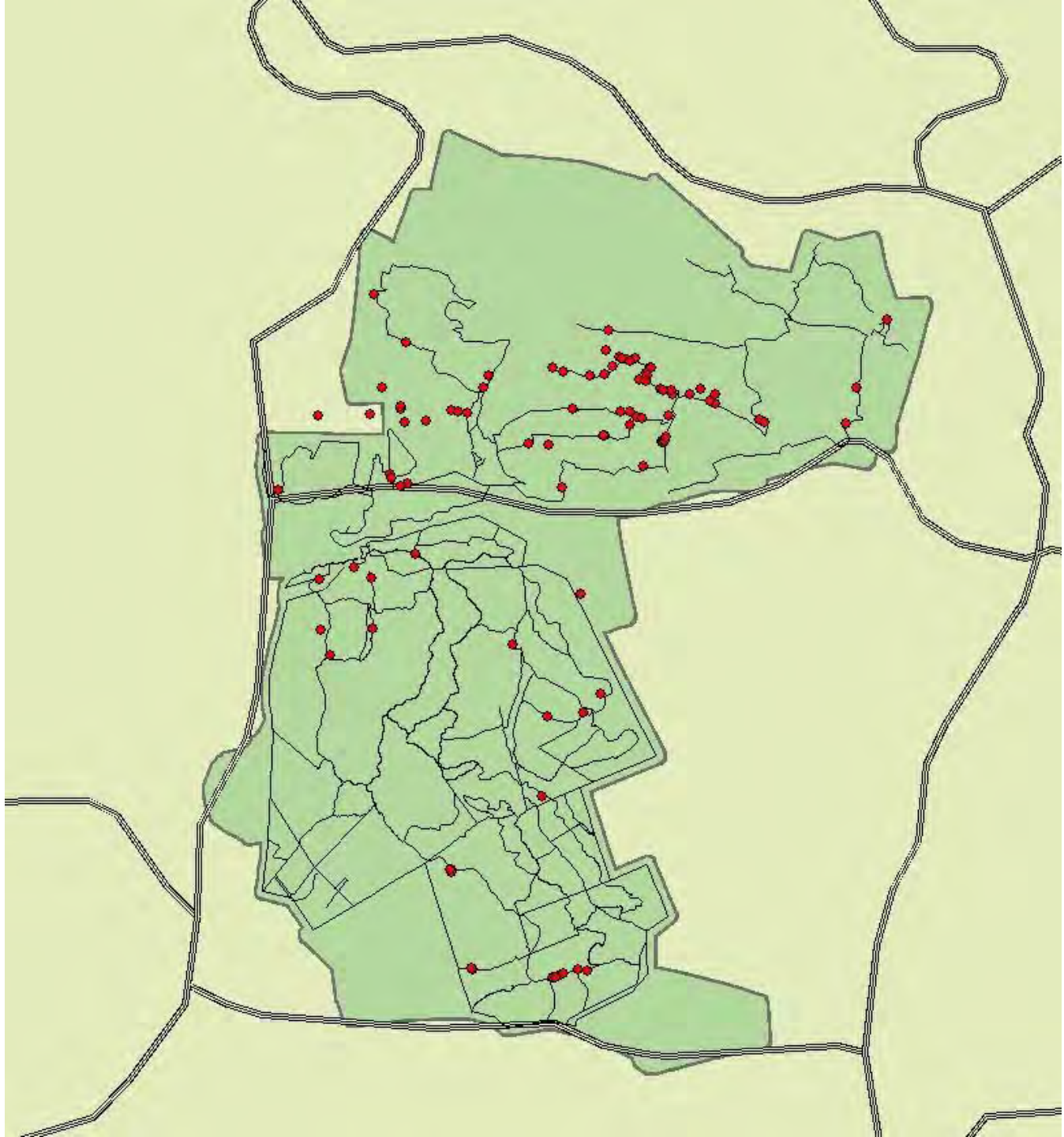
- **Extract DNA from feces to identify "unknown" samples and possibility determine paternity**

Acknowledgments

- **Co-authors (Jordana Meyer, Evan Sorley, Bruce Schulte and Elizabeth Freeman)**
- **John Addendorf, SANparks AENP Conservation Biologist**
- **Angela Gaylord, SANparks Regional Ecologist**
- **Thando Mendela, SANparks Research Assistant**
- **Maggie Hook, WKU MS student**
- **Maggie Wisniewska, WKU MS student**
- **Guides at River Bend Lodge, Gorah Lodge, Nguni Lodge and AENP**
- **Diana Armstrong, LPZ**

Lincoln Park Zoo

South African NATIONAL PARKS

BLACK RHINO MONITORING

WKU

GEORGE MASON UNIVERSITY