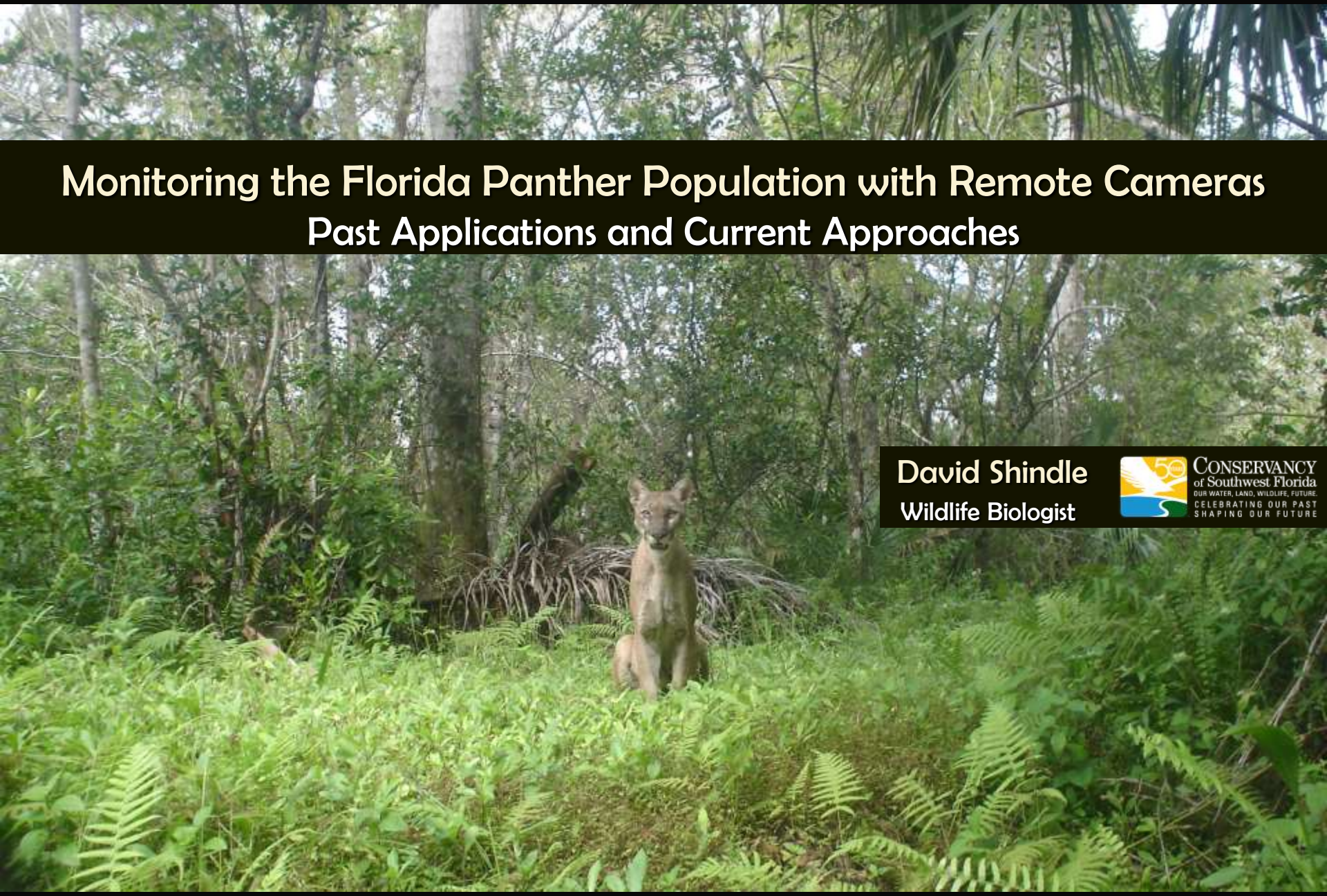
Monitoring the Florida Panther Population with Remote Cameras

Past Applications and Current Approaches



David Shindle
Wildlife Biologist

Conservancy of Southwest Florida
Our Water, Land, Wildlife, Future.
Celebrating Our Past Shaping Our Future

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE
CELEBRATING OUR PAST
SHAPING OUR FUTURE
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
U.S.
FISH & WILDLIFE
SERVICE
US Army Corps
of Engineers®
Jacksonville District
NAPLES
ZOO
at CARIBBEAN GARDENS

Caesar Kleberg
WILDLIFE
Research Institute
Texas A&M University-Kingsville

Feasibility of Using Remote Cameras to Survey South Florida's Rare and Elusive Carnivore

Feasibility of Using Remote Cameras to Survey South Florida's Rare and Elusive Carnivore: the Everglades Mink

Conservancy of Southwest Florida
Our Water, Land, Wildlife, Future.
Celebrating Our Past Shaping Our Future

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Feasibility of Using Remote Cameras to Survey Everglades Mink

Mink Bycatch

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
12 9:11

Photo Credit: D. Shindle and L. Grassman

Photo Credit: D. Shindle and L. Grassman

Feasibility of Using Remote Cameras to Survey Florida Panthers

Study Period: 2000-2001 Study Areas: ENP and FPWNR

Shindle, D.B., E.D. Land, D. Onorato, M. Wessel, and P. Kubilis. 2008.
Feasibility of using remote cameras to survey Florida panthers.
FWC In-house Report Series IHR 2008-003.

Feasibility of Using Remote Cameras to Survey Florida Panthers

Study Period: 2000-2001 **Study Areas:** ENP and FPWNR

Results and Conclusions:

Remote cameras failed to provide adequate data for conventional mark-recapture analyses.

- Inconsistent detection of marks.
- Inability to consistently identify individual panthers.

Feasibility of Using Remote Cameras to Survey Florida Panthers

Study Period: 2000-2001

Study Areas: ENP and FPWNR

Results and Conclusions:

Demonstrated that remote camera surveys were a cost-effective, non-invasive capture technique.

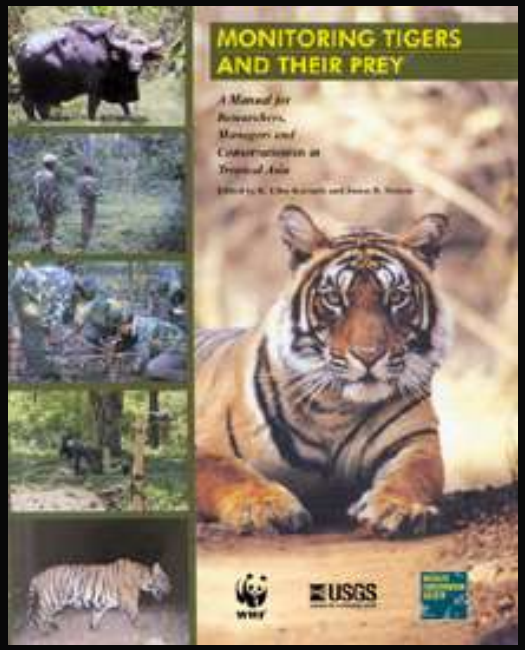
- Provided important life-history data that could be incorporated into future population monitoring schemes and demographic analyses.

Carbone et al. 2001. *The Use of Photographic Capture Rates to Estimate Densities of Tigers and other Cryptic Mammals.* Animal Conservation 4:75-79.

Functional relationship between photo capture rates of tiger and estimates of tiger density.

Capture rate method does not rely on animals identifiable as individuals.

A caveat of applying this technique is the necessity to calibrate density with capture rates.



Picayune Strand Restoration Project Area

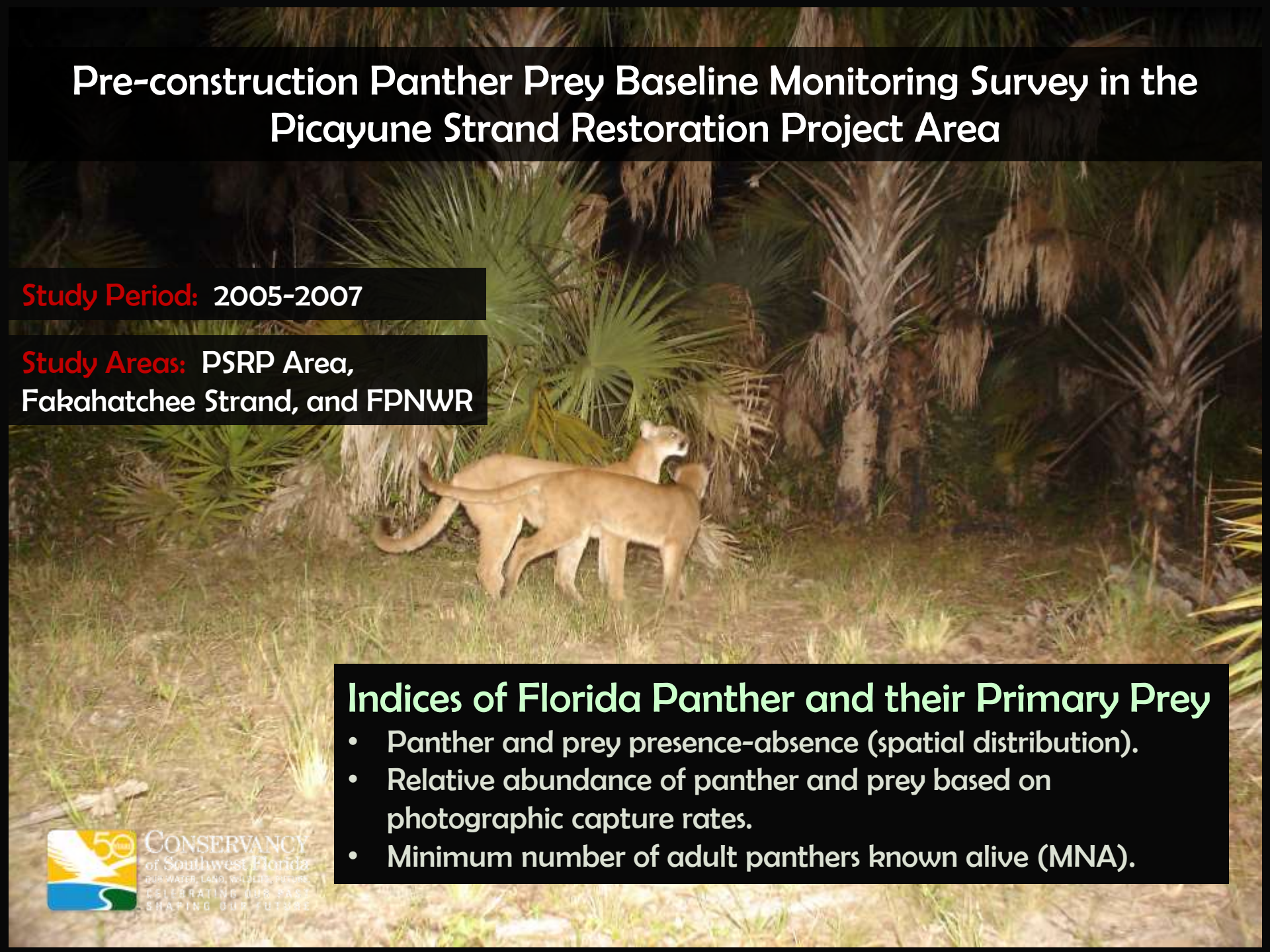
Pre-construction Panther Prey Baseline Monitoring Survey in the Picayune Strand Restoration Project Area

Study Period: 2005-2007

Study Areas: PSRP Area, Fakahatchee Strand, and FPNWR

Conservancy of Southwest Florida
Our Water, Land, Wildlife, Future.
Celebrating Our Past Shaping Our Future

Pre-construction Panther Prey Baseline Monitoring Survey in the Picayune Strand Restoration Project Area



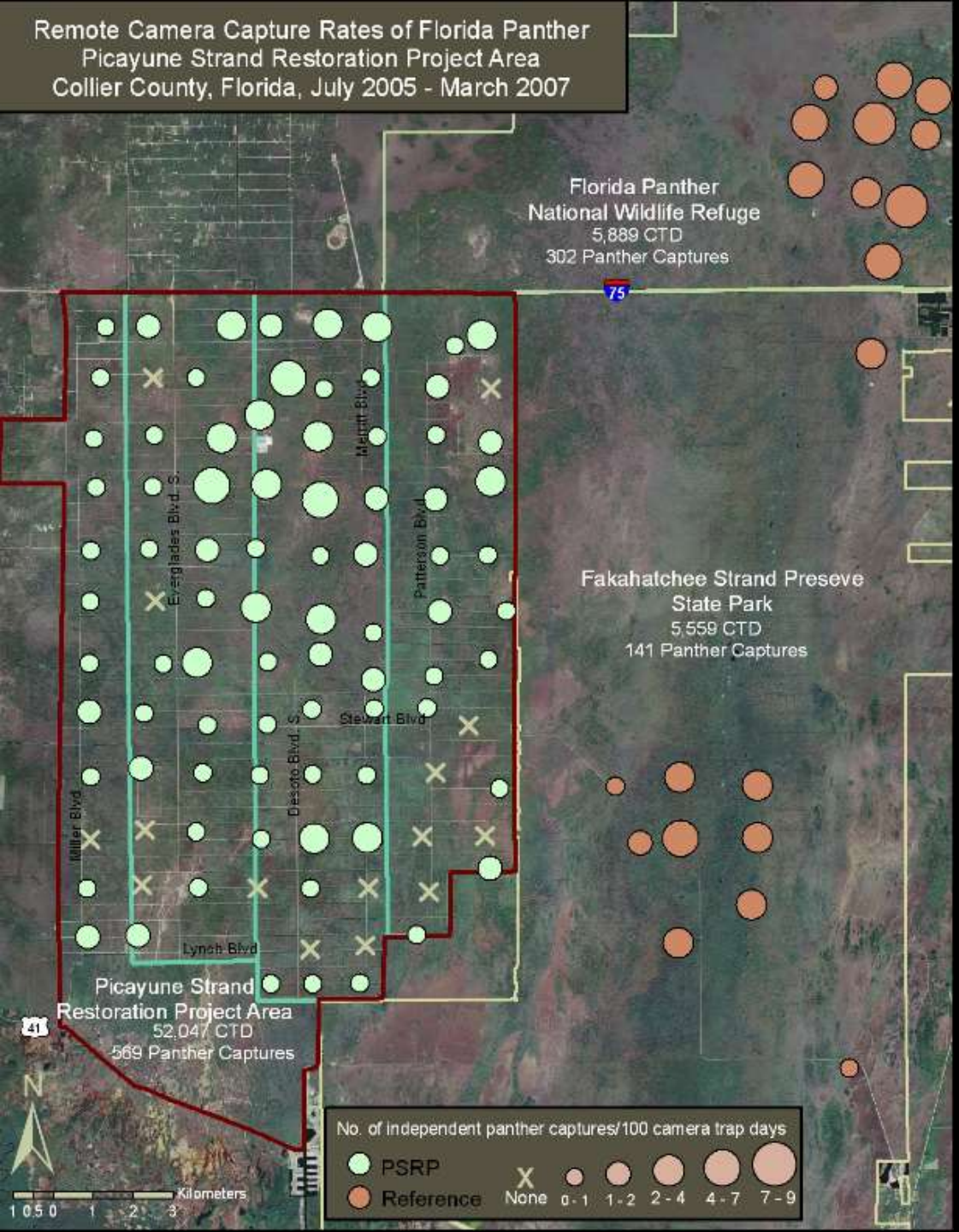
Study Period: 2005-2007

Study Areas: PSRP Area, Fakahatchee Strand, and FPNWR

Indices of Florida Panther and their Primary Prey

- Panther and prey presence-absence (spatial distribution).
- Relative abundance of panther and prey based on photographic capture rates.
- Minimum number of adult panthers known alive (MNA).

Conservancy of Southwest Florida



Florida Panther

Total No. of Photos

PSRP	FAKA	FPNWR
569	148	321

No. of Independent Captures

PSRP	FAKA	FPNWR
569	141	302

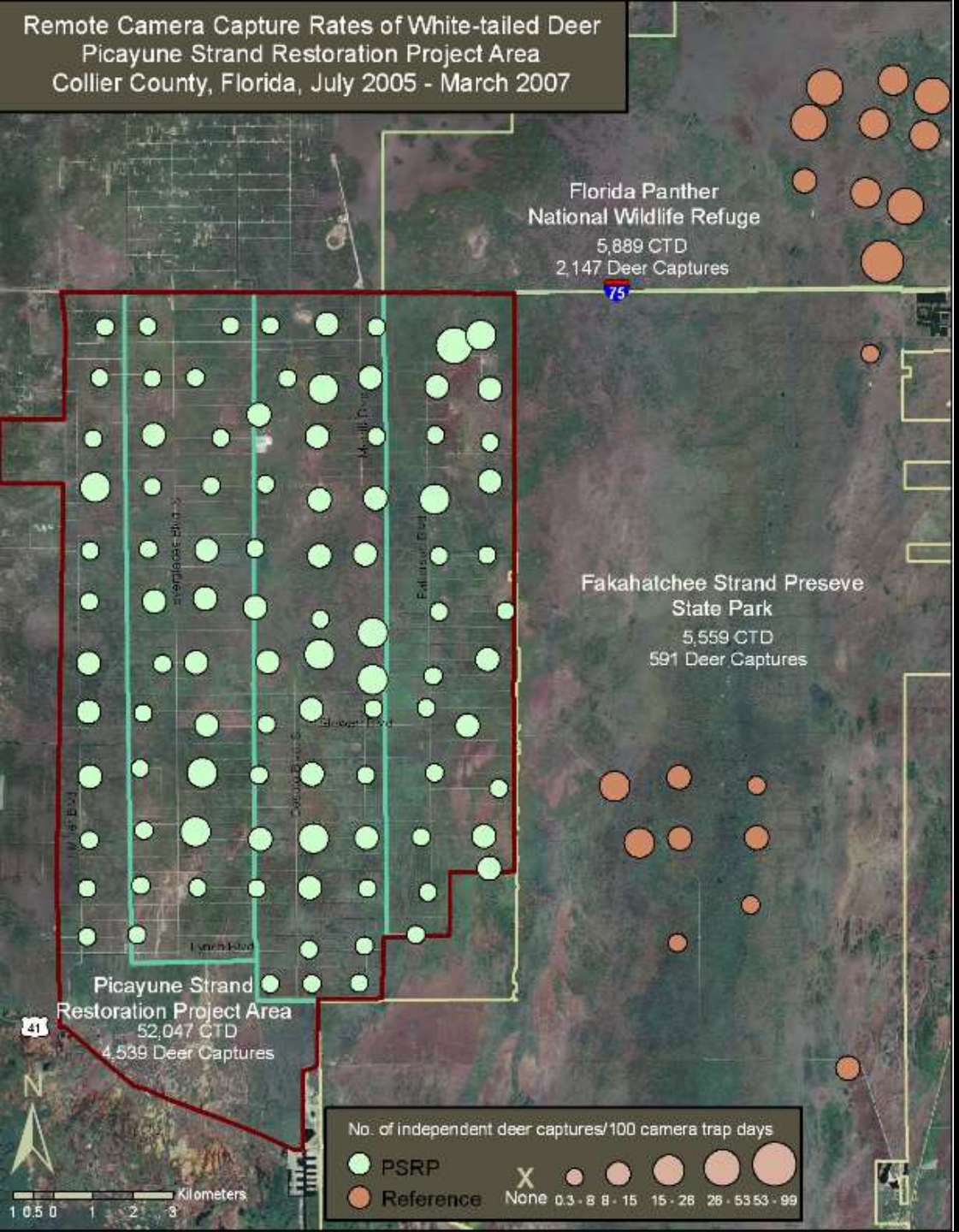
Mean Capture Rate

PSRP	FAKA	FPNWR
1.1 ± 0.2	2.5 ± 1.0	5.2 ± 1.7

% of Area Occupied

PSRP	FAKA	FPNWR
88%	100%	100%

CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE



White-tailed Deer

Total No. of Photos

PSRP	FAKA	FPNWR
5,760	1,411	2,548

No. of Independent Captures

PSRP	FAKA	FPNWR
4,539	591	2,147

Mean Capture Rate

PSRP	FAKA	FPNWR
8.6 ± 1.5	10.7 ± 4.0	36.1 ± 18.9

% of Area Occupied

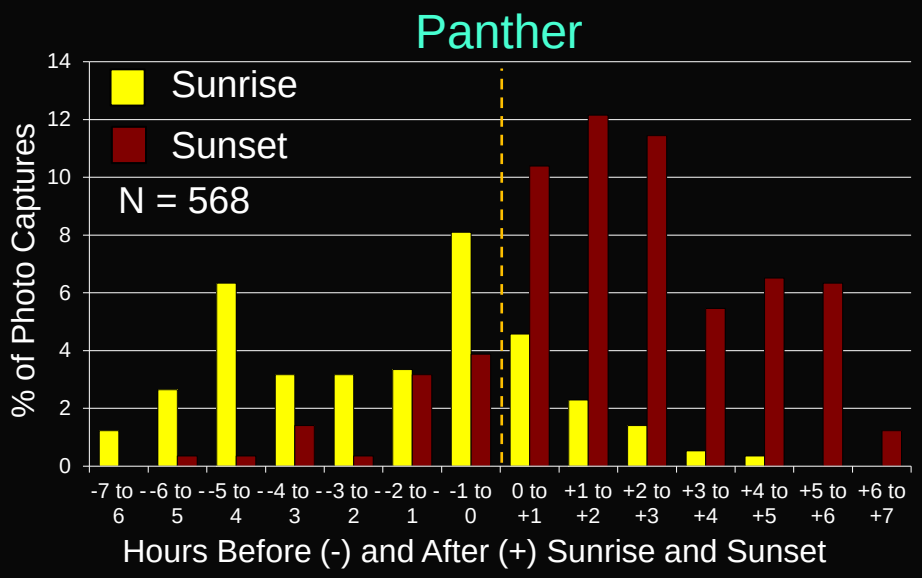
PSRP	FAKA	FPNWR
100%	100%	100%

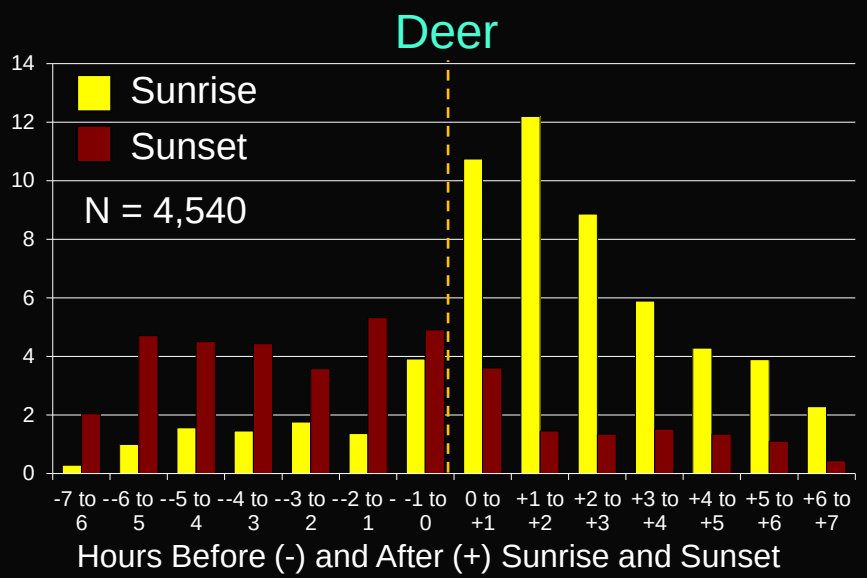
CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Activity Patterns of Florida Panther and White-tailed Deer

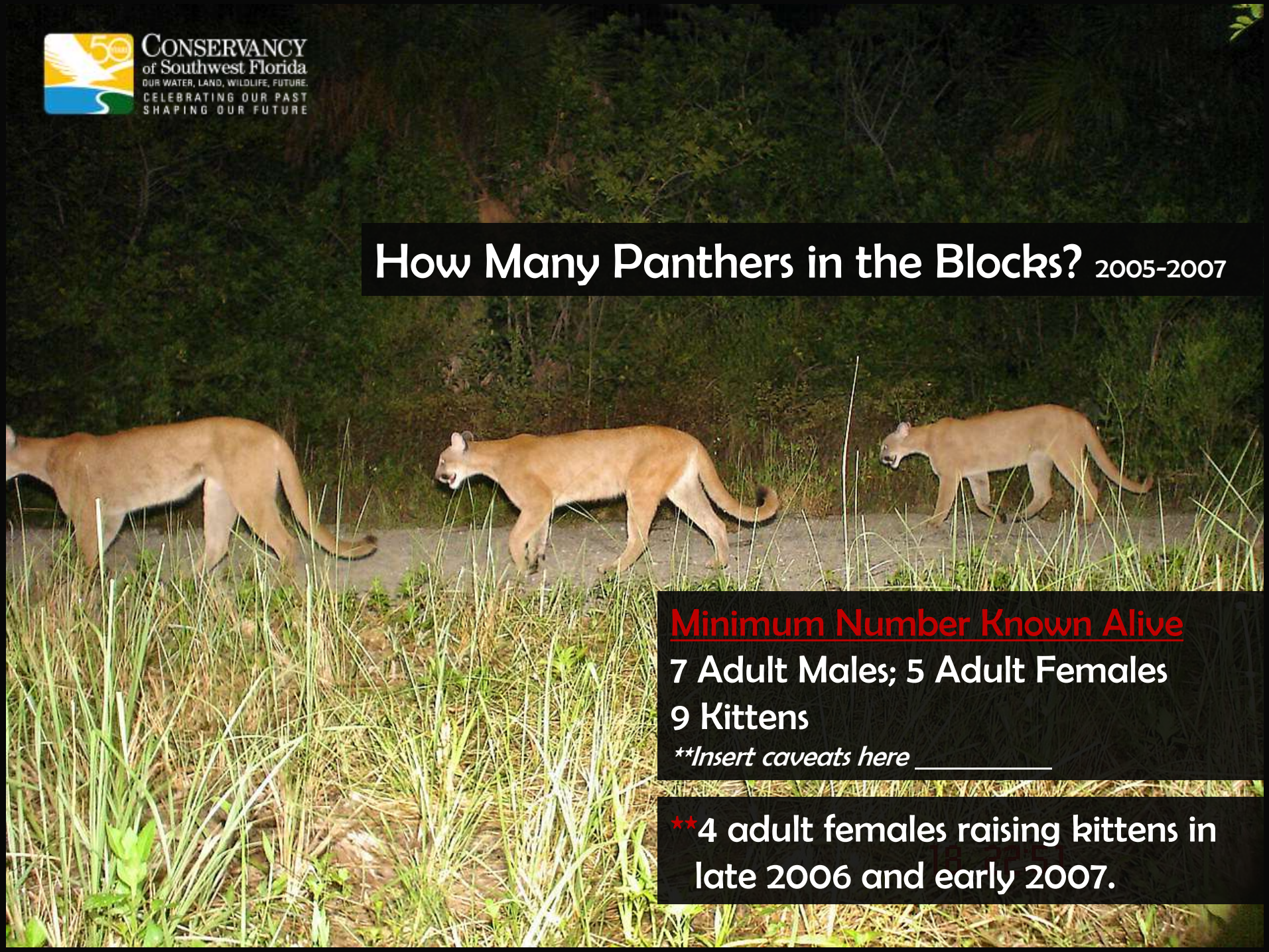
Predator Avoidance Behavior in Action?

Locomotory Activity Patterns of Florida Panther and White-tailed Deer Relative to Sunrise and Sunset in the Picayune Strand Restoration Project Area





CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE


CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE
How Many Panthers in the Blocks? 2005-2007
Minimum Number Known Alive
7 Adult Males; 5 Adult Females
9 Kittens
**Insert caveats here
**4 adult females raising kittens in late 2006 and early 2007.

CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

24 15:54

CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Picayune Strand Restoration Project Area
Post-Construction Monitoring Plan

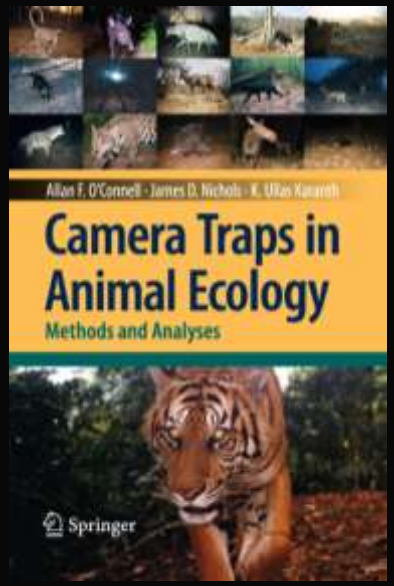
Florida panther prey base monitoring will begin after the first full wet season upon completion of the entire PSRP (2018-2019).

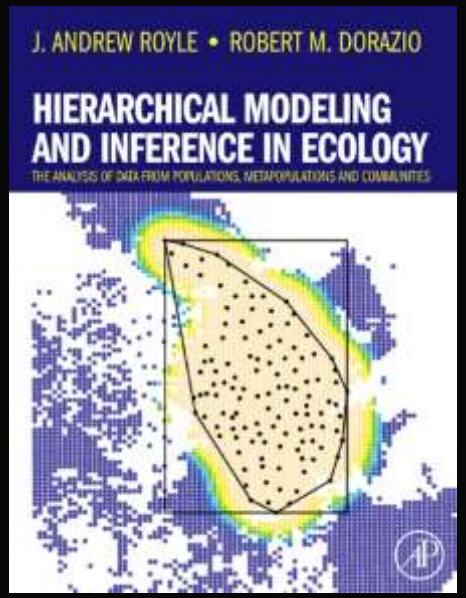
Monitoring events will cover a 2-year period and be performed every 5 years, or until the year 2050.

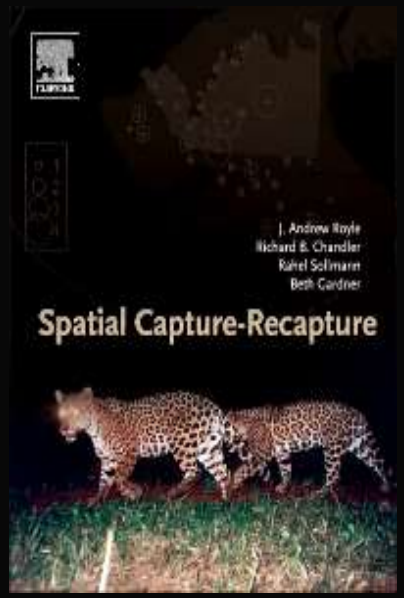
Targets:

- Trends in spatial distribution and abundance that examine whether panther and prey populations are remaining relatively stable or increasing.
- The maintenance or increase of a reproducing population of panthers is important.

Review of Camera Trap Survey Data of the Florida Panther ~~and their Prey~~ in Southwestern Florida: Analyses using Statistical Estimation Methods and Recommendations for Future Survey Design







CONSERVANCY of Southwest Florida

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

U.S. FISH & WILDLIFE SERVICE

USGS science for a changing world

NC STATE UNIVERSITY

Spatial Mark-Resight

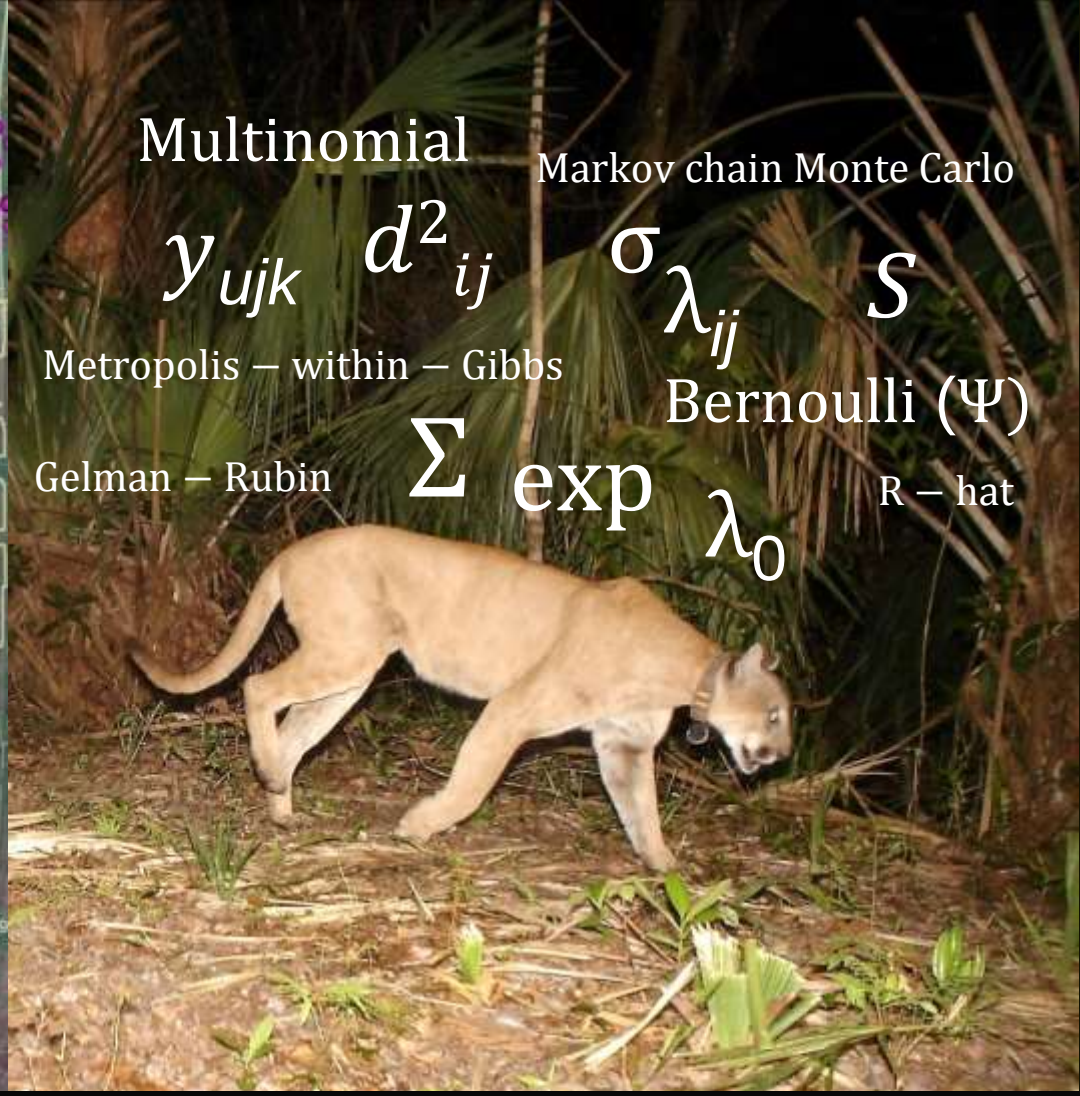
Sollmann, R., B. Gardner, R. B. Chandler, D. B. Shindle, D. P. Onorato, J. A. Royle, and A. F. O'Connell. 2013. *Using Multiple Data Sources Provides Density Estimates for Endangered Florida Panther.* Journal of Applied Ecology 50:961-968.

Conservancy of Southwest Florida

USGS science for a changing world

NC STATE UNIVERSITY

Florida Fish and Wildlife Conservation Commission



Sollmann, R., B. Gardner, R. B. Chandler, D. B. Shindle, D. P. Onorato, J. A. Royle, and A. F. O'Connell. 2013. *Using Multiple Data Sources Provides Density Estimates for Endangered Florida Panther.* Journal of Applied Ecology 50:961-968.

Conservancy of Southwest Florida

USGS science for a changing world

NC STATE UNIVERSITY

Florida Fish and Wildlife Conservation Commission

Spatial Mark-Resight

Unmarked Captures

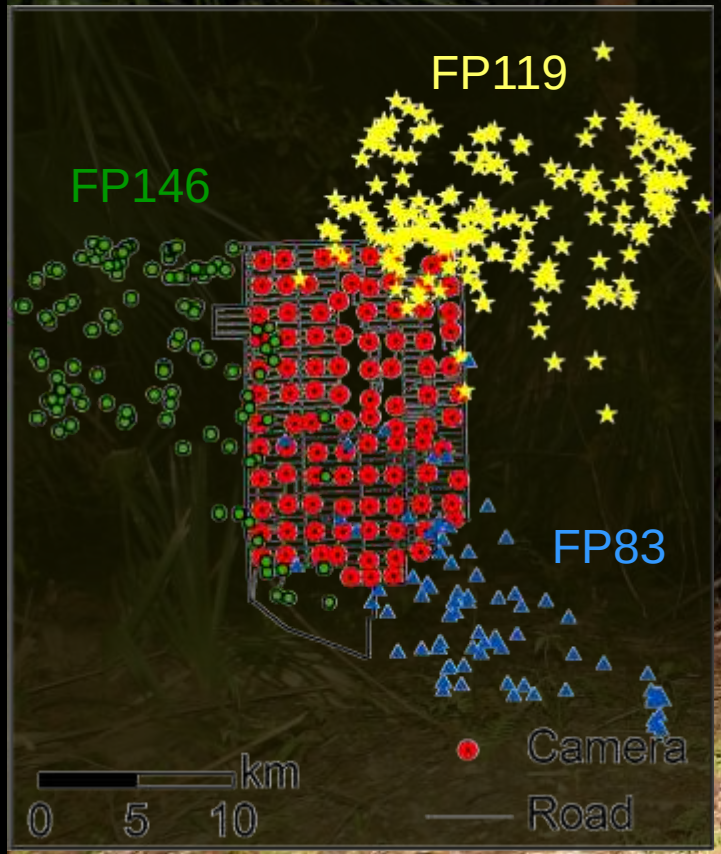
Assumed to occur via the same processes as marked panther captures.

Marked Captures

Radiocollared panthers provide information on individual detection and movement.

- Uses simultaneously collected camera trapping and telemetry data.
- Allows for only a portion of the population to be identified.
- Links abundance to a clearly defined area.

Spatial Mark-Resight



	Density [per 100 km^2]	Confidence Interval
Occasion 1	1.51	0.81 – 2.73
Occasion 2	1.46	0.76 – 2.97

Precision of model and future density estimates should improve with an increased number of radiocollared panthers and recaptures.

Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge

Study Period: 2012 - in progress

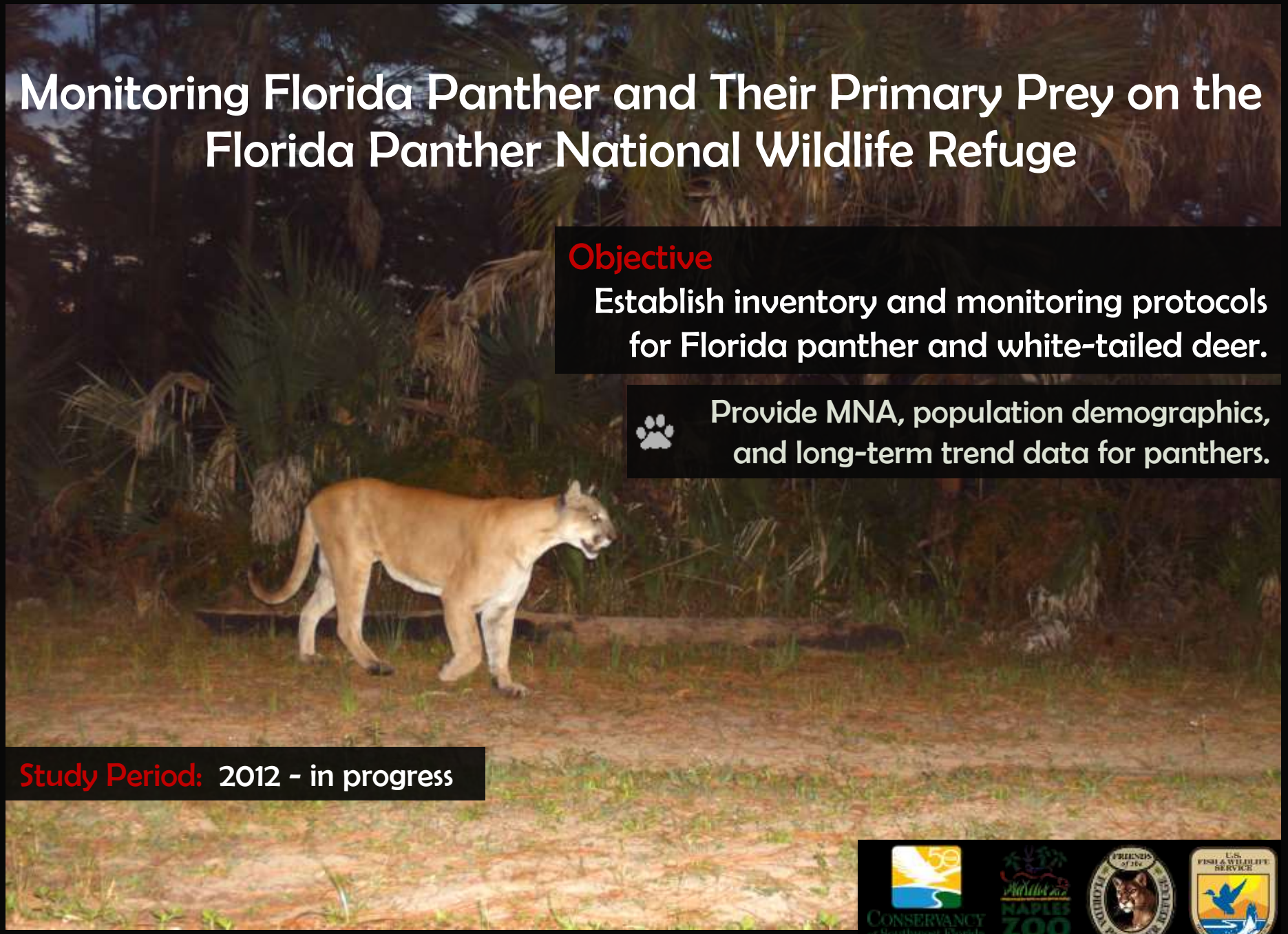
Conservancy of Southwest Florida

Naples Zoo

Friends of the Florida Panther Refuge

U.S. Fish & Wildlife Service

Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge

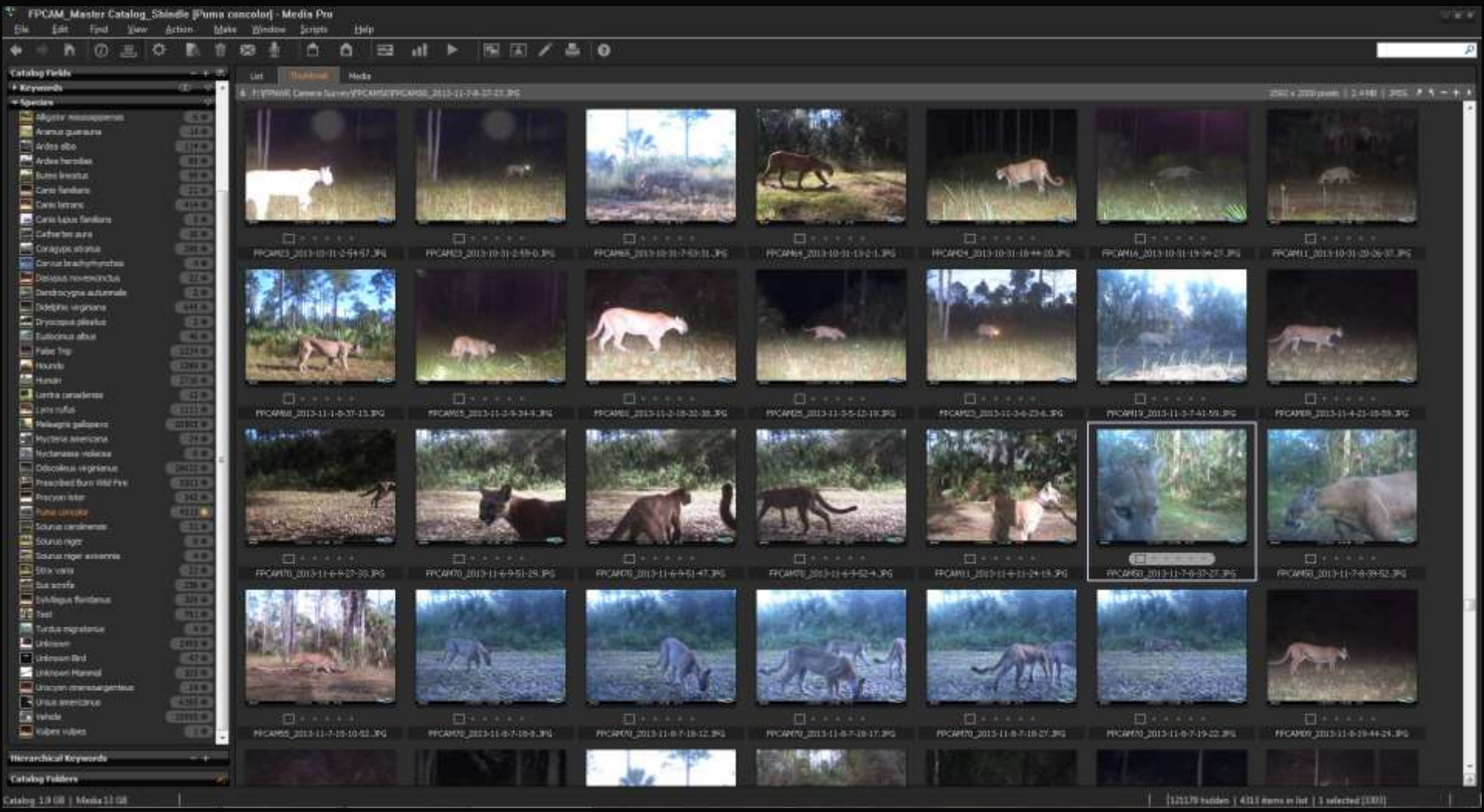


Objective

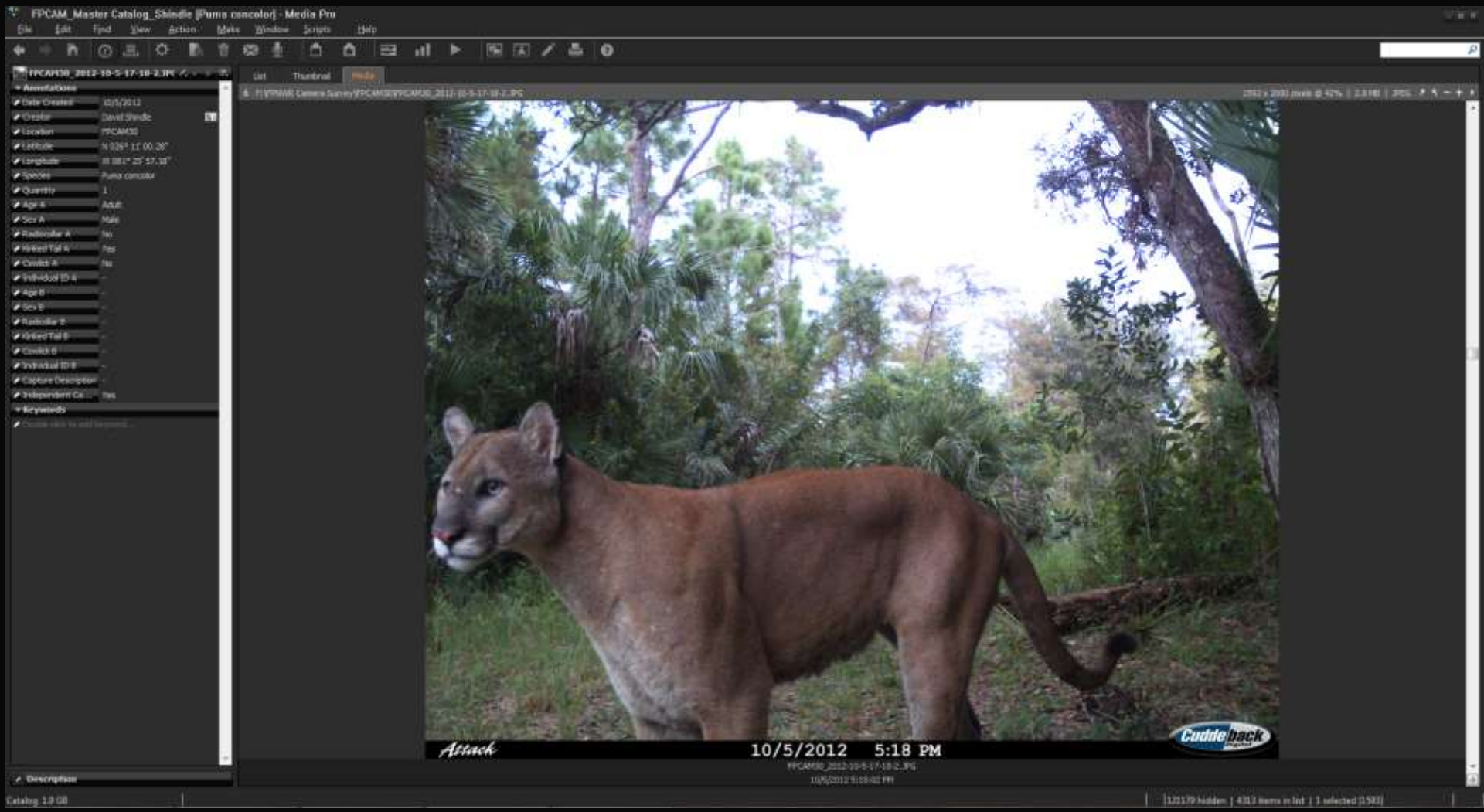
Establish inventory and monitoring protocols for Florida panther and white-tailed deer.

- Provide MNA, population demographics, and long-term trend data for panthers.

Study Period: 2012 - in progress



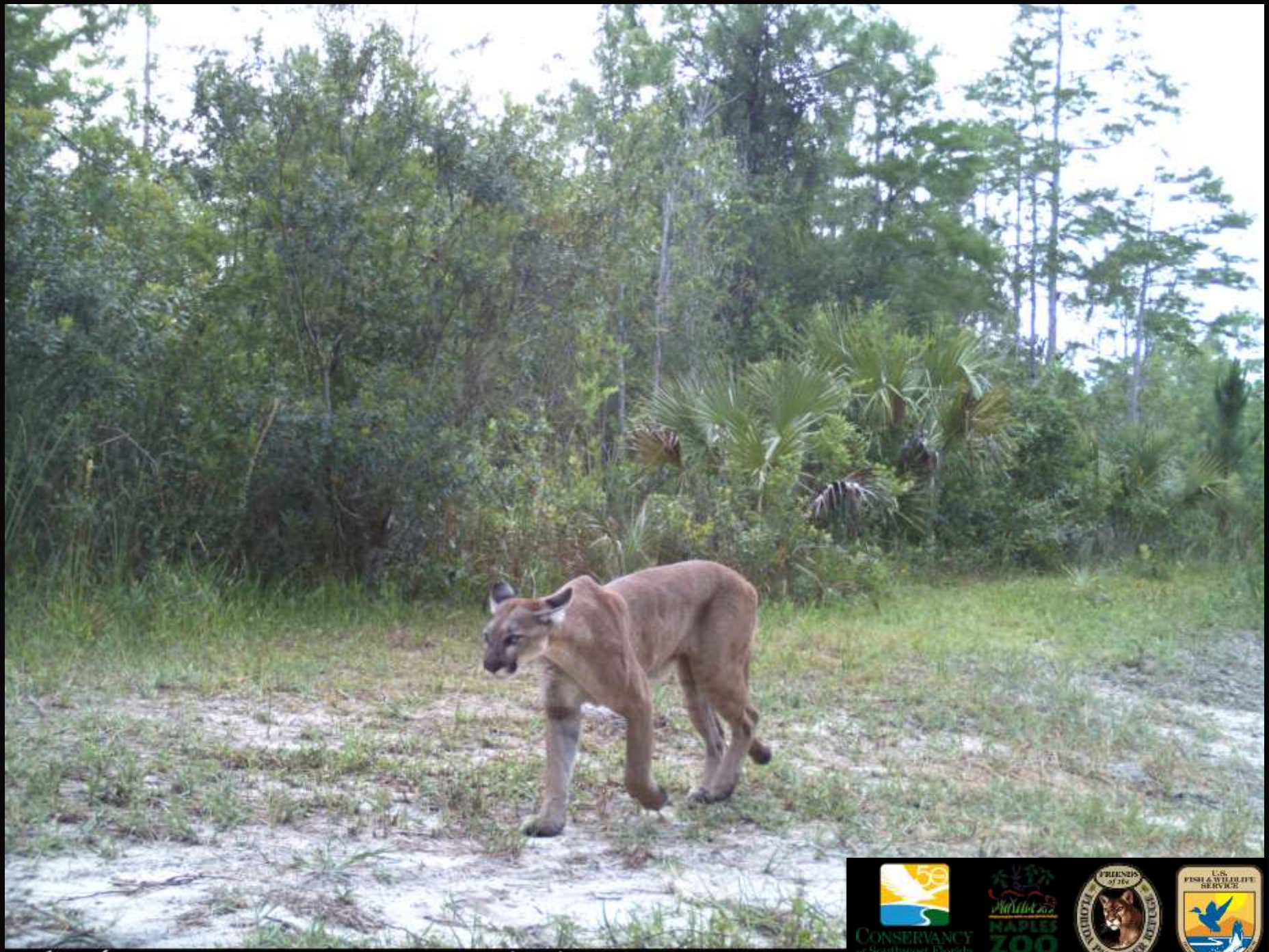
CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE



CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Attack
2/10/2012 4:28 PM
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE


Attack
5/13/2012 3:51 PM
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

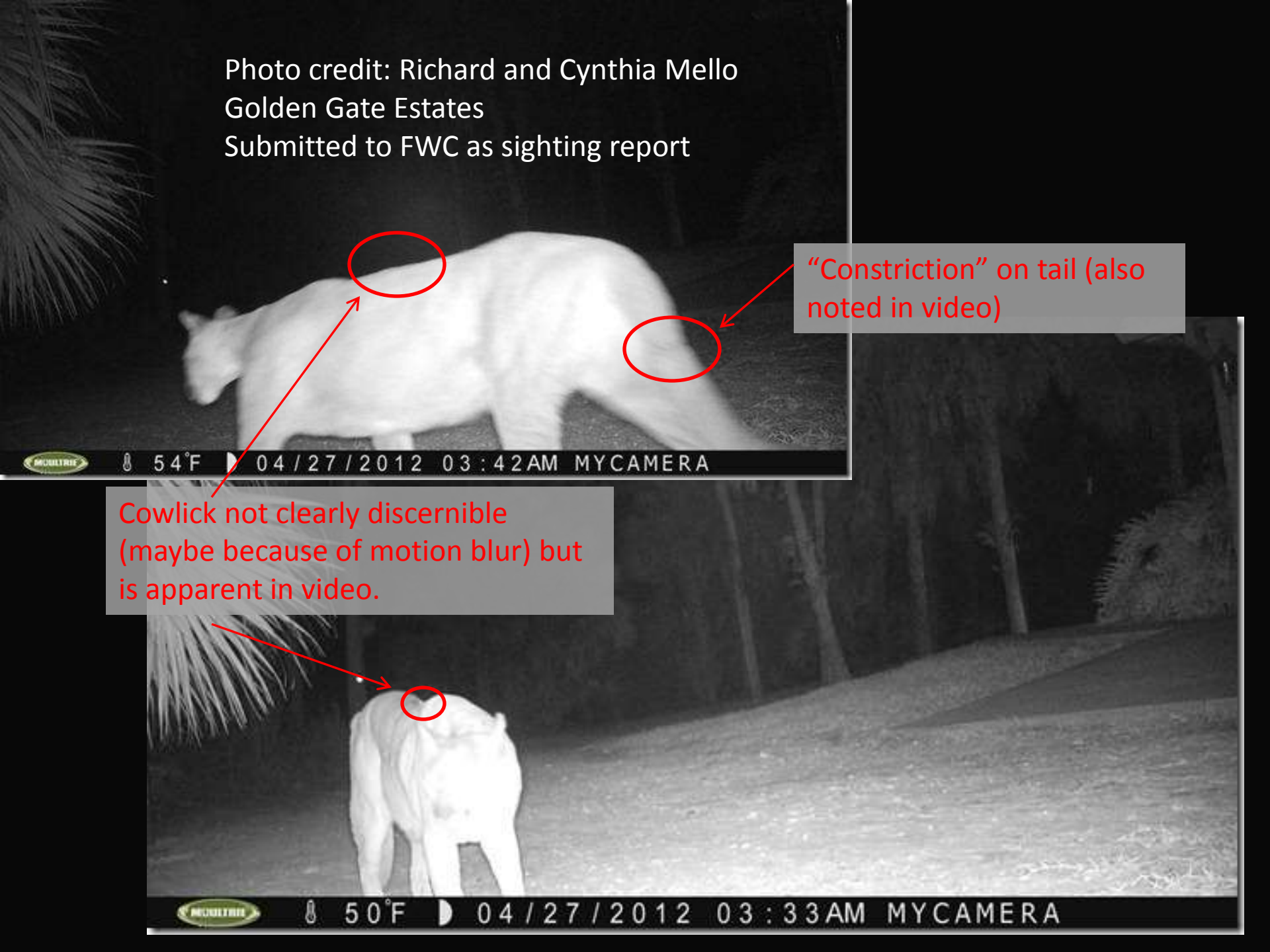
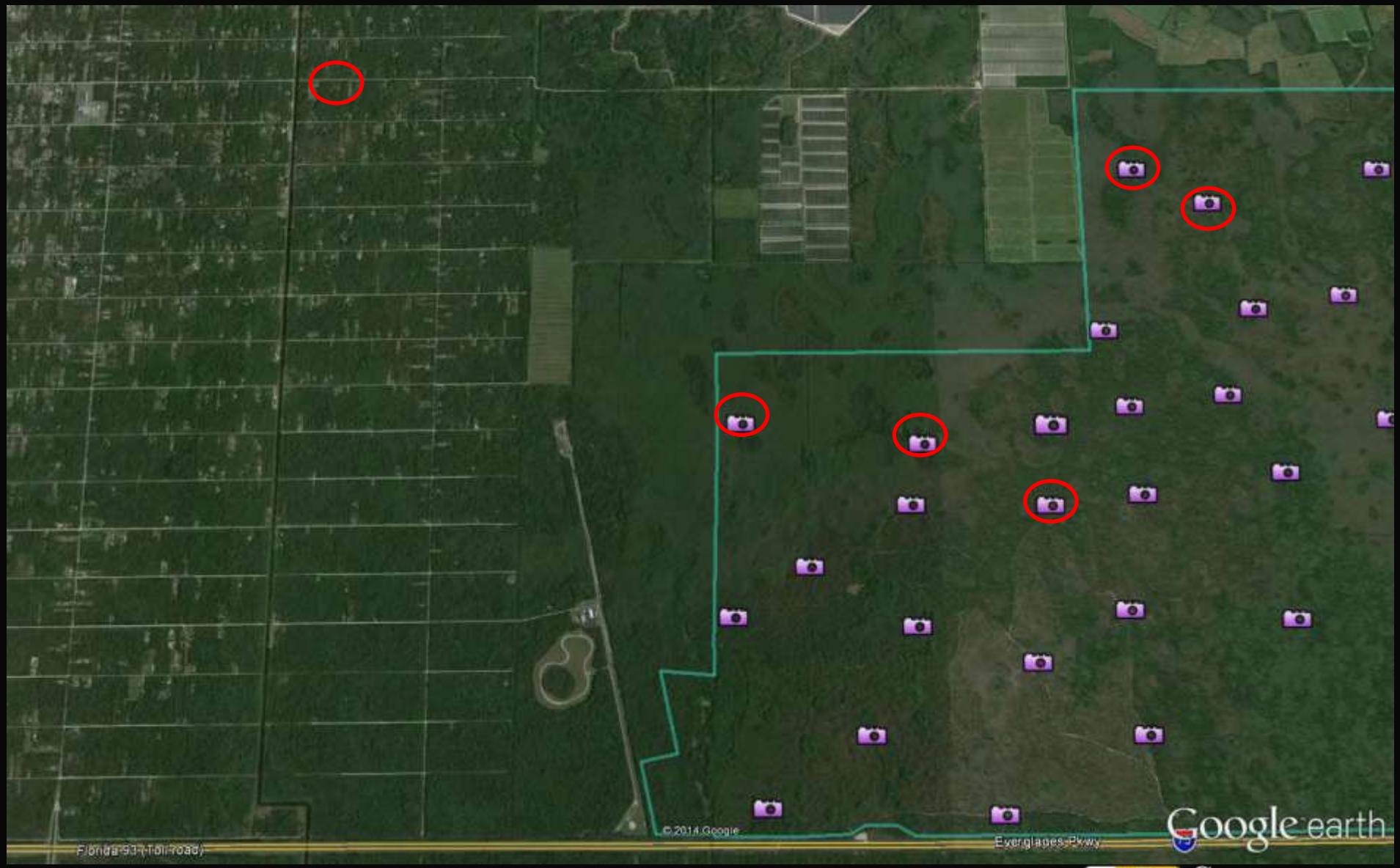


Photo credit: Richard and Cynthia Mello
Golden Gate Estates
Submitted to FWC as sighting report
"Constriction" on tail (also noted in video)
Cowlick not clearly discernible (maybe because of motion blur) but is apparent in video.
54°F 04/27/2012 03:42AM MYCAMERA
50°F 04/27/2012 03:33AM MYCAMERA

Attack
12/14/2011 11:32 AM
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

Attack
1/26/2013 5:55 PM ID:14
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE



CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

Using Camera Traps as a Tool to Monitor Important Demographic Parameters of the Florida Panther Population:

Reproductive Success and Kitten Survival

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Attack
10/17/2013 11:49 AM ID:69
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS
FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Attack
12/13/2013 6:47 AM ID:64
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Attack
6/8/2014 7:15 PM ID:45
Conservancy of Southwest Florida
Naples Zoo
Florida Panther Refuge
U.S. Fish & Wildlife Service

Florida Panther National Wildlife Refuge 2013 Annual Panther Count Data Submitted to Mr. Roy McBride, Rancher's Supply, Inc.

Uncollared

Adult Female FPNWR_F2 with 2 kittens

Adult Female FPNWR_F4 with 3 kittens

Adult Female FPNWR_F7 with 3 kittens

Radiocollared

Adult Female FP113** with 1 kitten

Adult Female FP222 with 3 kittens

Adult Female FP195

Adult Female FP215

7 Adult Females 12 Kittens

Uncollared

Adult Male FPNWR_M2

Adult Male FPNWR_M4

Adult Male FPNWR_M5

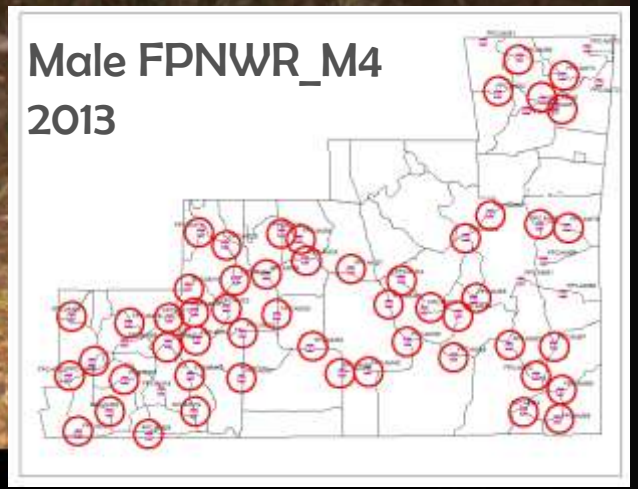
Radiocollared

Adult Male FP183

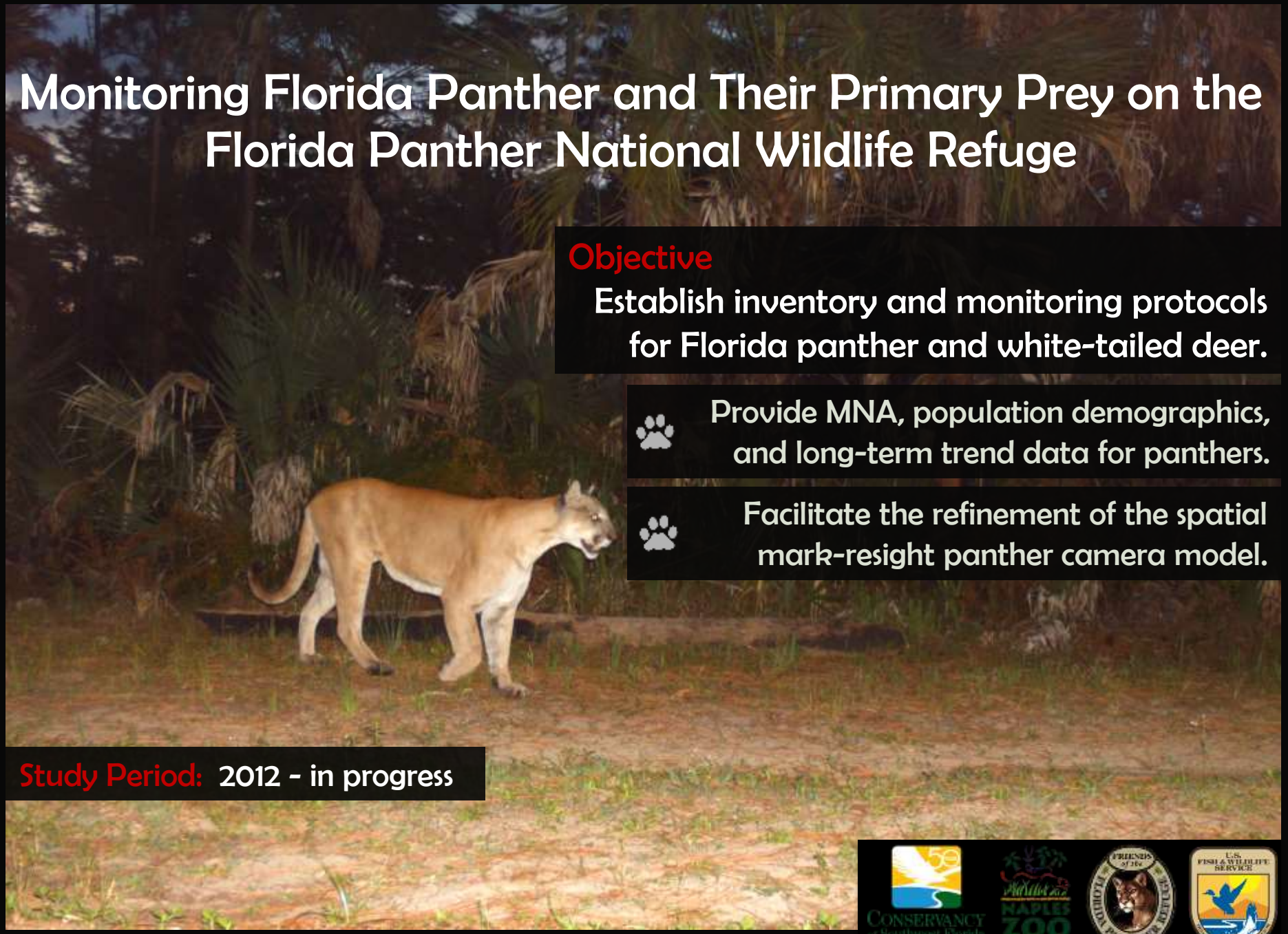
Adult Male FP216**

**failed radiocollar

5 Adult Males



Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge



Objective

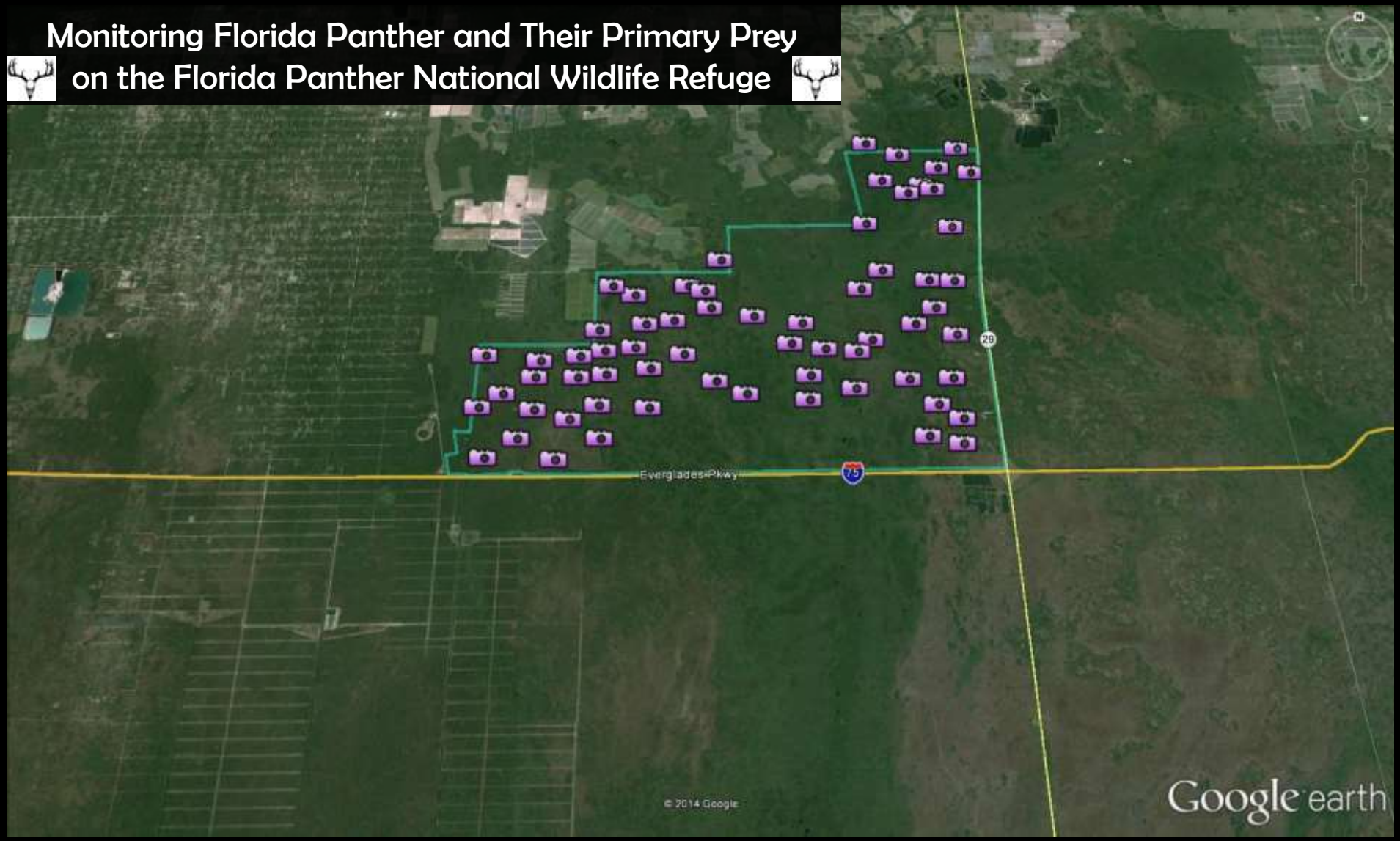
Establish inventory and monitoring protocols for Florida panther and white-tailed deer.

- Provide MNA, population demographics, and long-term trend data for panthers.
- Facilitate the refinement of the spatial mark-resight panther camera model.

Study Period: 2012 - in progress

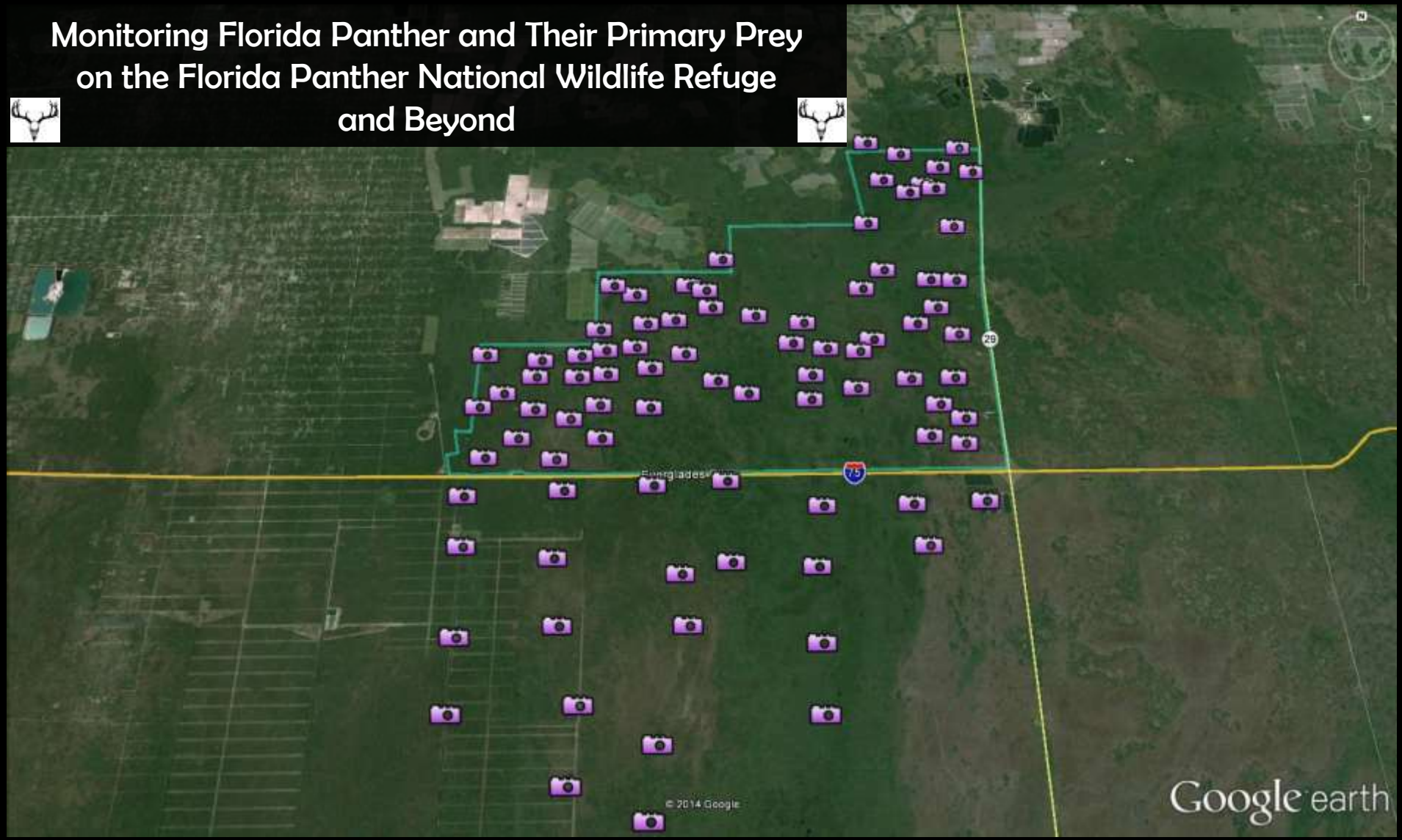
Conservancy of Southwest Florida · Naples Zoo · Friends of the Florida Panther Refuge · U.S. Fish & Wildlife Service

Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge

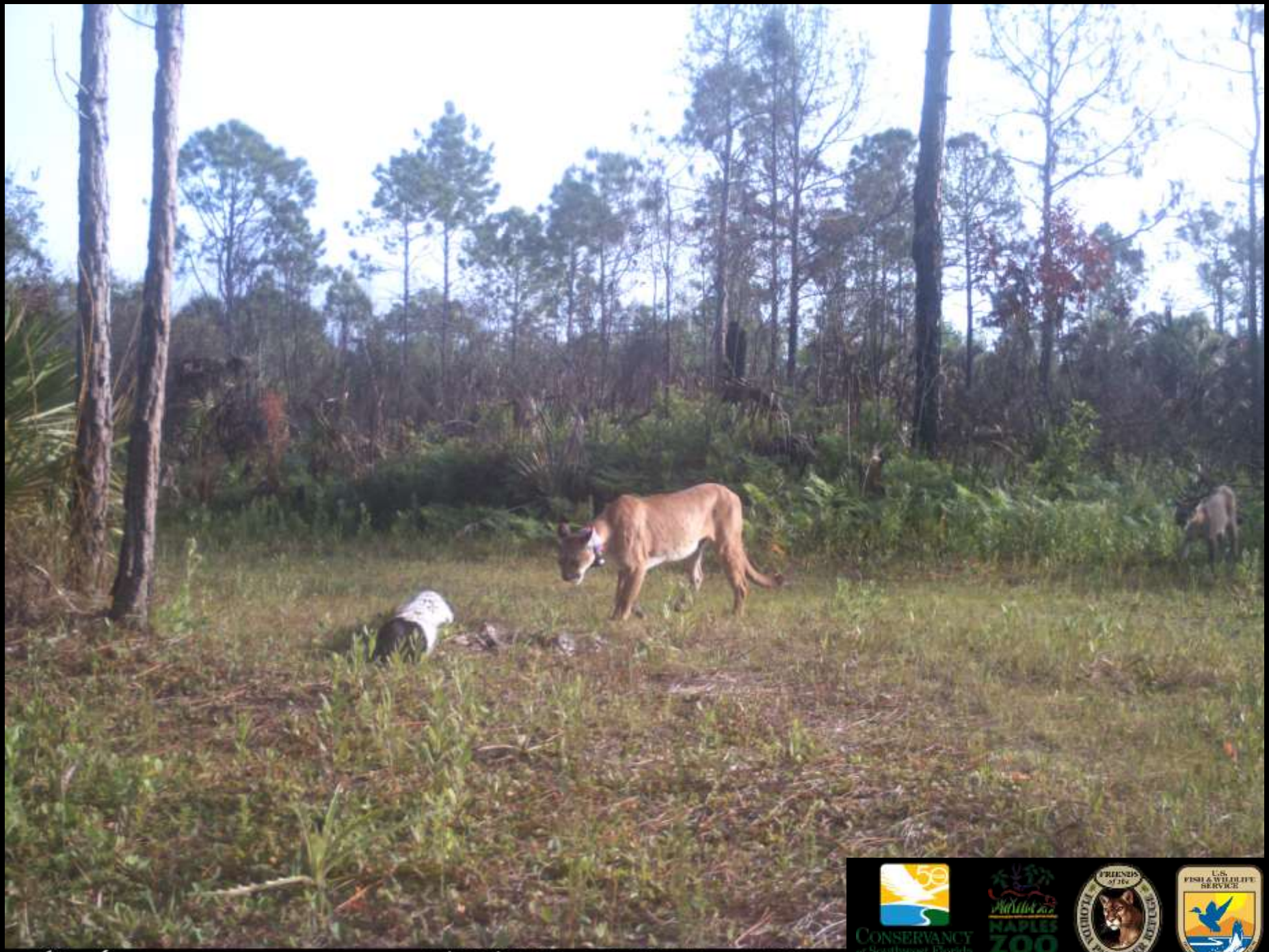


CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge and Beyond



CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE


Attack
3/23/2013 8:01 AM ID:23
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge

Objective

Establish inventory and monitoring protocols for Florida panther and white-tailed deer.

- Provide MNA, population demographics, and long-term trend data for panthers.
- Facilitate the refinement of the spatial mark-resight panther camera model.
- Assess the utility of camera data to monitor demographics and trends of deer herd.

Study Period: 2012 - in progress

Conservancy of Southwest Florida · Naples Zoo · Friends of the Florida Panther Refuge · U.S. Fish & Wildlife Service

Attack
7/14/2012 10:28 AM
Conservancy of Southwest Florida
Naples Zoo
Friends of the Florida Panther Refuge
U.S. Fish & Wildlife Service

Attack
9/7/2012 12:19 PM

Attack
9/4/2012 3:29 PM

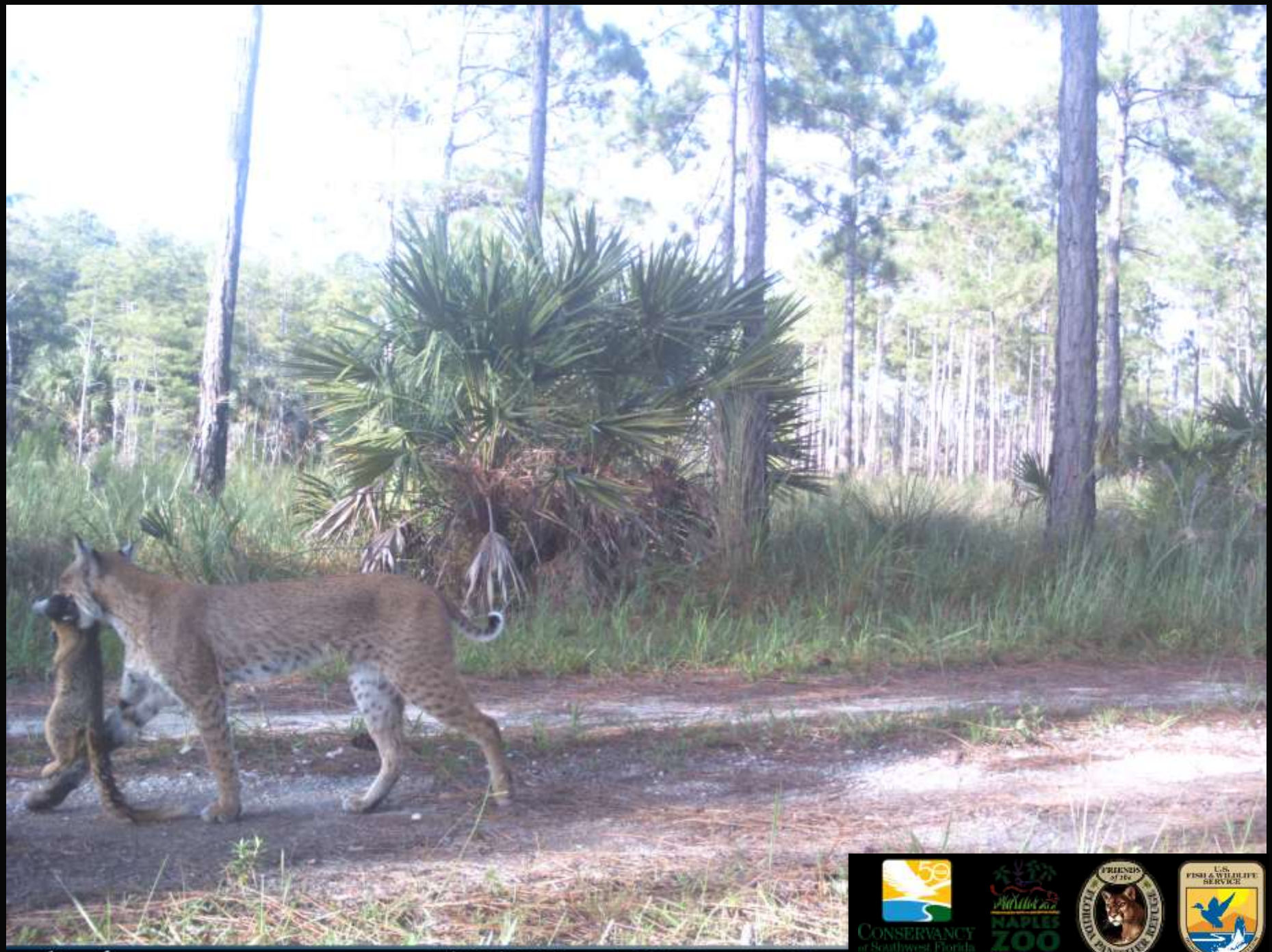
Attack
8/30/2012 6:44 PM

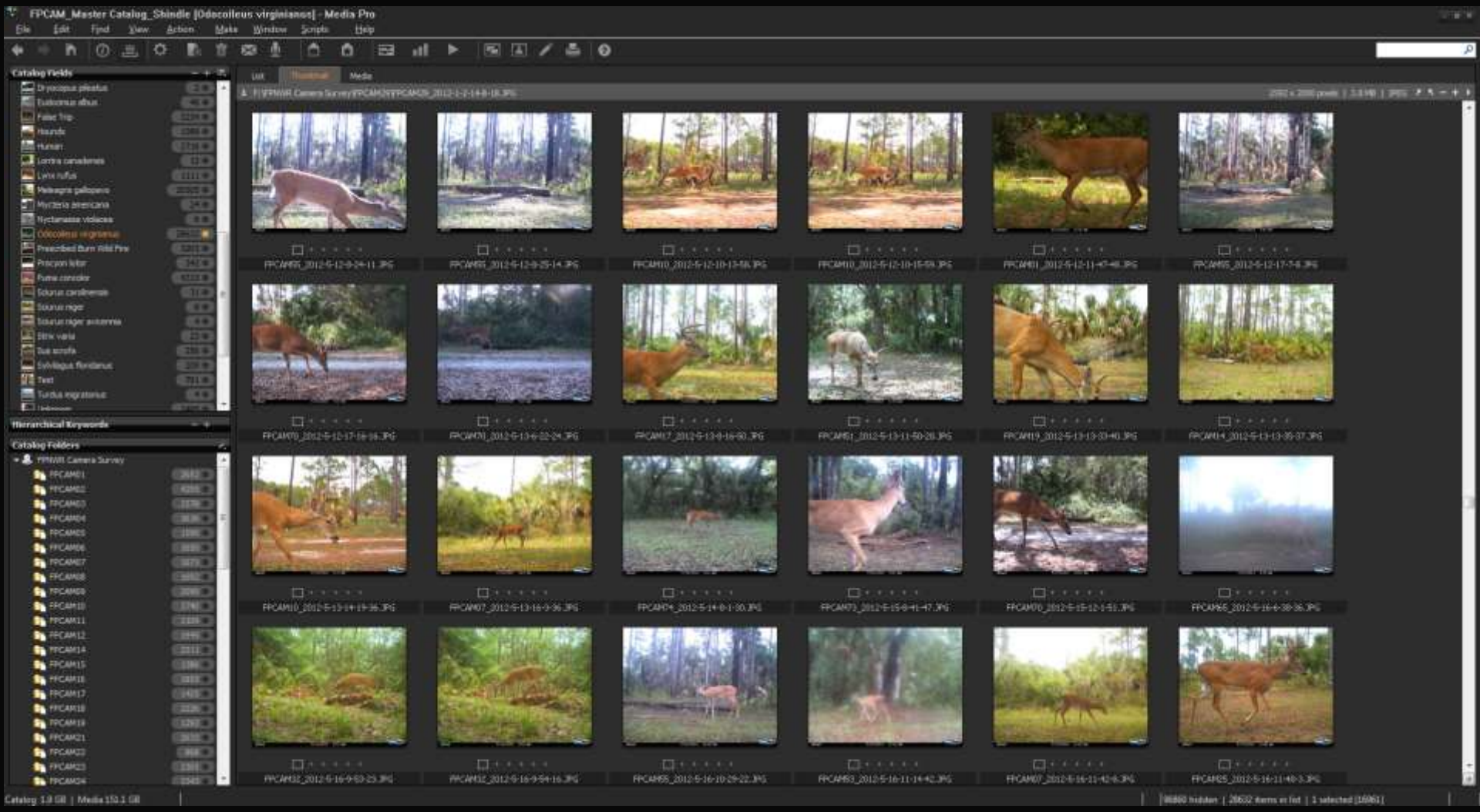
Attack
4/11/2014 7:59 PM ID:1
CuddeBack

Attack
2/22/2012 12:15 PM
CuddeBack

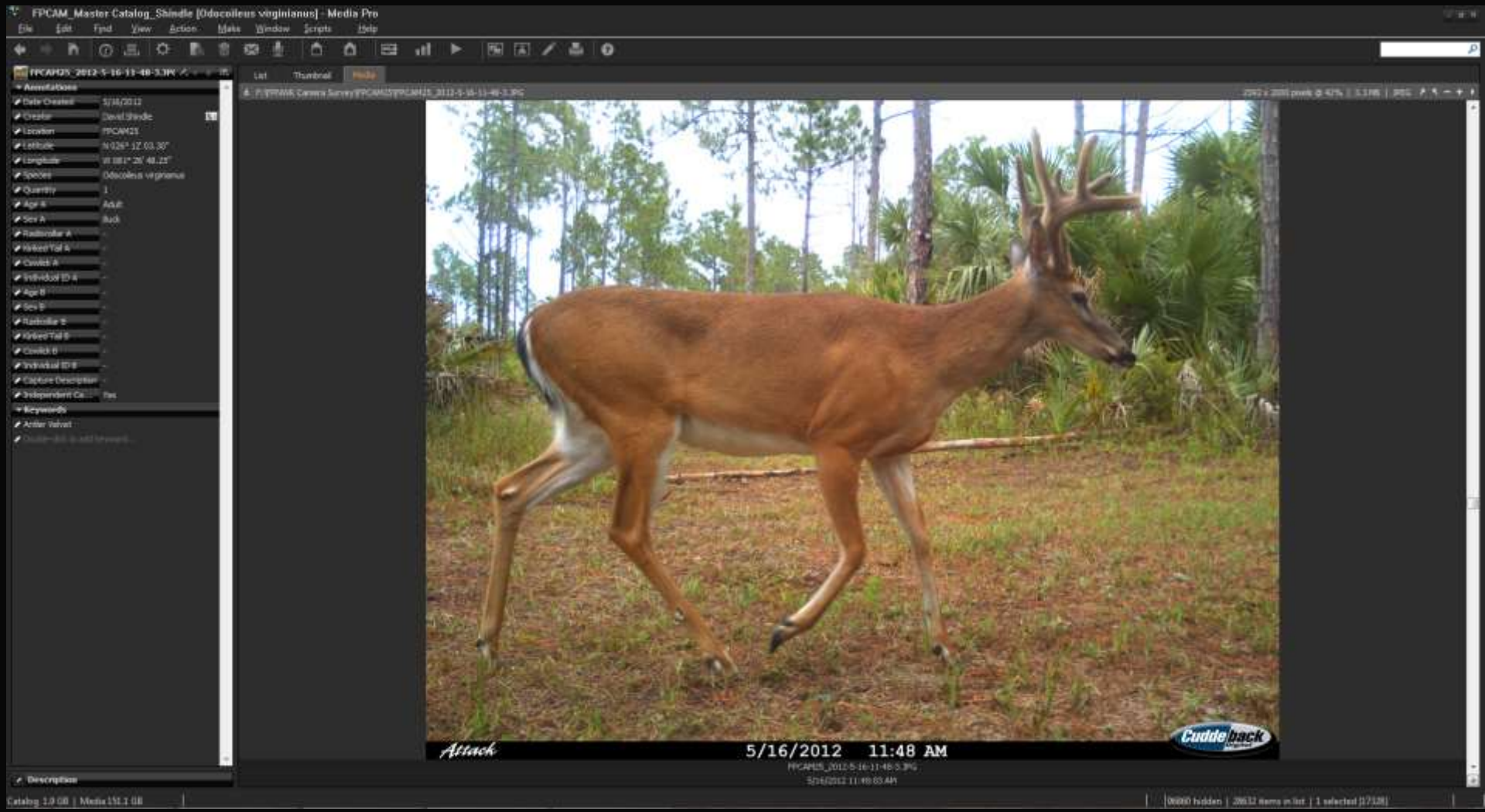
Attack
2/11/2012 4:46 AM
Conservancy of Southwest Florida
Naples Zoo
Florida Panther Refuge
Friends of the
U.S. Fish & Wildlife Service

Attack
4/23/2014 9:34 PM ID:64
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE


Attack
7/28/2014 5:18 PM ID:10
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE



CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE



CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Remote Camera Data Used for Evaluating Population Trends and Demographics of the White-tailed Deer Herd on the FPNWR

- Fawn:Doe and Buck:Doe Ratios as indicators of habitat quality and herd health
- Recruitment as a measure of deer reproductive success
- Fawning Period, Antler Shedding, Antler Hardening, and Activity Periods

CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST SHAPING OUR FUTURE

Attack 6/10/2013 12:33 AM ID:15

Cuddeback Digital

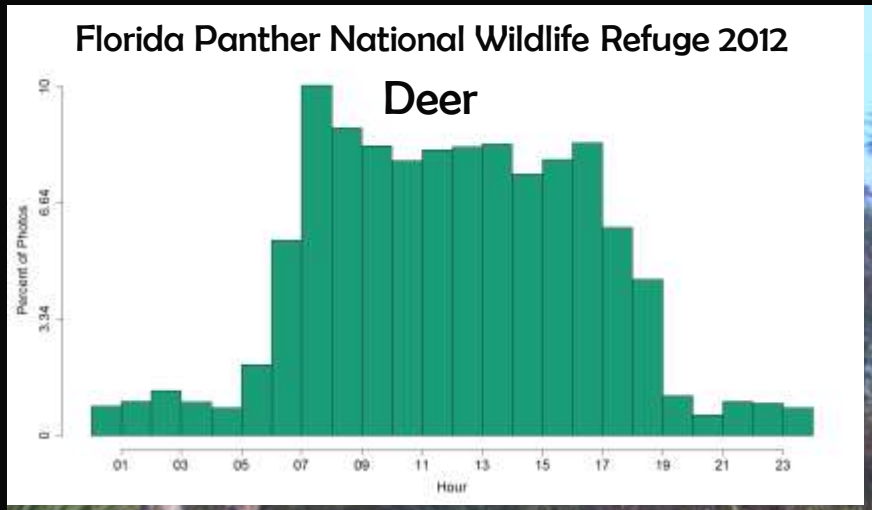
Long-term Remote Camera Monitoring of White-tailed Deer in Southern Florida: a Snapshot of Unique Selection Pressures and Regional Adaptations

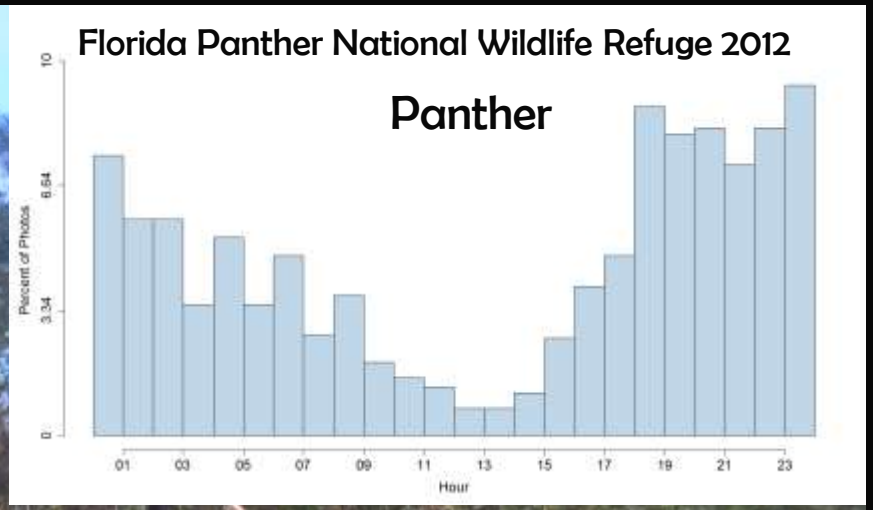
CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST SHAPING OUR FUTURE

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

U.S. FISH & WILDLIFE SERVICE

2014 Southeastern Deer Study Group Meeting, Athens, GA





"Deer move most at dawn and dusk. End of story. Like taxes and death, you can count on two things when talking about mature bucks: they move most at dawn and dusk, and during the rut. Deer are crepuscular. It's built into their DNA." Quality Deer Management Assoc.

Anywhere But Here Theory

All a prey animal needs to do is be anywhere the predator isn't — it doesn't matter if it's a foot away, or a hemisphere — and it will live another day. The predator, on the other hand, must be exactly where its prey is, and at exactly the same moment, or it will starve. Thus for a predator, mastery of both time and space — in addition to a thorough understanding of terrain and prey behavior — are crucial.

–Clark Barrett, excerpt from *The Tiger*

CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Attack
12/13/2011 8:32 AM
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Attack
12/17/2011 10:34 AM
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

Attack
1/22/2012 9:57 AM
CONSERVANCY of Southwest Florida
NAPLES ZOO
FRIENDS of the FLORIDA PANTHER REFUGE
U.S. FISH & WILDLIFE SERVICE

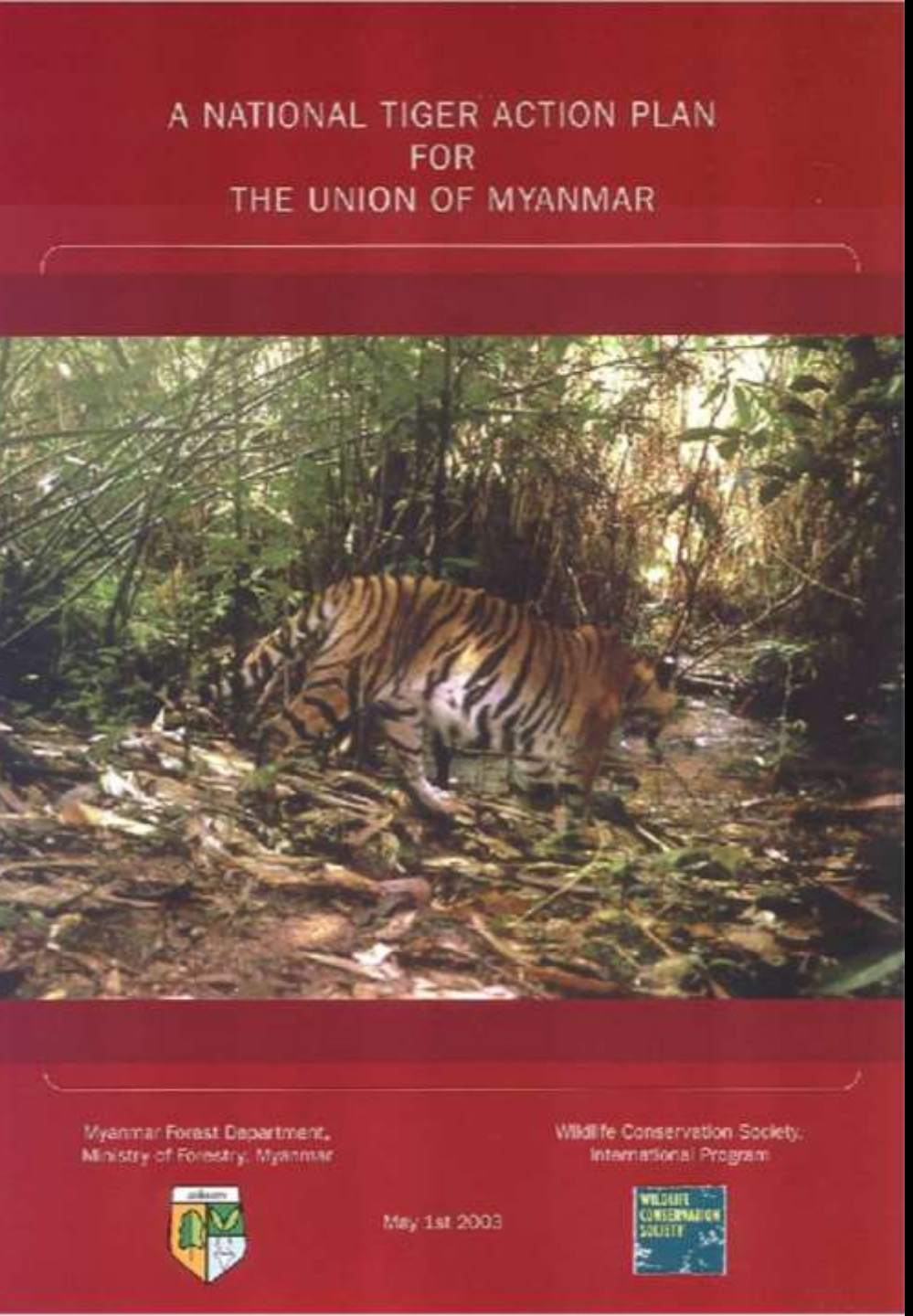
CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

South Florida Deer Research Project

Objectives

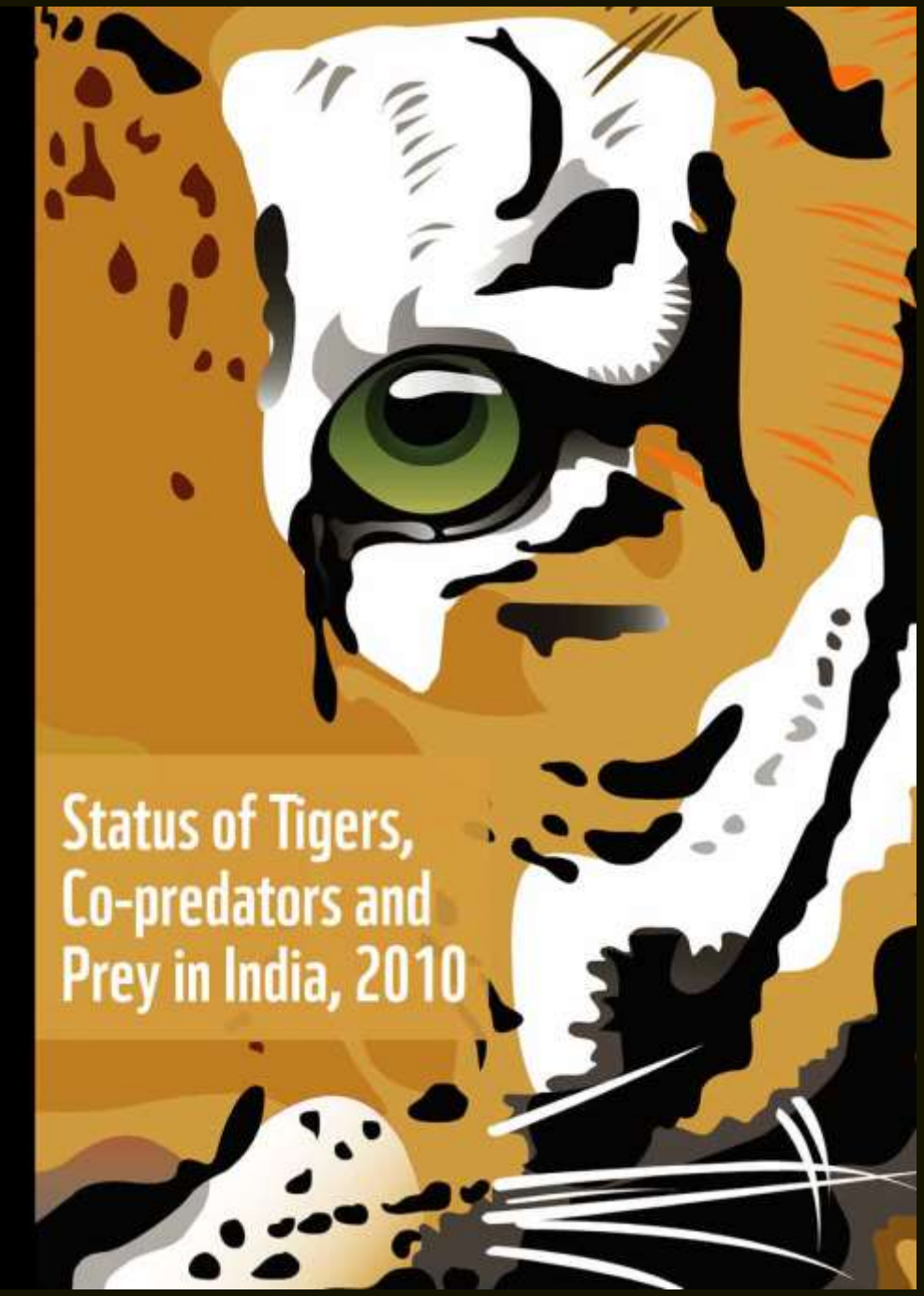
- Understand what factors influence deer population dynamics in South Florida.
- Develop a survey method using remote-sensing cameras that will provide dependable deer density and abundance estimates at a large-scale.

CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE



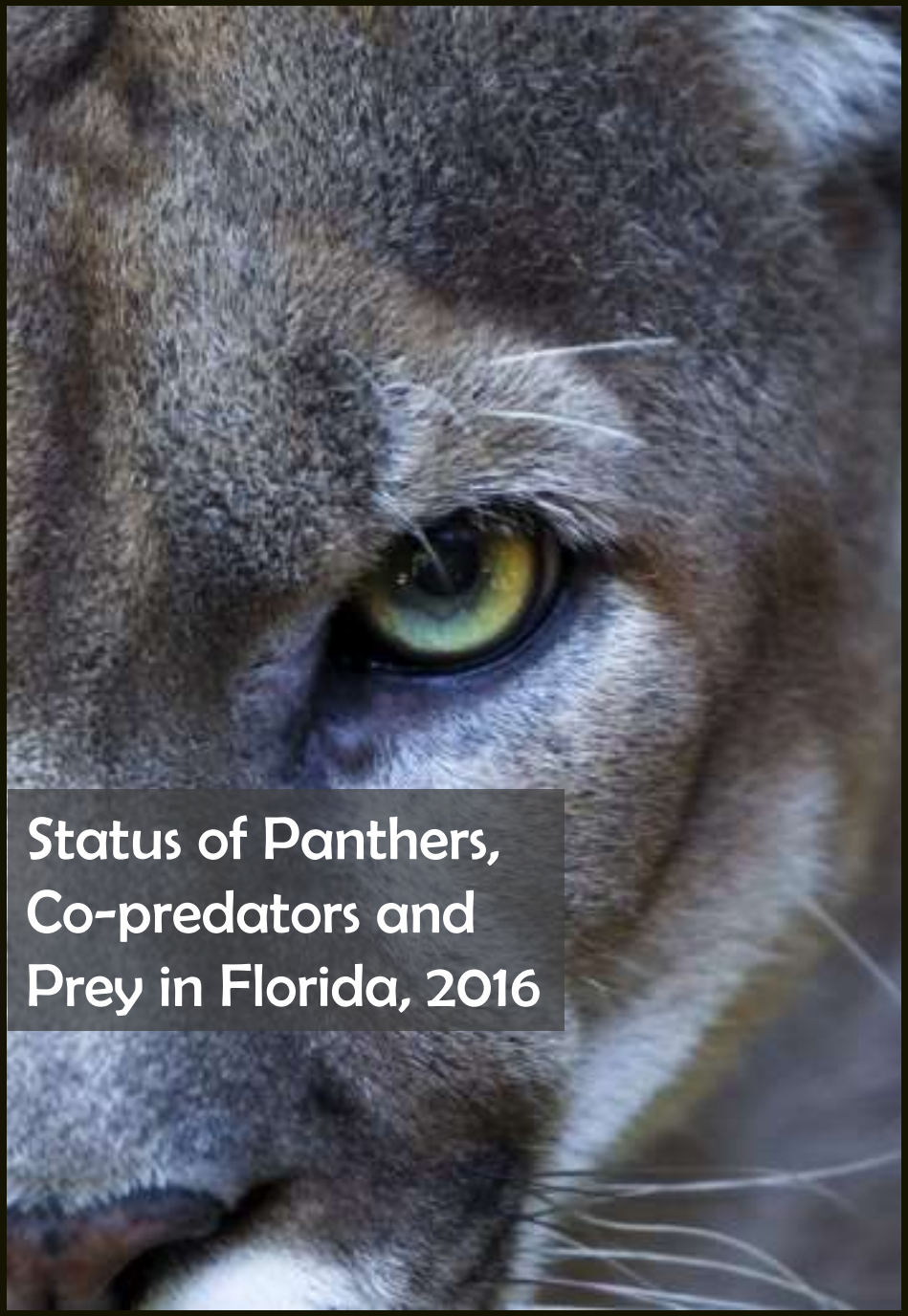
Interpretation of Tiger Population Status From Field Observations

Population Status	Interpretation
Reproductive population	Observations of pregnant females, juveniles, and /or cubs
Present, but not necessarily reproductive	Observations of adult male or non-pregnant adult female individuals
Low density, ecologically effective absence	Tigers may be present at low density but are not recorded
True absence	Tigers are not recorded over a period of monitoring at a site



Project Tiger

National Repository of Camera Trap Photographs of Tigers (NRCTPT)



Status of Panthers, Co-predators and Prey in Florida, 2016

Project Panther

CONSERVANCY
of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

The End!