

Quantifying surface disturbances related to oil production in West Florida, USA

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Introduction

- Oil history in Florida
 - **1901: first wells near Pensacola (West Florida)**
 - 1910-1939: 87 wells West and Southwest Florida
 - 1939: state offered \$50,000 for 1st oil discovery
 - **1943: Humble Oil strikes oil (Collier county)**
 - 1945: regulation in FL (drilling and production)
 - 1947: taxing oil and gas
 - 1948: 650,000 barrels
 - **1970: Jay field discovery (Santa Rosa/Escambia)- FL's largest**
 - 1979:
 - FL oil production peaks (48 m barrels)- ranked 8th nationally
 - Jay production peaks (36 m barrels ~99k b/d)
 - 1980: Blackjack Creek production peaks (6 m barrels ~17k b/d)
 - 1988: McClellan production peaks (64 k barrels)
 - **2014: Florida ranks 23 and 24 in gas and oil production- BUT substantial offshore deposits in eastern Gulf of Mexico**

Introduction cont.

- **Jay field: 46.05 km² (Santa Rosa & Escambia)**
- 1 billion barrels (original estimate; about half has been produced)
- Proved reserves: 10-15 million barrels
- Production:
 - 1979: 100,000 b/d FL
 - 2013:
 - 6,300 b/d FL
 - 3,673 b/d Jay (90% oil, 10% natural gas liquids).
- Jay = 62% of FL production
- Florida GDP
 - Real estate = 17%
 - Leisure & hospitality (tourism) = 6-13%
 - **Natural resource & mining = 1%**

Context: HSE, E&P, Geospatial and Sustainability

- Question: Do E&P activities necessarily lead to large-scale landscape disturbances- and how do we manage this?
 - WHO: HSE- Reducing environmental alterations related to E&P
 - HOW: Geospatial- data and methods: “accounting from above” - mapping and monitoring
 - WHERE: Upstream E&P
 - WHY: Develop environmental performance standards- sustainability (E&P +)
 - WHY ELSE?

Context cont.

1. Conservationist View:

Oil and gas E&P create permanent landscape disturbances that lead to large-scale land-use and land-cover change.

2. Industry Challenges:

Environmental (risk) management practices (SPE):

- Reducing surface footprint
- Provide relevant, reliable and comparable (investor) information.
- Sustainability reporting.

Objective:

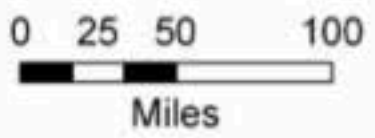
Determine environmental performance/
sustainability of oil and gas operations in West
Florida.

- A. Quantify and map landscape disturbances based on infrastructure features.
- B. Identify leading cause of landscape change.
- C. Rank env performance/sust.
- D. Report findings (sust reporting).

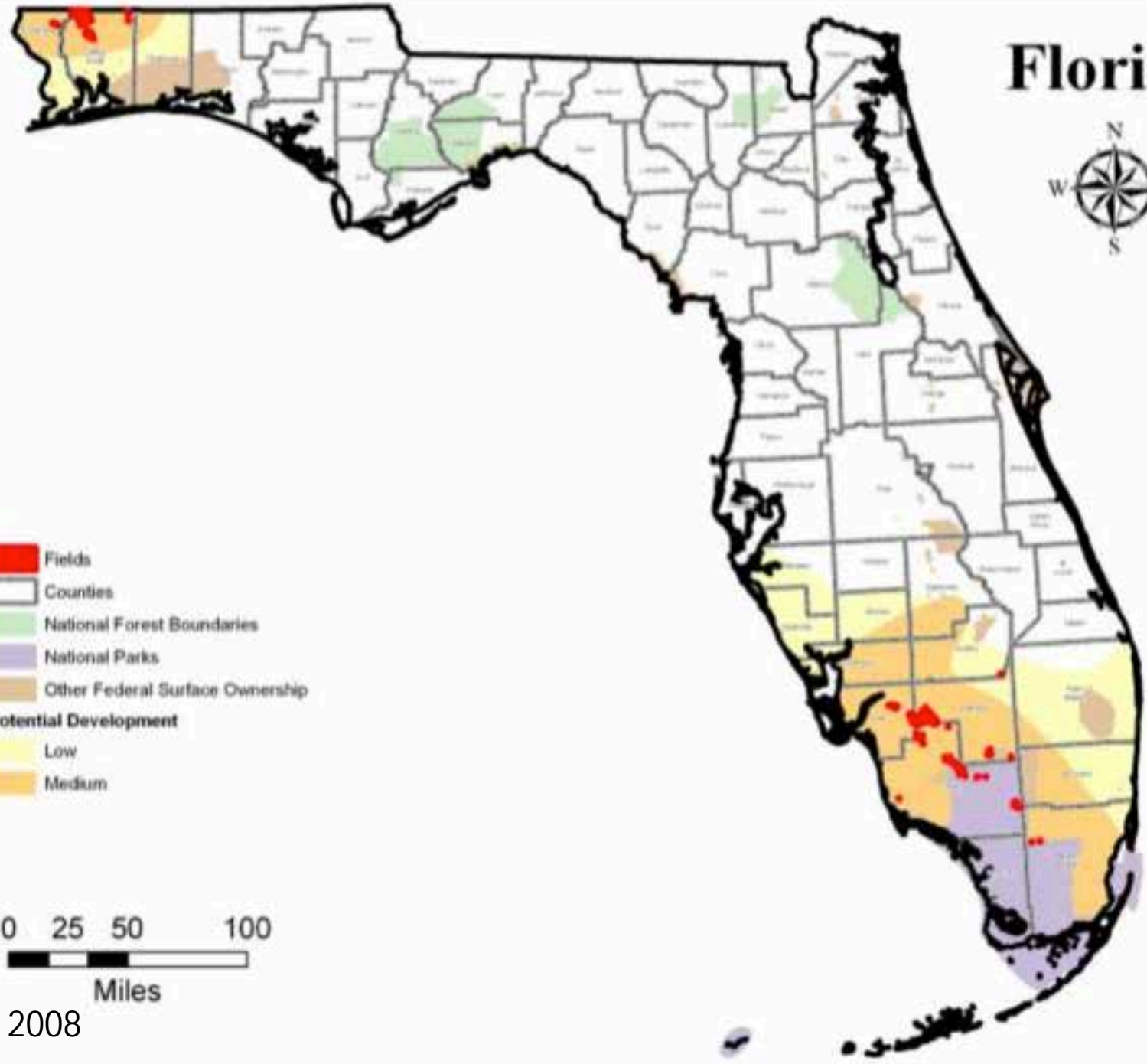
Florida



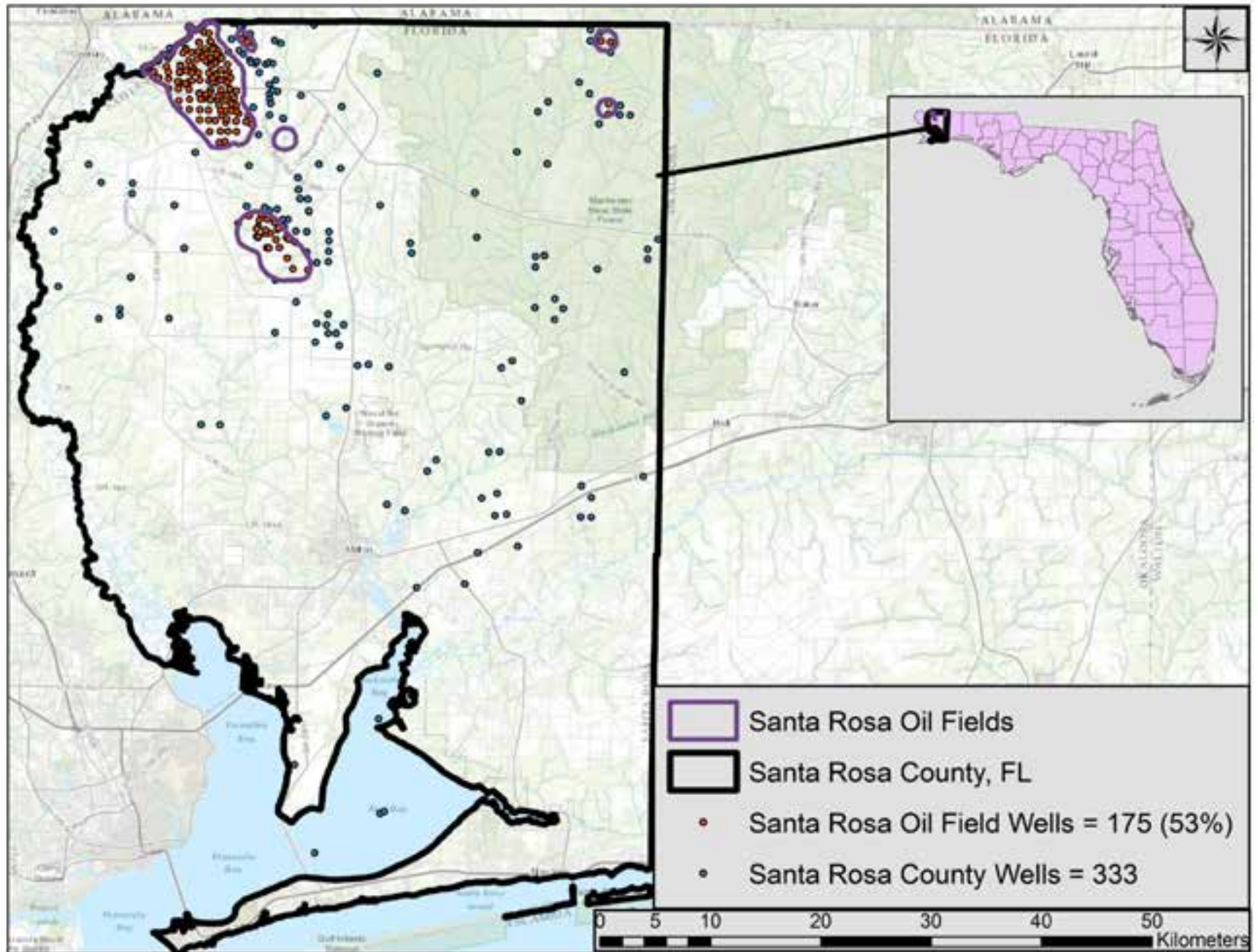
- Fields
- Counties
- National Forest Boundaries
- National Parks
- Other Federal Surface Ownership
- Potential Development**
 - Low
 - Medium

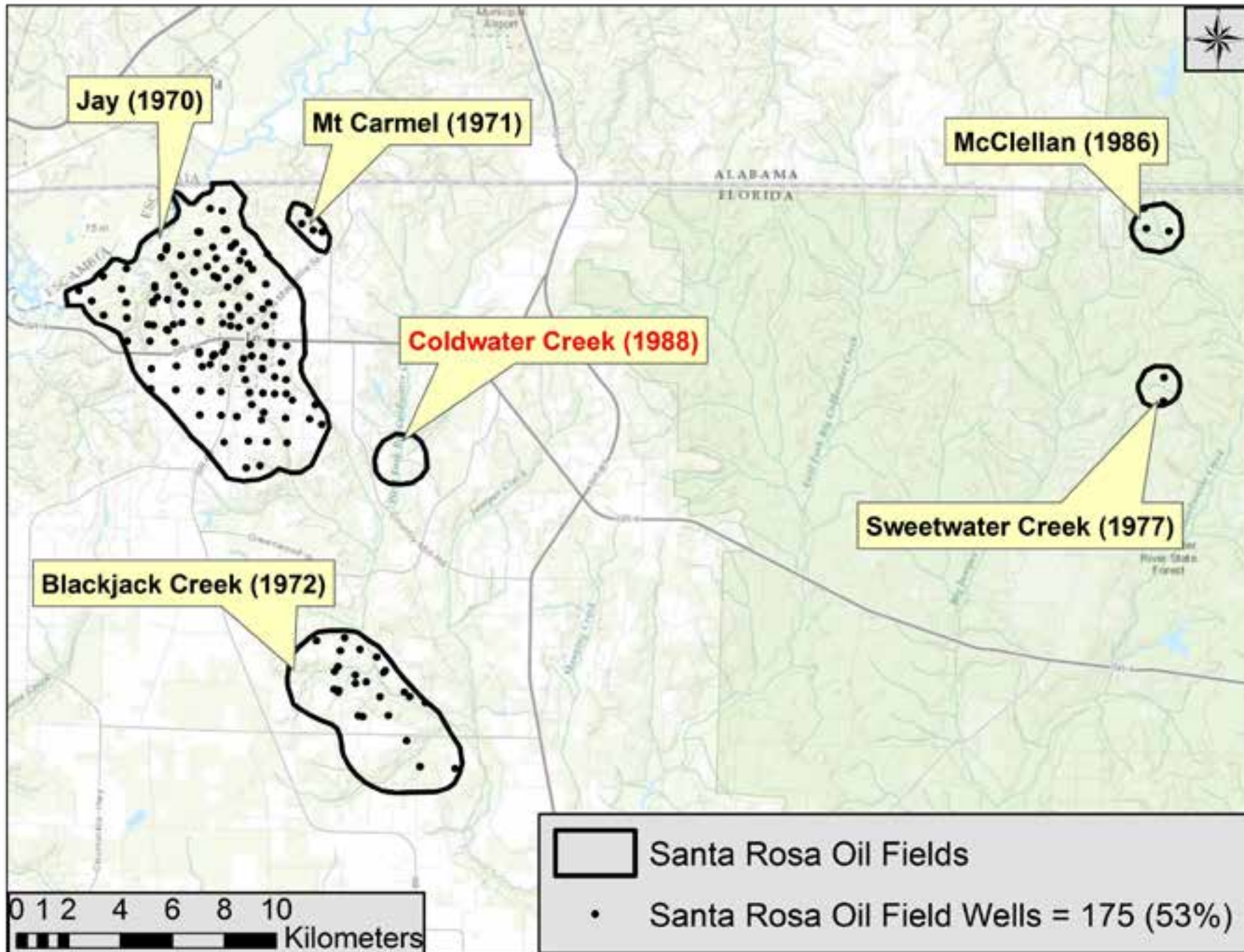


BLM, 2008



Study Area: West Florida, Santa Rosa County





Approach (Data & Methods)

- Surface footprint accounting
 - Geospatial (Earth observation and GIS) and landscape ecology techniques.
 - Measure and map surface disturbances related to visible infrastructure features: “accounting from above” (Mathieu, 2010).

Data

- 1949, 1965 and 1973 historical B&W air photos (georectified)
- 2004 and 2007 orthoquad air photos (LABINS)
- 2013, 2014 satellite imagery (ESRI)
- Florida roads (FGDL, FDOT)
- Florida counties (FGDL)
- Land-use Land-cover (Santa Rosa; NASS)
- Santa Rosa county 6 oilfields- georectified and digitized from Lloyd (1991)
- Oil wells (FGS)

Methods cont.

- Identifying all infrastructure features: datasets, editing and digitizing.
- Assign size (weight)/ standards:
 - US Bureau of Land Management (BLM) E&P disturbance measures
 - DOT
 - Canad Stand Assoc (CSA)
 - European Env Agency
 - PHMSA
 - Roads/Infra/E&P lit

Measurements (Landscape and Road Ecology)

1. Wells
2. Well density (# wells/oilfield km²)
3. Infrastructure length (km)
4. Infrastructure density (km/km²)
5. Direct effects
 - Infrastructure: oil roads, wells, CPFs, non-oil roads
6. Indirect (Edge) effects
 - Infrastructure: Infrastructure: oil roads, wells, CPFs, non-oil roads
7. Core Areas
8. Land-use land-cover

Jay, 1949

Historical Landscape



10/28-65

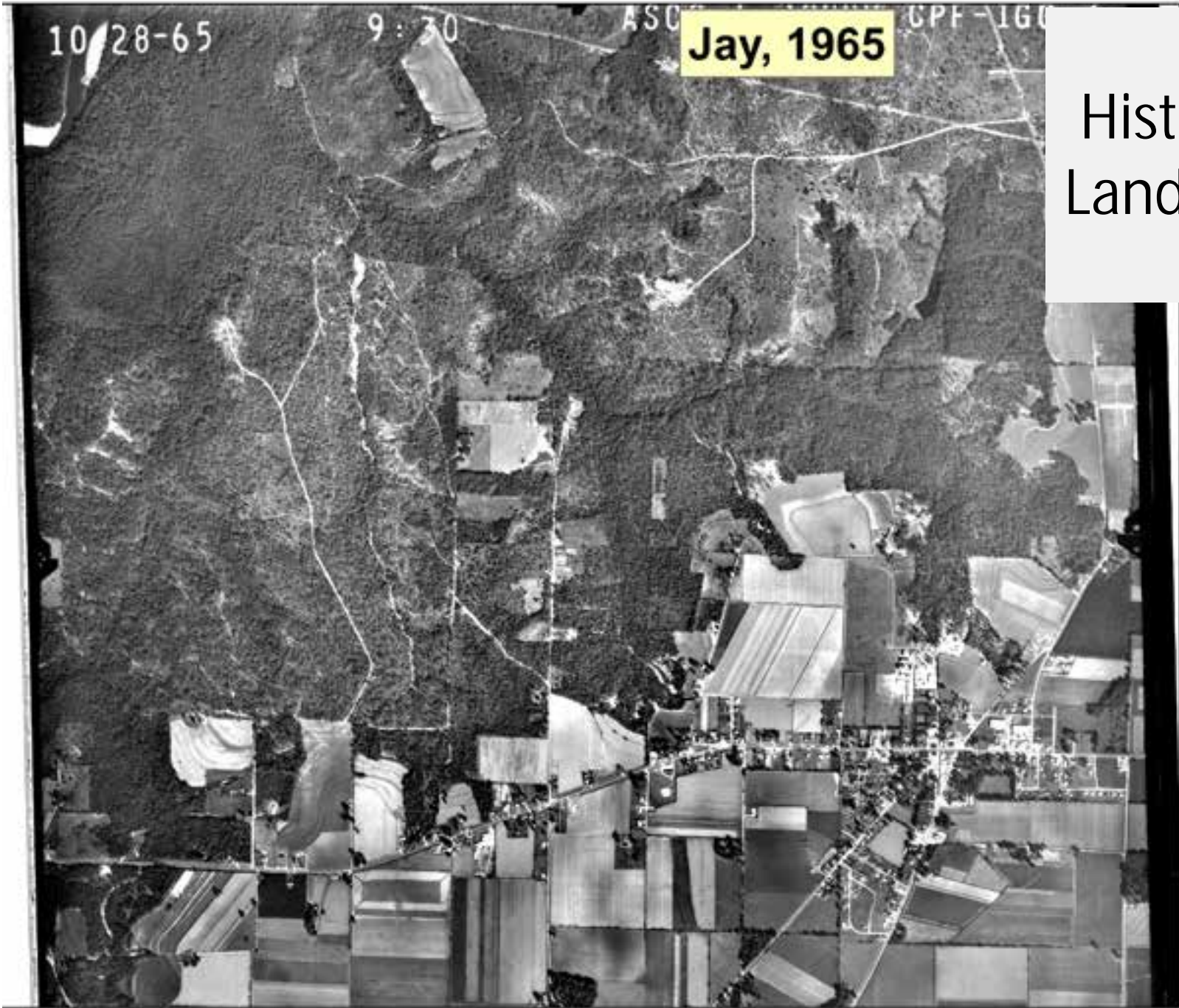
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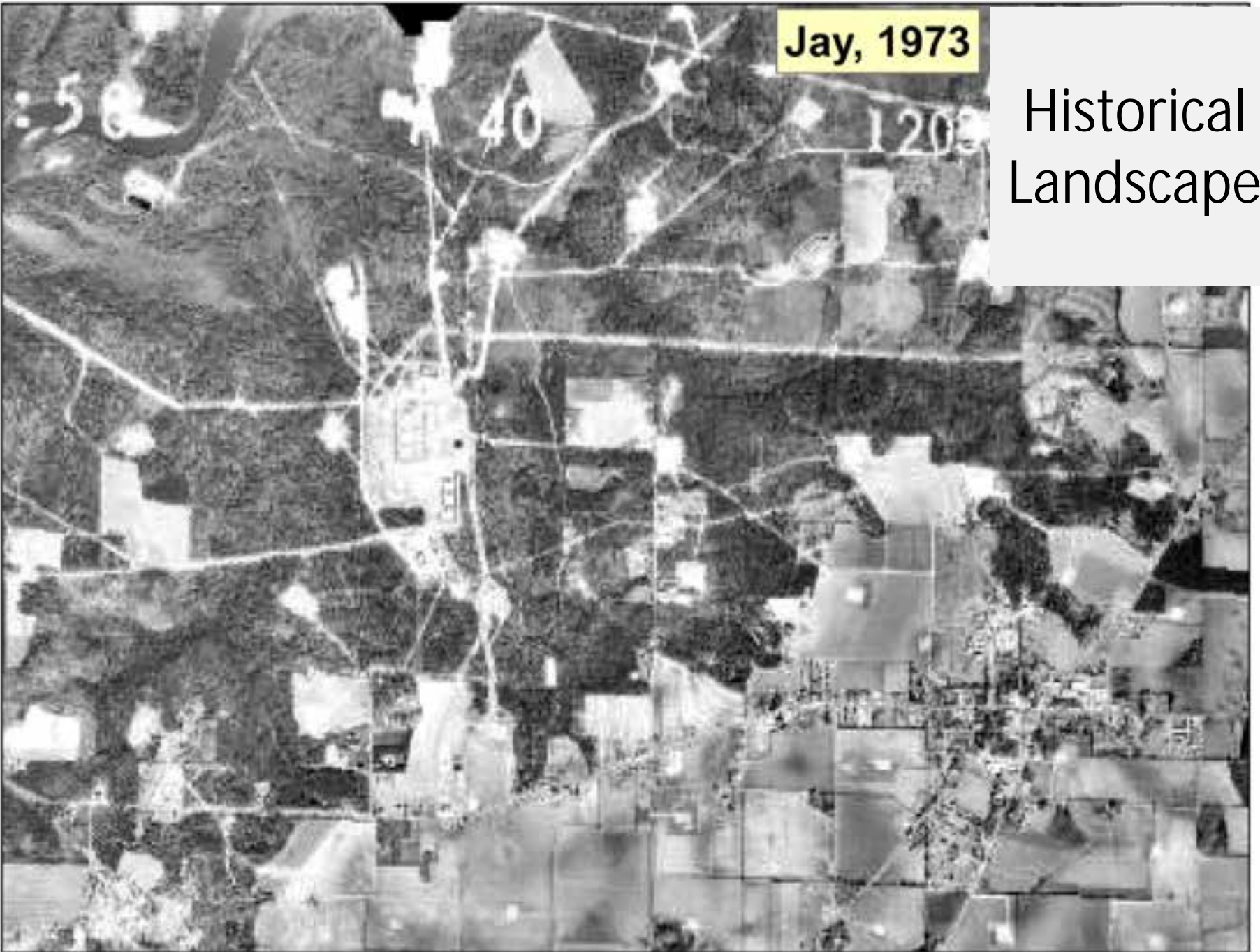
Jay, 1965

Historical Landscape



Jay, 1973

Historical Landscape





Jay, 2004



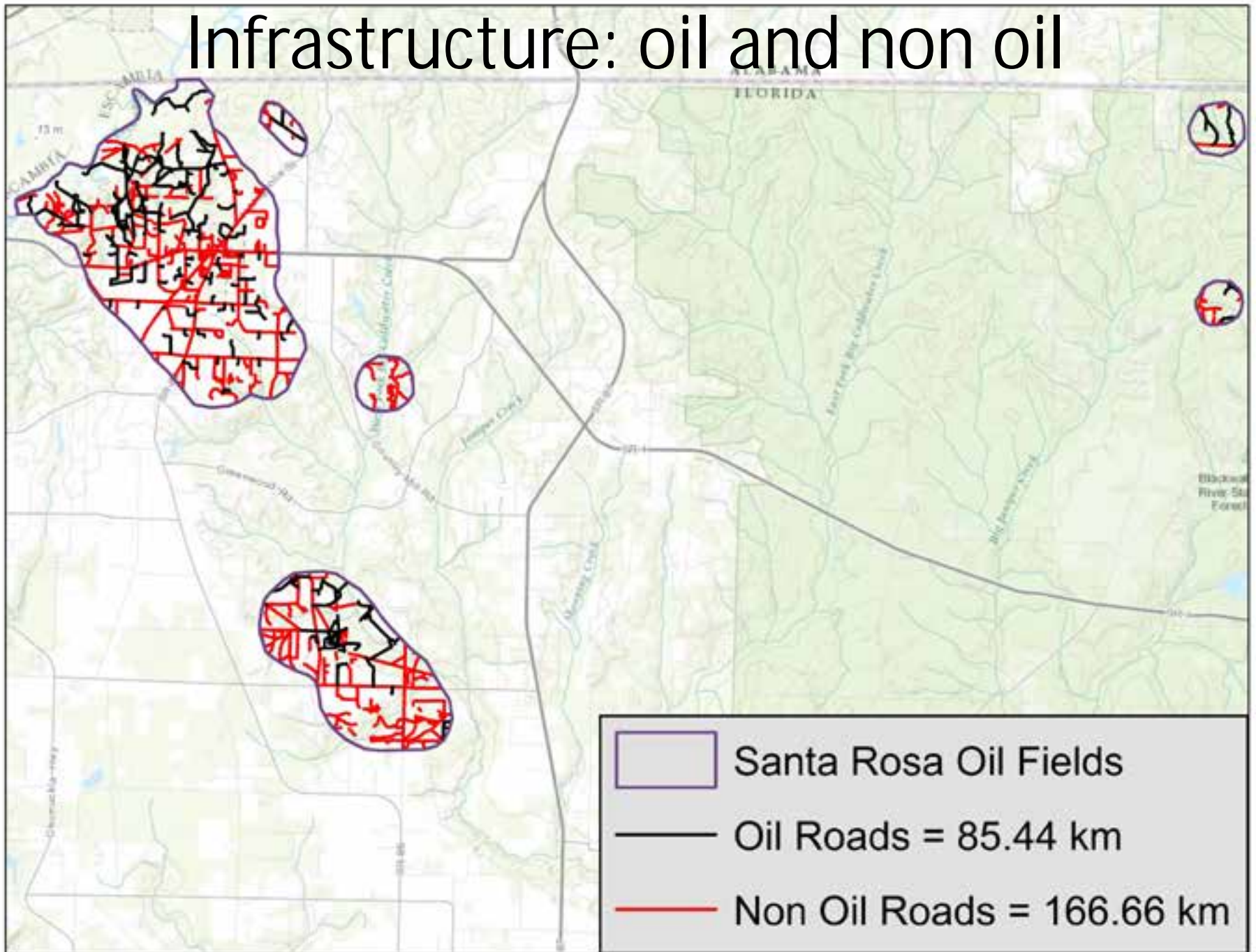
Jay, 2013

Findings

Oil wells and well density

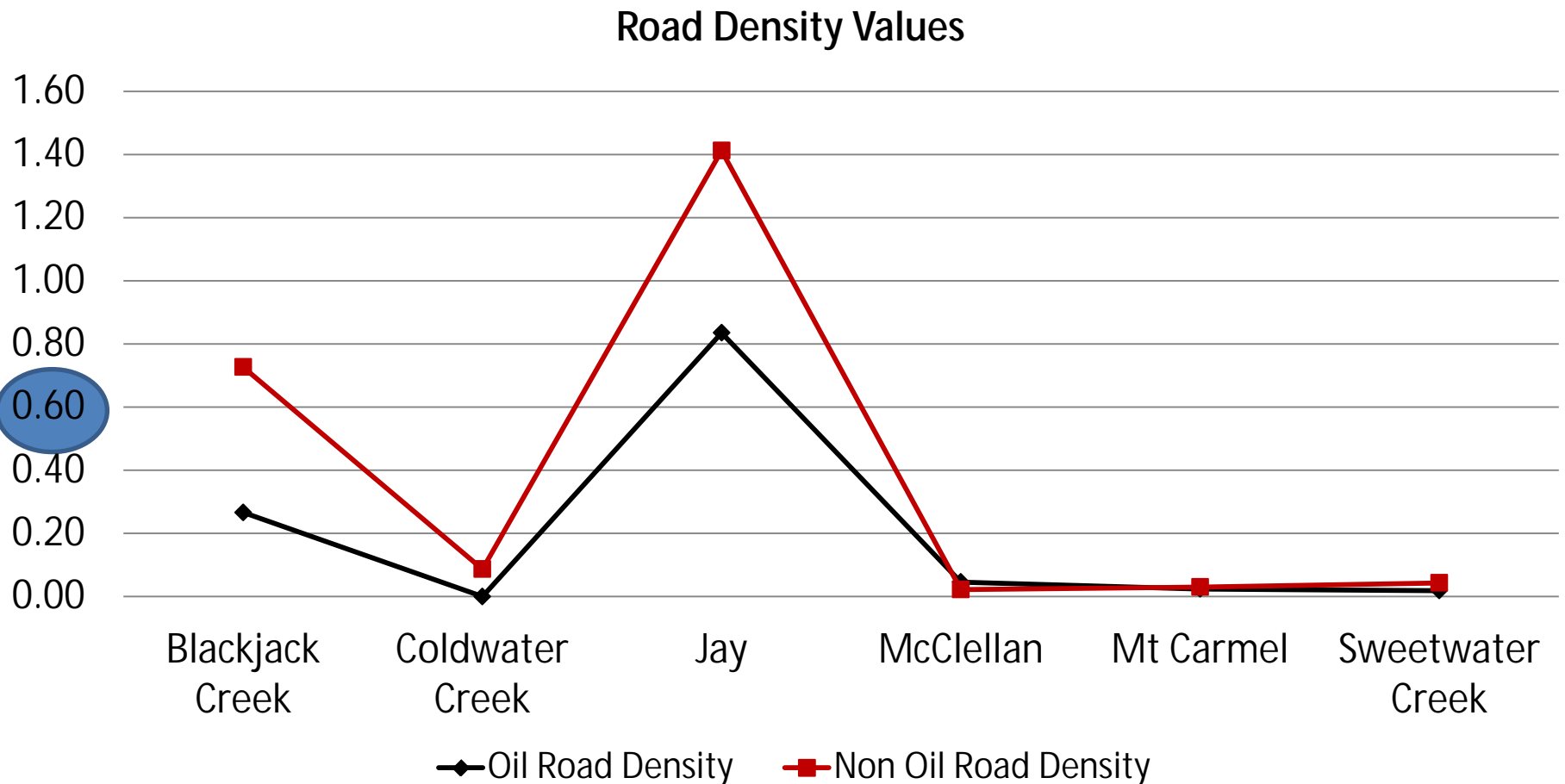
- Florida = 1,388 wells
- Santa Rosa = 333 wells
 - 24% of Florida's oil wells = Santa Rosa (#1 county)
 - 53% of Santa Rosa oil wells = 6 oilfields
 - 91% = Jay oilfield
 - 38% are wildcat wells

Infrastructure: oil and non oil

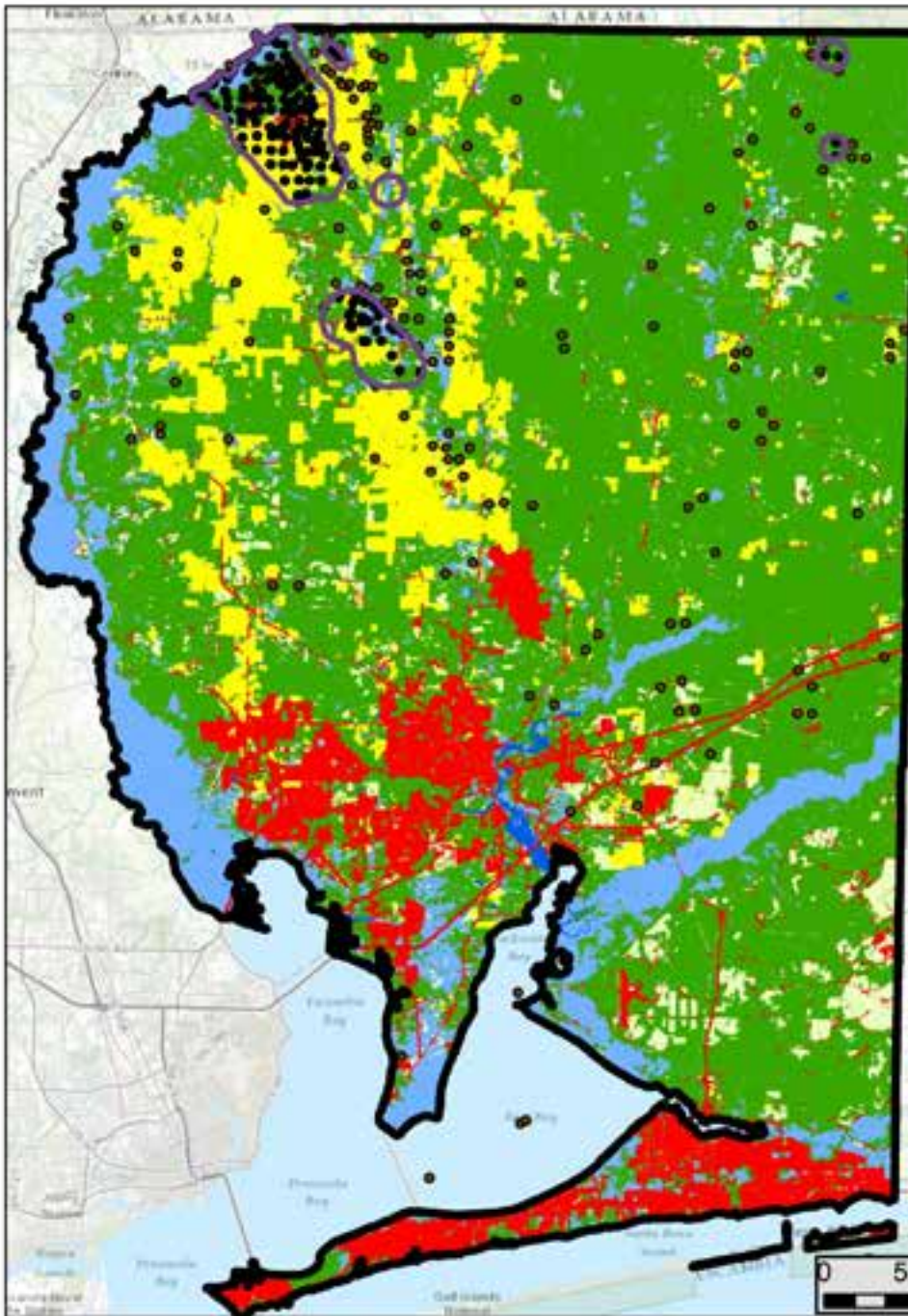


Infrastructure: oil and non oil

- Road density: 0.1 in remote regions to 40.0 in urban areas.











Land Use



- Santa Rosa Oil Field Wells = 175 (53%)
- Santa Rosa County Wells = 333

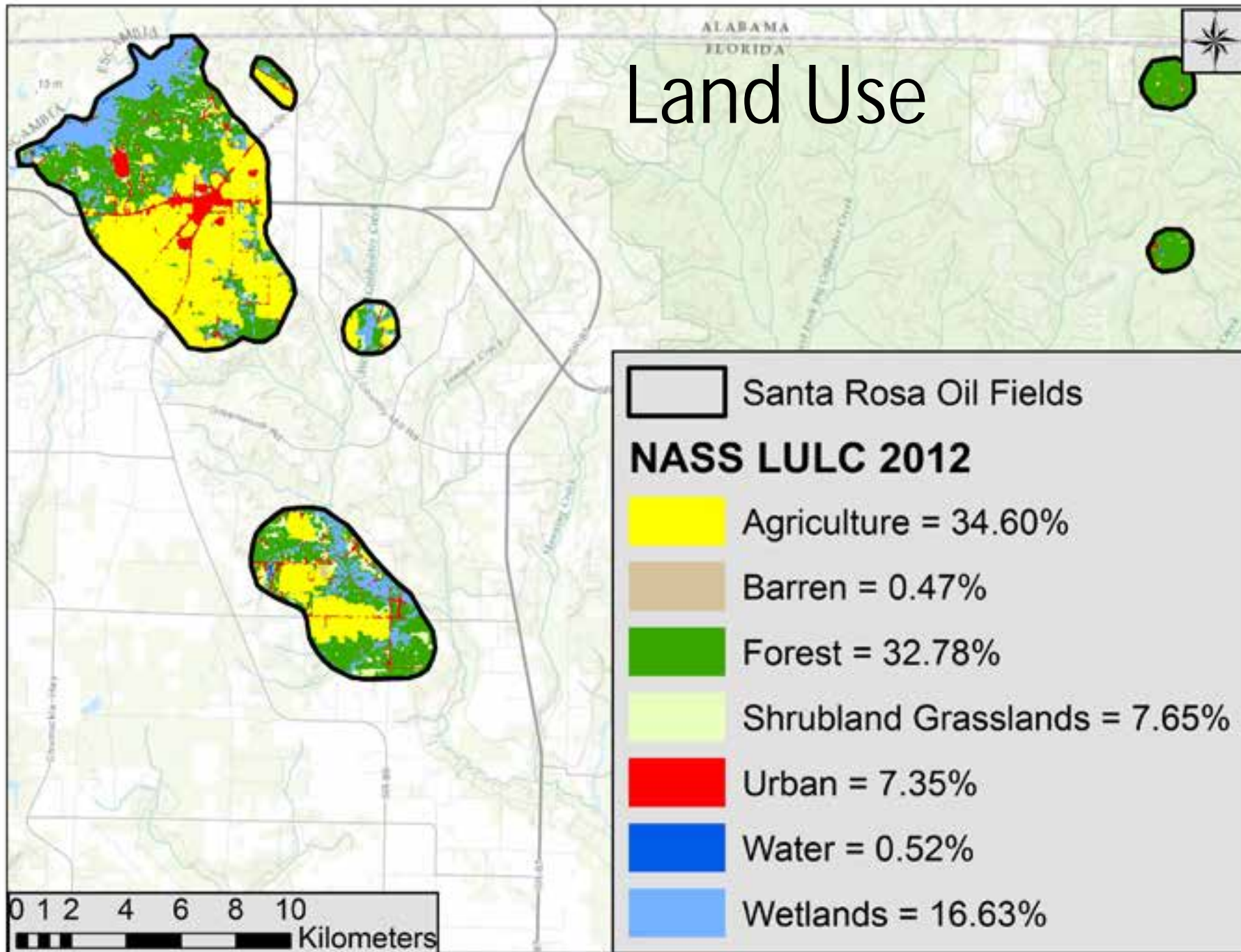
-  Santa Rosa Oil Fields
-  Santa Rosa County, FL

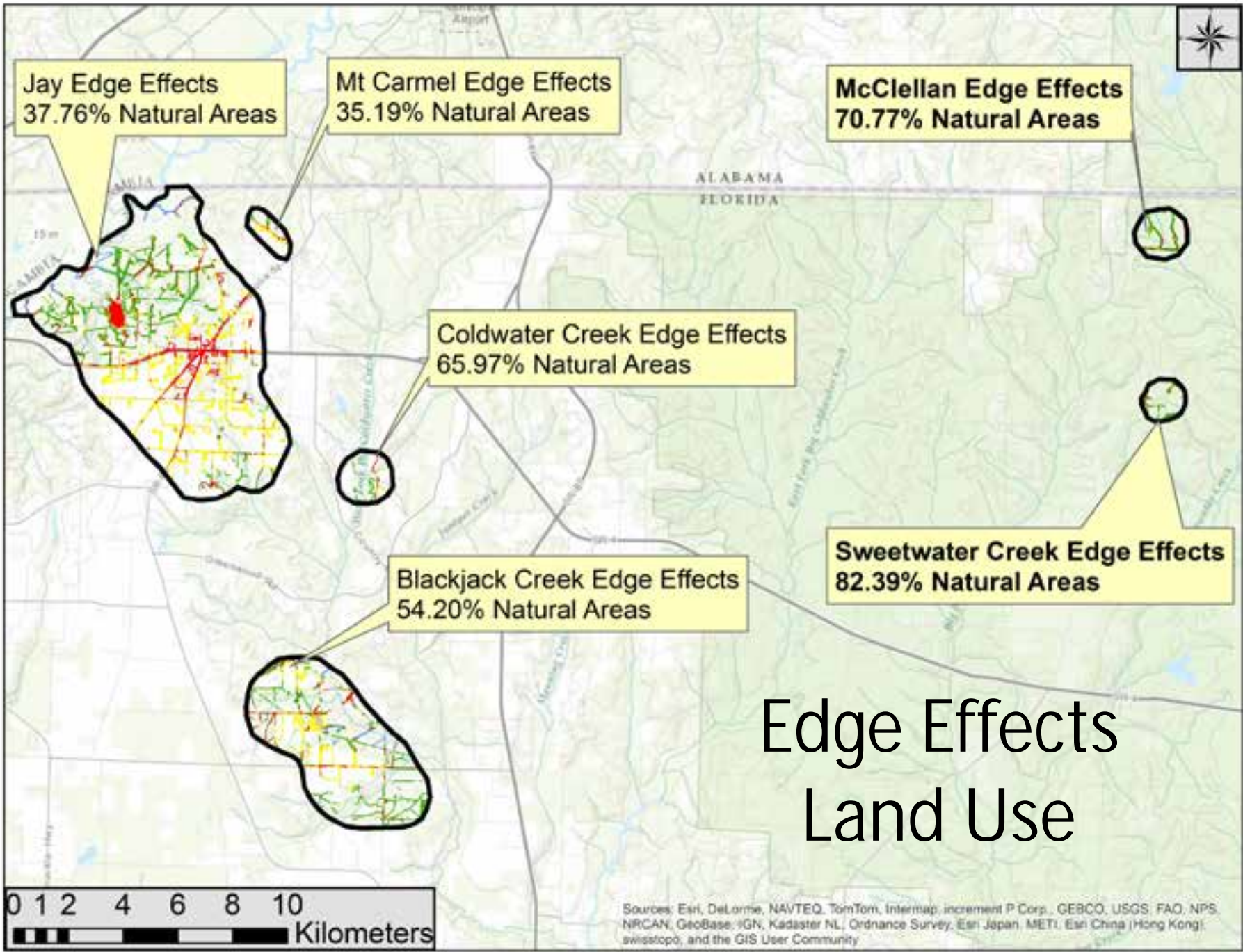
NASS LULC 2012

-  Agriculture = 11.45%
-  Barren = 0.42%
-  Forest = 53.60%
-  Shrubland Grasslands = 8.40%
-  Urban = 11.63%
-  Water = 0.76%
-  Wetlands = 13.63%
-  No Data = 0.12%



Land Use





Jay Edge Effects
37.76% Natural Areas

Mt Carmel Edge Effects
35.19% Natural Areas

McClellan Edge Effects
70.77% Natural Areas

Coldwater Creek Edge Effects
65.97% Natural Areas

Blackjack Creek Edge Effects
54.20% Natural Areas

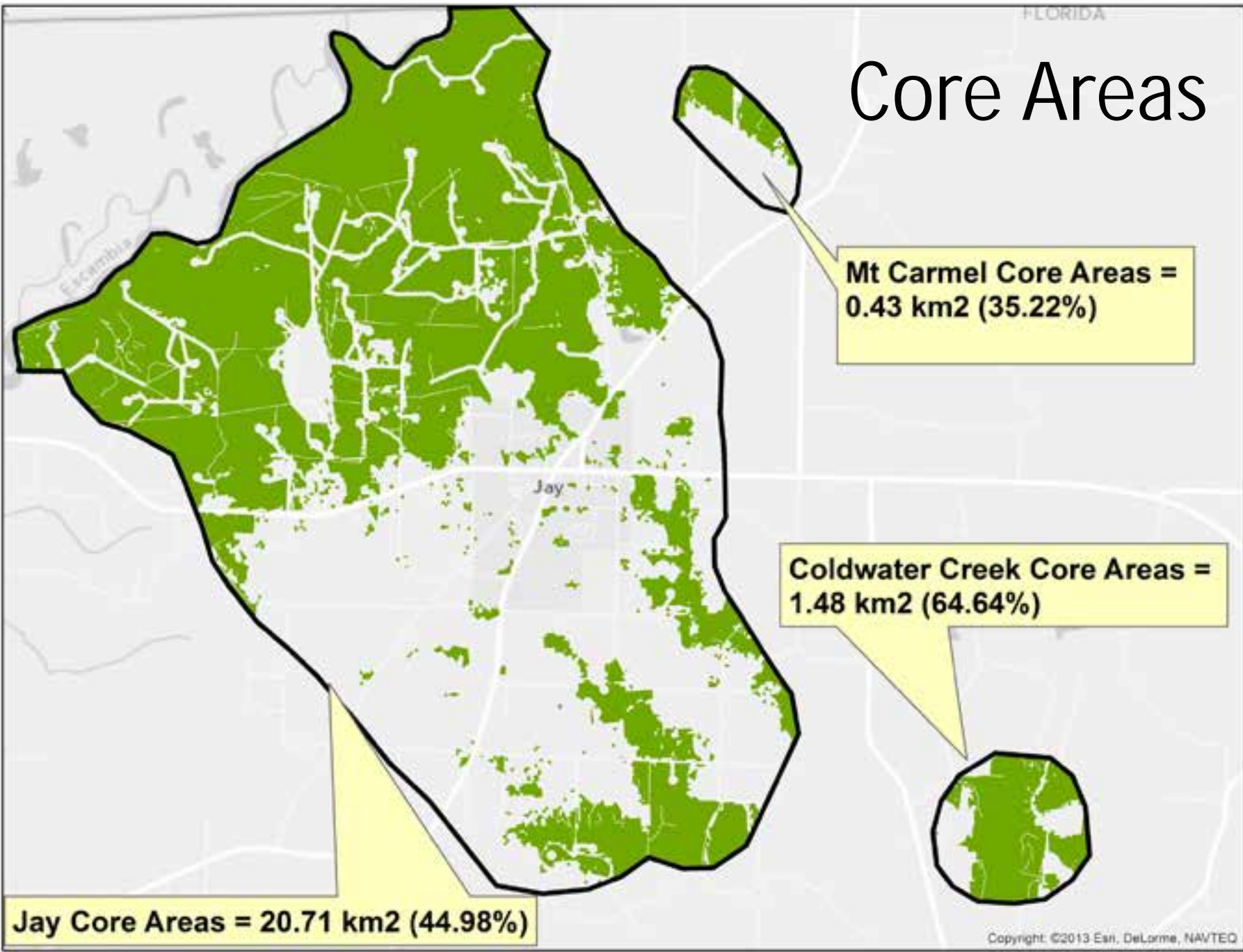
Sweetwater Creek Edge Effects
82.39% Natural Areas

Edge Effects Land Use



Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Core Areas

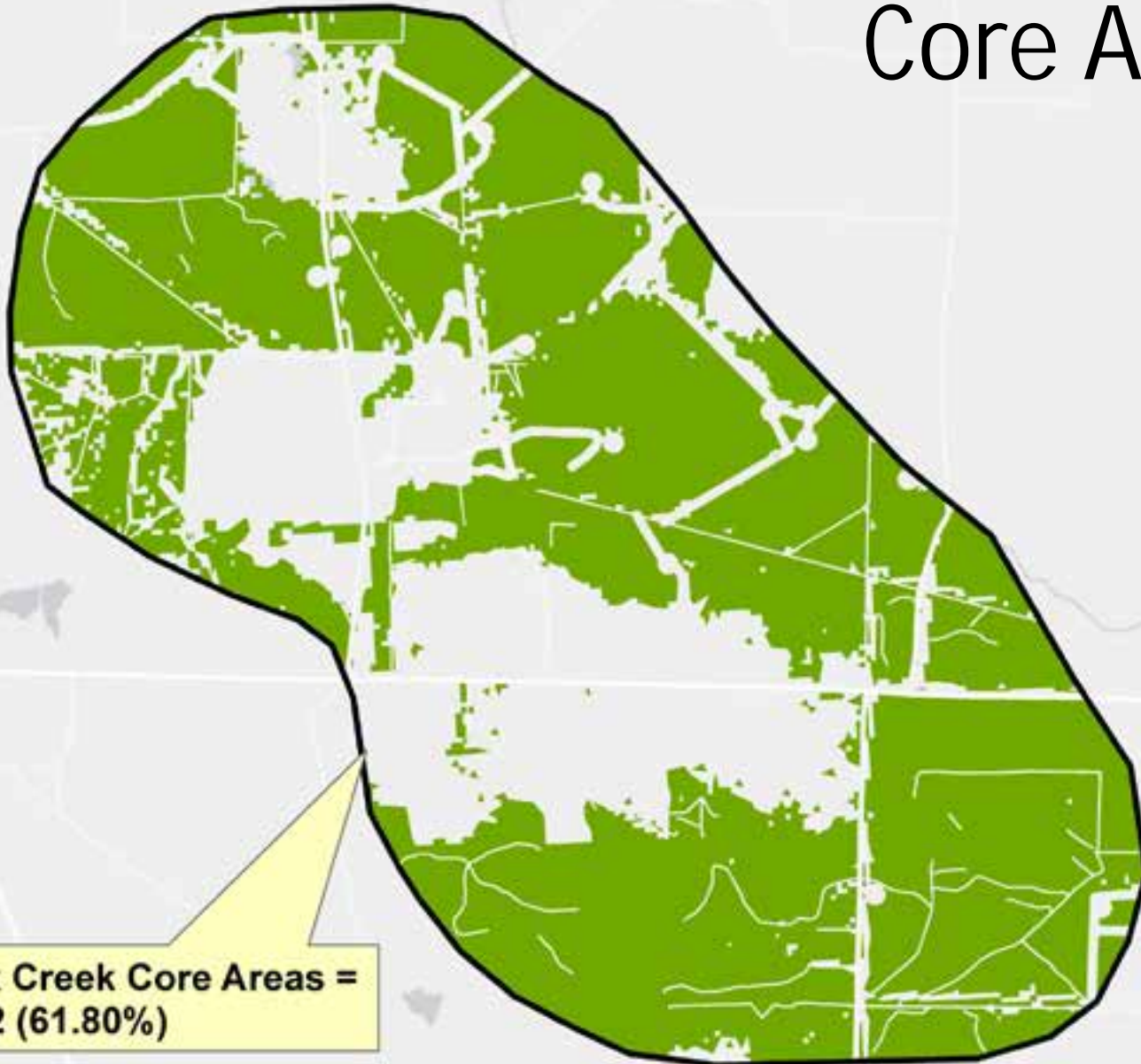


**Mt Carmel Core Areas =
0.43 km2 (35.22%)**

**Coldwater Creek Core Areas =
1.48 km2 (64.64%)**

Jay Core Areas = 20.71 km2 (44.98%)

Core Areas



**Blackjack Creek Core Areas =
11.54 km² (61.80%)**

Core Areas



**McClellan Core Areas =
1.78 km² (85.88%)**



**Sweetwater Creek Core Areas =
1.23 km² (84.84%)**

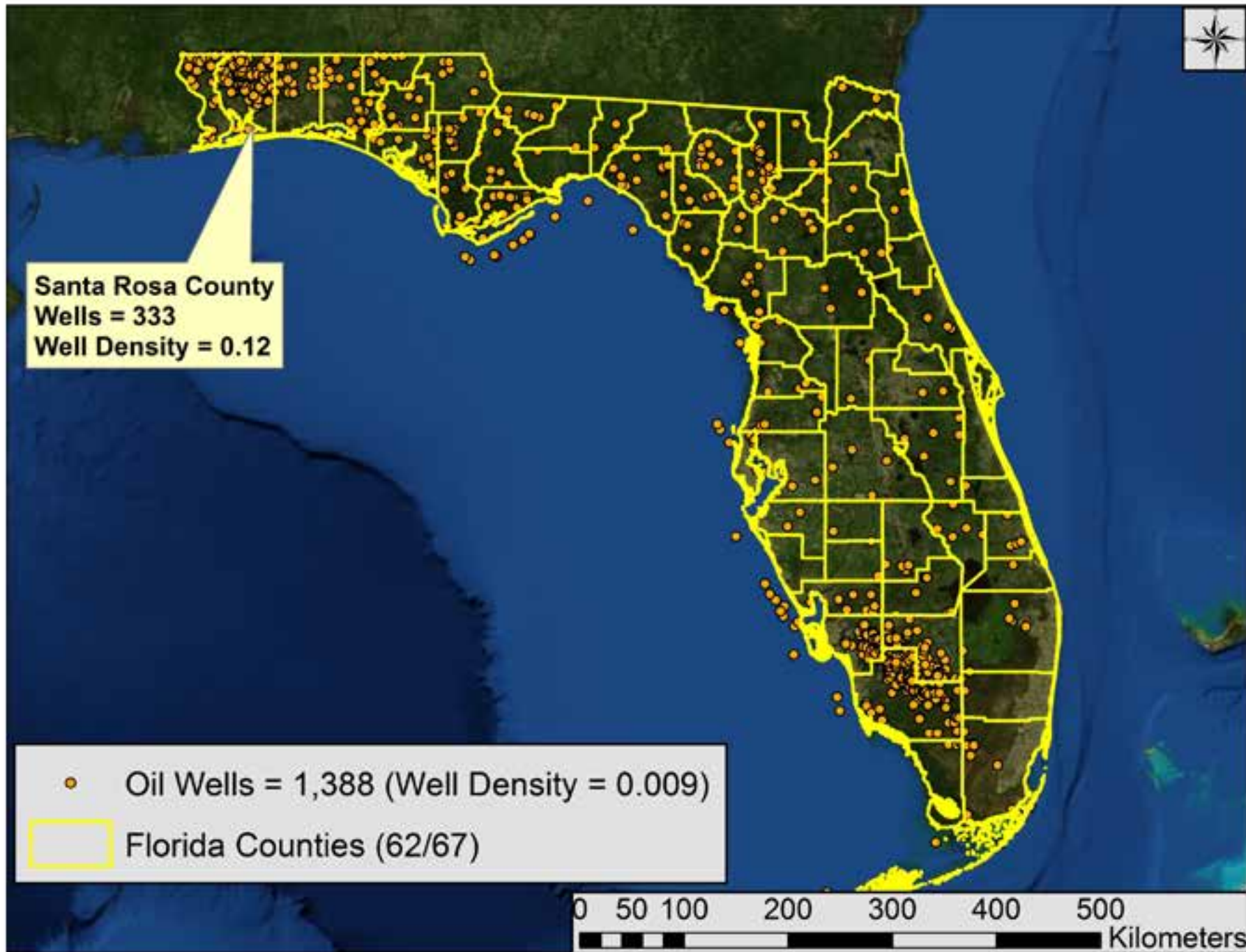
Environmental Performance

OILFIELD	RANK
Coldwater Creek	1
Sweetwater Creek	2
McClellan	3
Mt Carmel	4
Blackjack Creek	5
Jay	6

Conclusion/Discussion

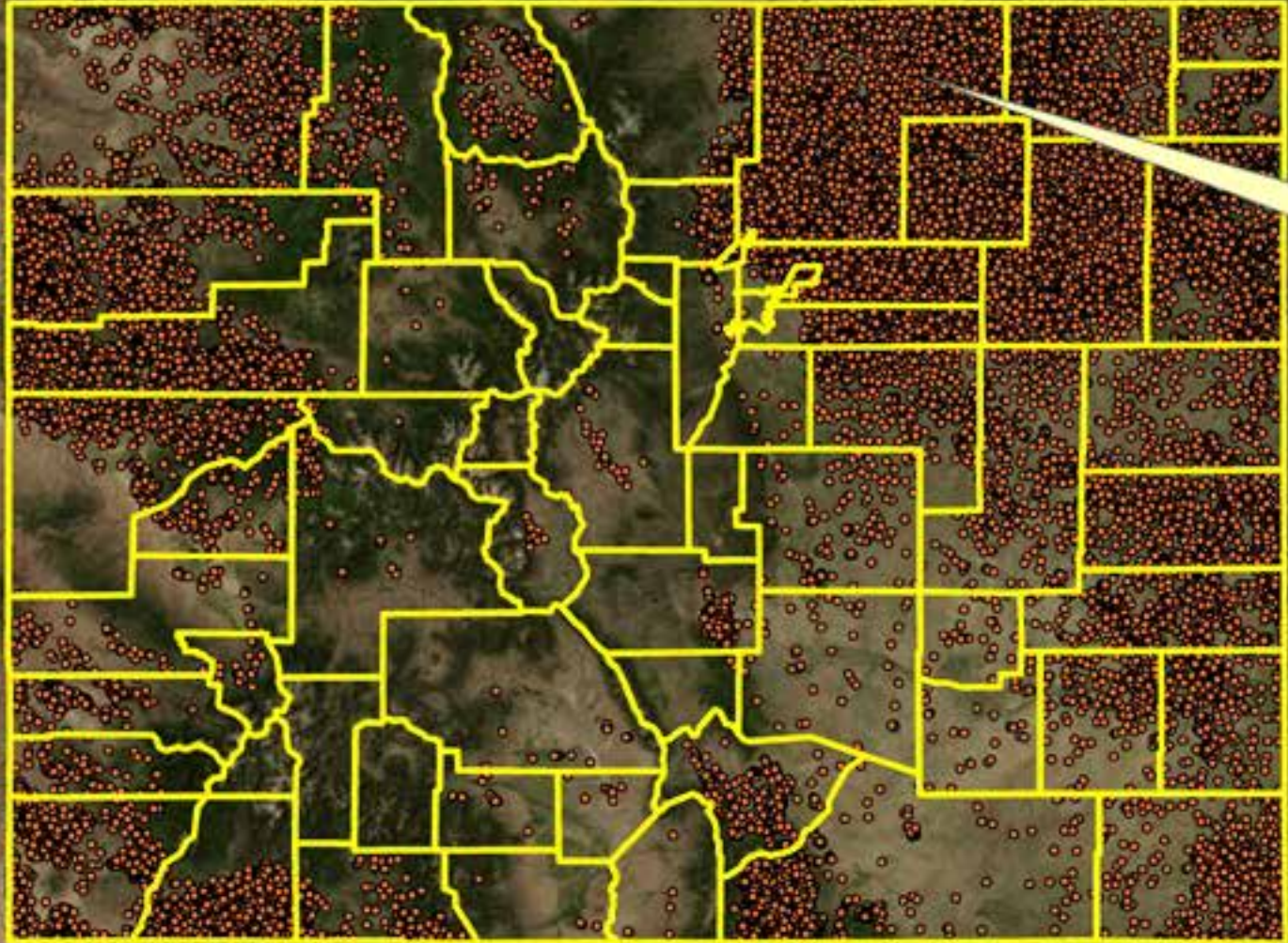
- Agriculture: main driver of landscape change.
- Oil activities contributed a small amount of disturbance in each oil field- 10% max.
- Core areas range from 35 – 86% of oilfields.
- Based on current disturbance patterns, future E&P should create limited alterations.

- Comparison: Florida and Colorado



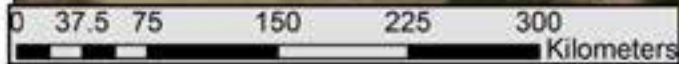


Weld County
Wells = 30,333
Well Density = 1.66



• Oil Wells = 102,199 (Well Density = 0.23)

□ Colorado Counties (64)



Future work:

- Examine oil E&P landscape disturbances in:
 - Ecuador
 - South Florida
 - Southern Alabama
 - Colorado
 - Western Argentina
- Use raster data throughout project

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Questions?

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Source: <http://www.hess.com/operations/shale-energy/environment>