Provision of Selected Ecosystem Services by Conservation Easements in the Upper Chattahoochee Watershed

Fabio Jose Benez Secanho

PhD student

Warnell School of Forestry & Natural Resources

fabio.secanho@uga.edu

Warnell School of Forestry & Natural Resources
UNIVERSITY OF GEORGIA

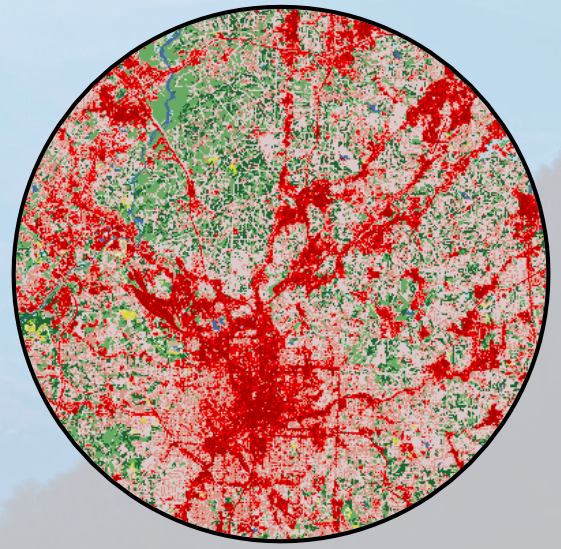
ACES 2018 - A Community on Ecosystem Services
Washington, DC
06/12/2018

Introduction

Ecosystem services

Most of ESs are in a state of decline

Urban sprawl is a major factor



ESs will keep declining

Source: (MEA 2005, Nowak and Walton 2005, Costanza et al. 2014, , Pereira et al. 2010)

Introduction

Land conservation

Conservation easements (CEs)

Legal agreements that permanently limit the development or use of a property

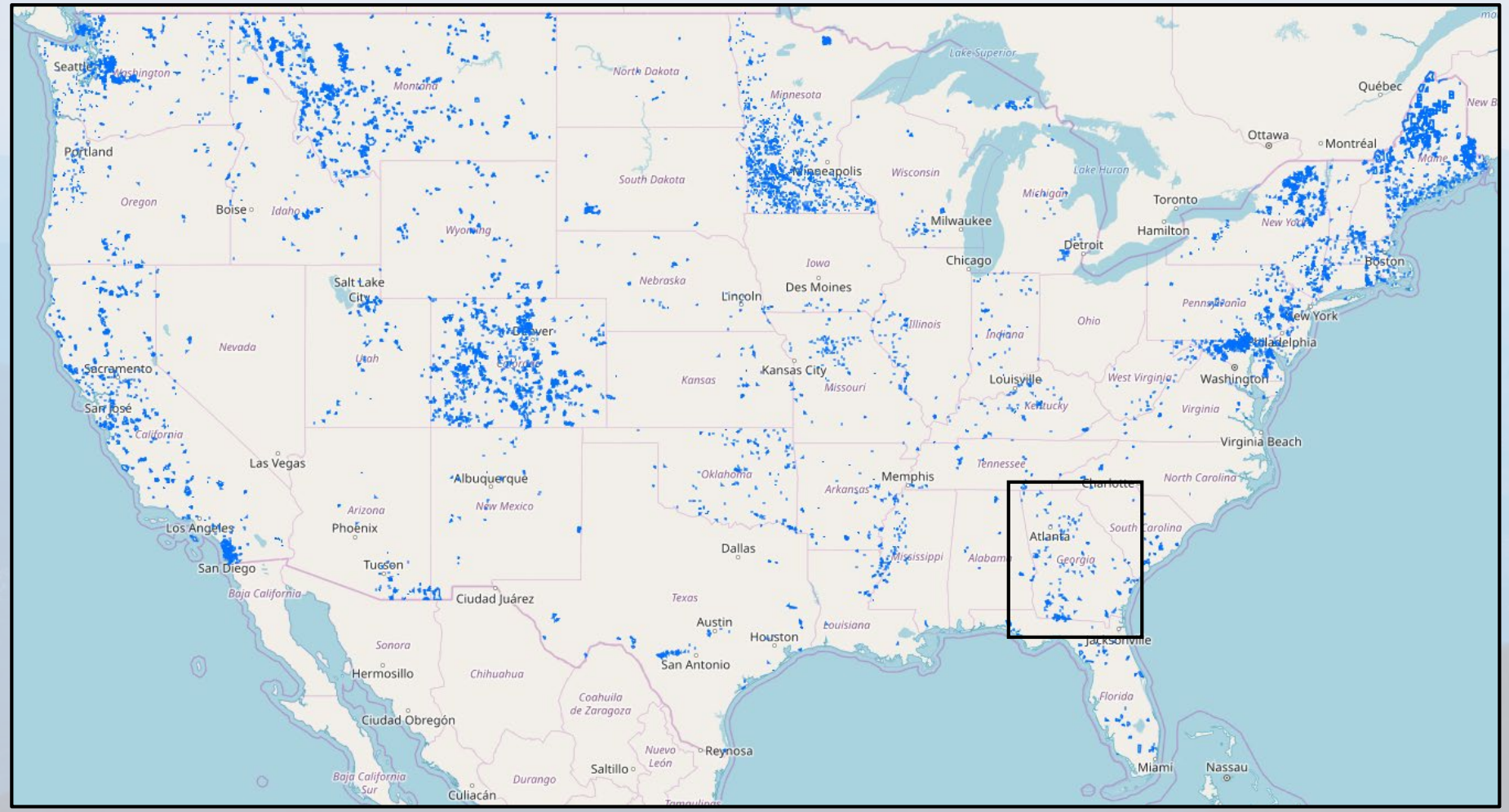
Federal: Donations qualify for a tax deduction proportional to the foregone value of the land (IRC Section 170(h))

Georgia: tax credits (state income tax) equal to 25 percent of the fair market value of their donations (Georgia Conservation Tax Credit)

Source: (Looney 2017, IRS)

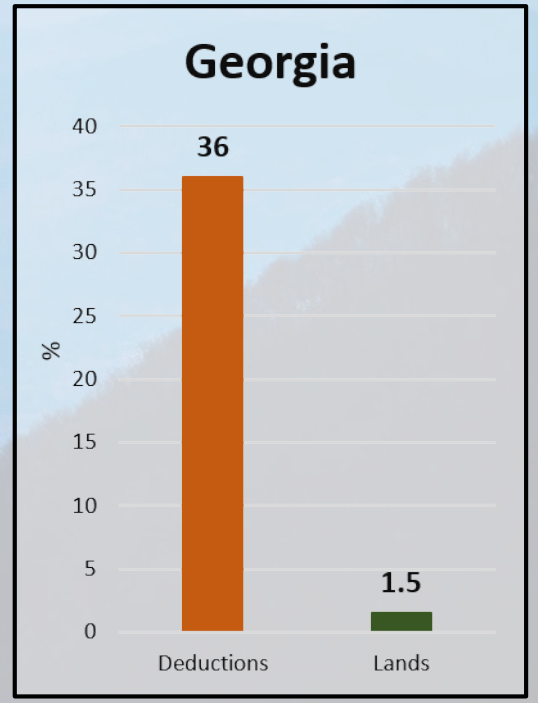
Introduction

Conservation easements (CEs)



$3.3 billion (2014)

27 million acres



Source: National Conservation Easement Database (NCED)

Source: (Looney 2017, IRS)

Goal and objective

Goal

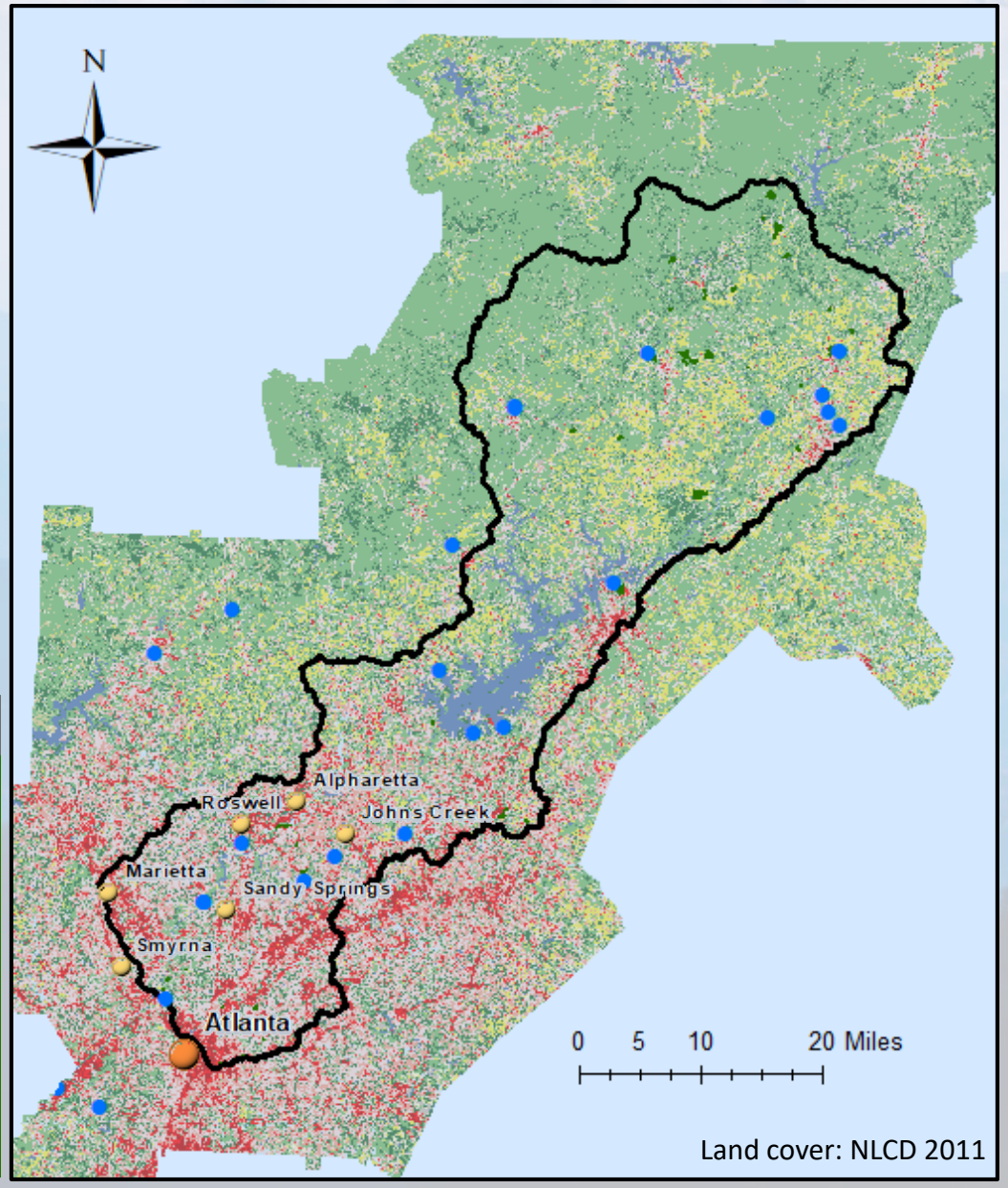
Conduct an environmental assessment on CEs in the Upper Chattahoochee watershed to verify the contribution of these conservation efforts to provision of ESs.

Objective

1) Efficiency of CEs in providing selected ESs compared to other land typologies;

Upper Chattahoochee watershed

Upper Chattahoochee watershed



Methods

InVEST
integrated valuation of ecosystem services and tradeoffs

Quantifying ecosystem services

- **InVEST models:** Carbon ⟶ carbon storage

  Sediment Delivery Ratio ⟶ water purification

  Nutrient Retention ⟶ water purification

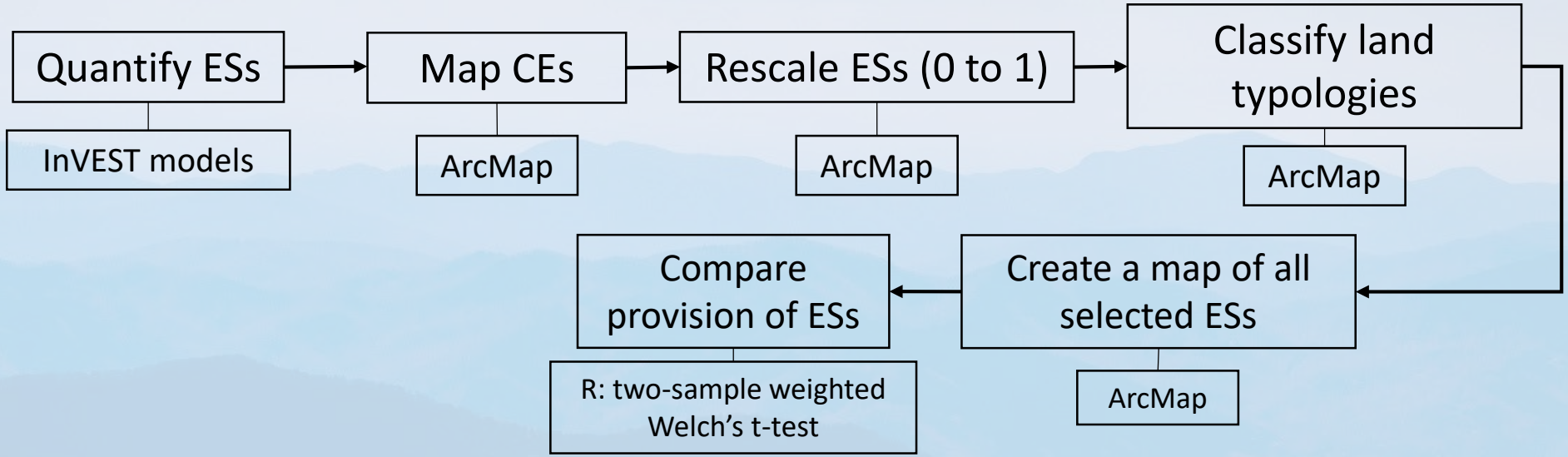
  Water yield ⟶ water production

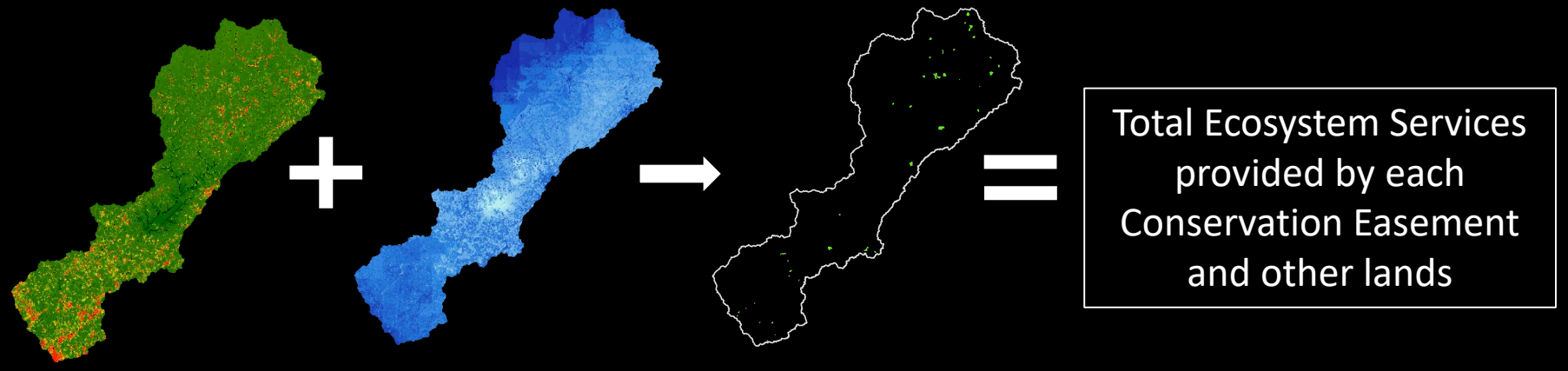
  Habitat ⟶ habitat quality

- Outcome: raster files showing the provision of selected ecosystem services per pixel;

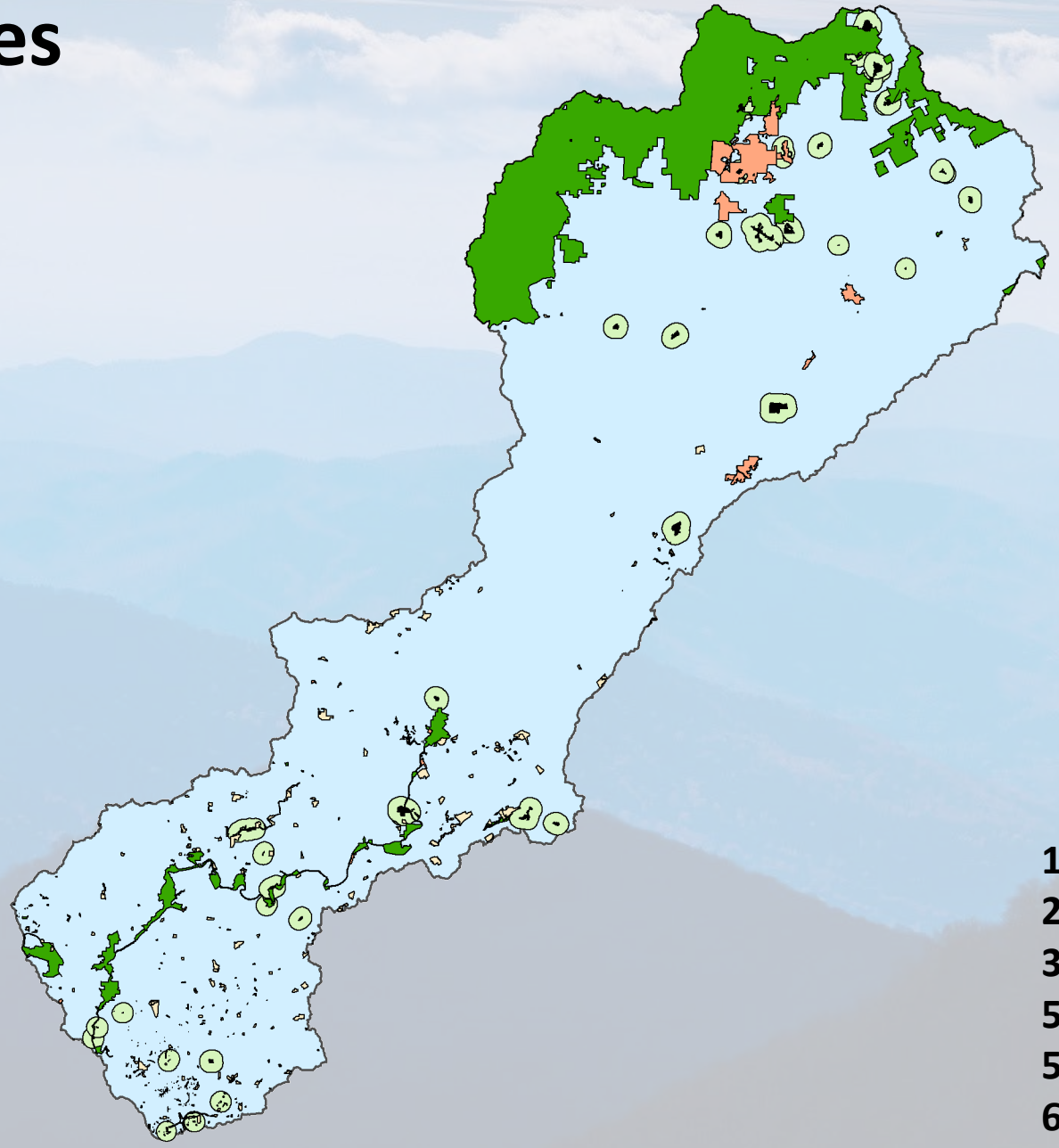
- Aggregate all raster files to display total ESs provided per pixel.

Methods


Quantify ESs
InVEST models
Map CEs
ArcMap
Rescale ESs (0 to 1)
ArcMap
Classify land typologies
ArcMap
Create a map of all selected ESs
ArcMap
Compare provision of ESs
R: two-sample weighted Welch's t-test

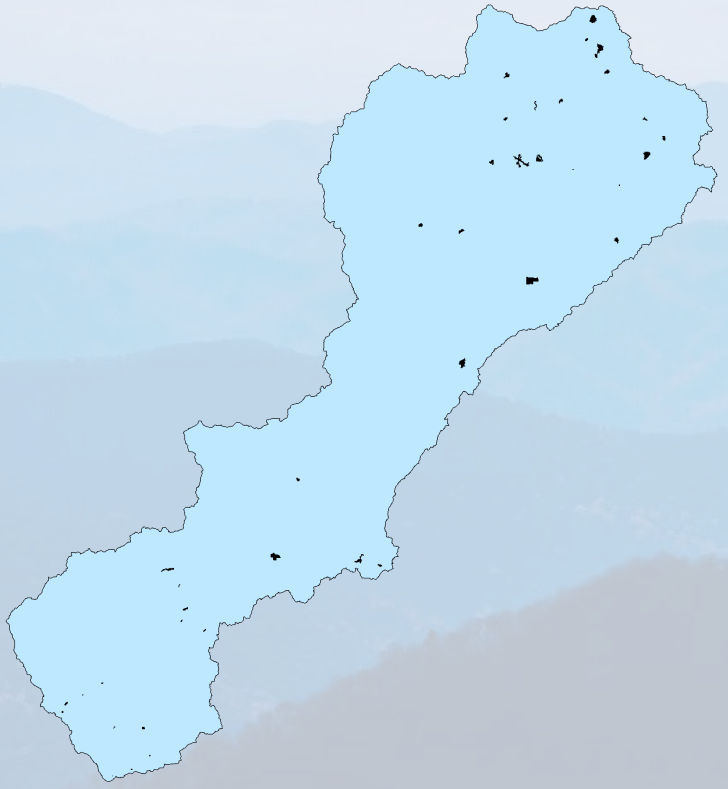

ES1
ES2
Conservation Easements
Total Ecosystem Services provided by each Conservation Easement and other lands

Land typologies



1- Average
2- Conservation easements
3- 1km buffer
5- Local prot. areas
5- State prot. areas
6- Federal prot. areas

Methods: With vs Without CEs

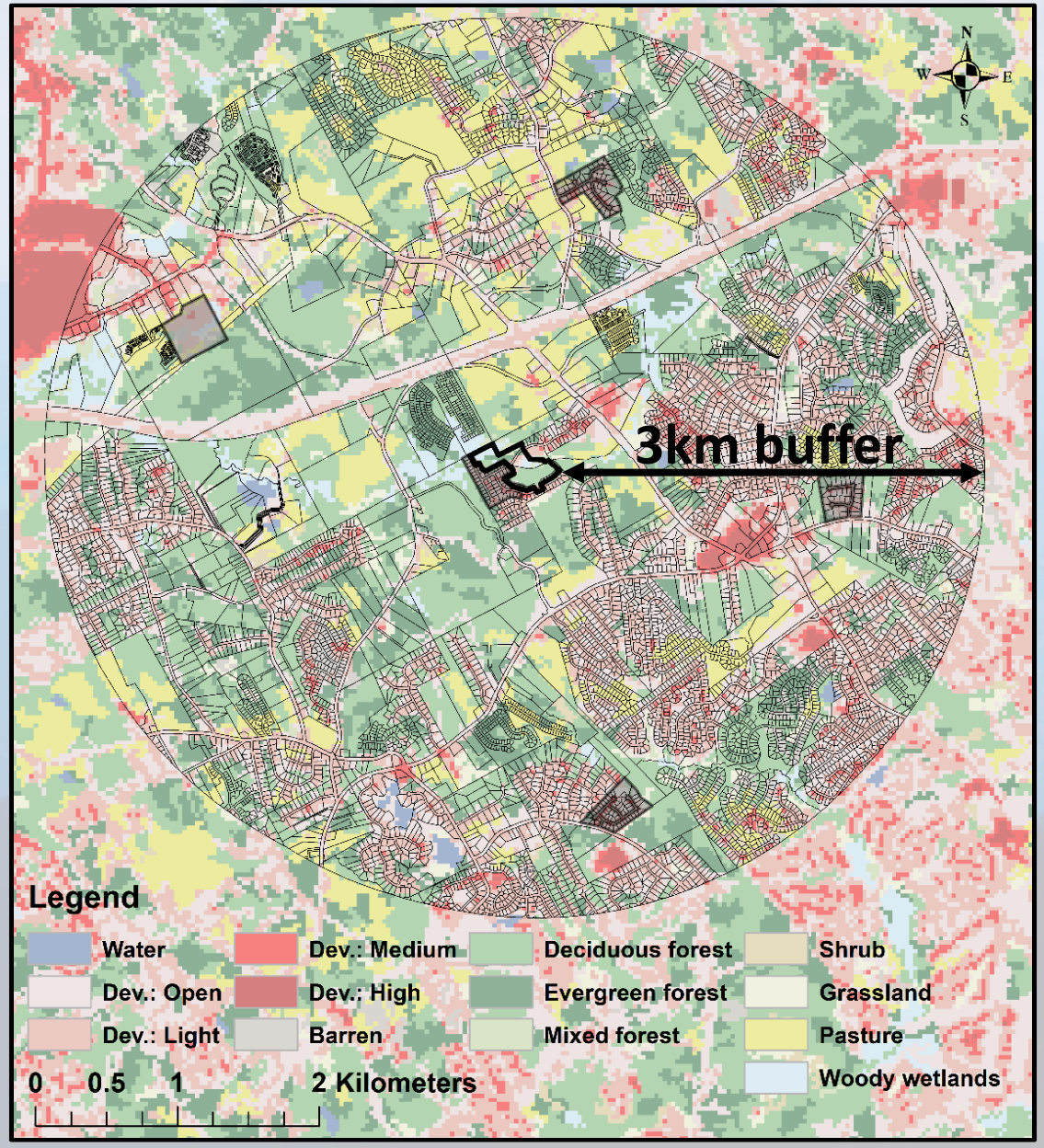


VS

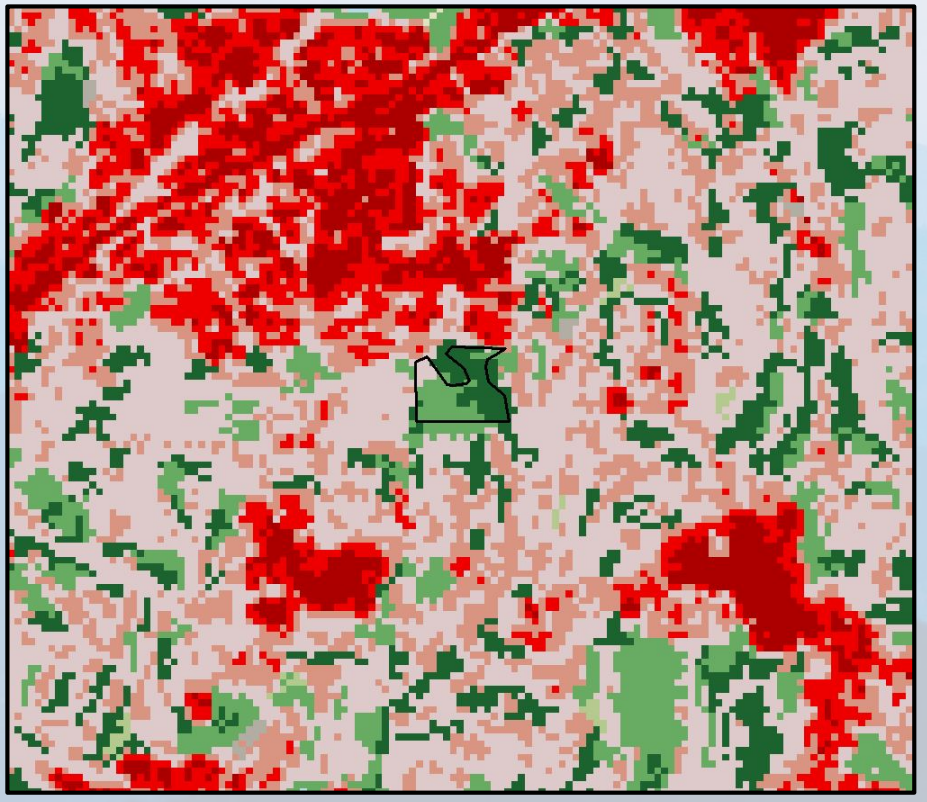
Current scenario

Simulated scenario

Methods: With vs Without CEs

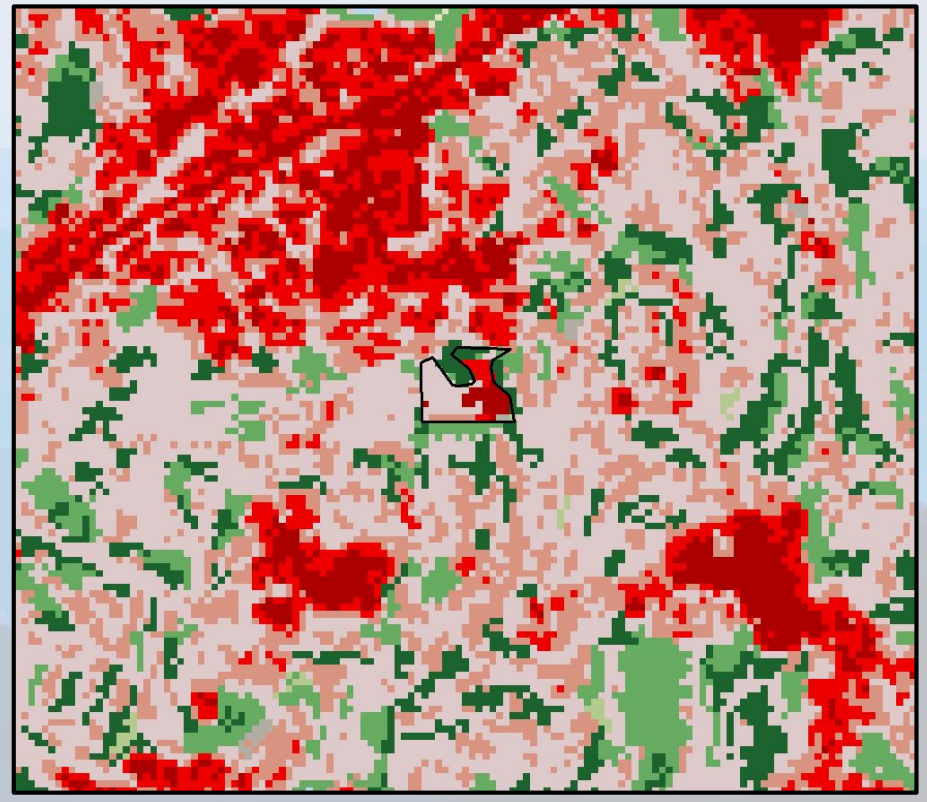


Methods: With vs Without CEs



Current scenario

VS

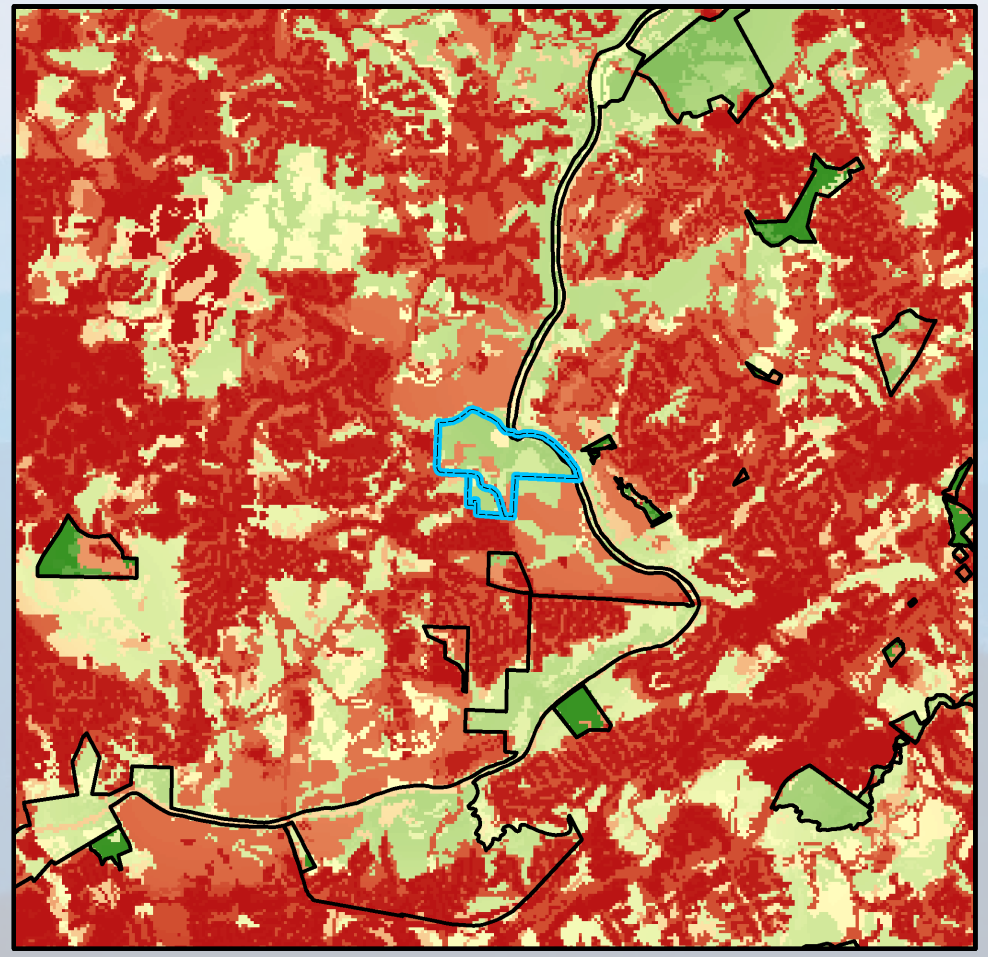


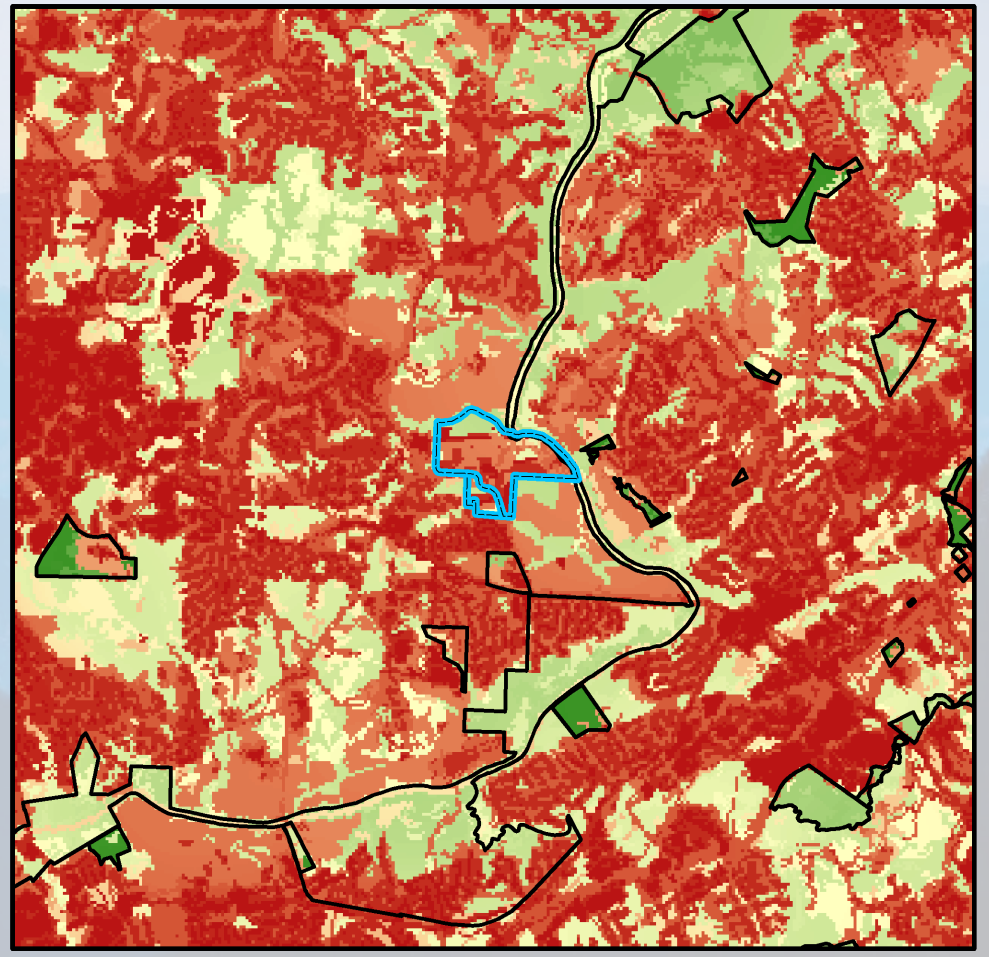
Simulated scenario

Habitat quality

Year

2001 2006 2011





Habitat quality

Max

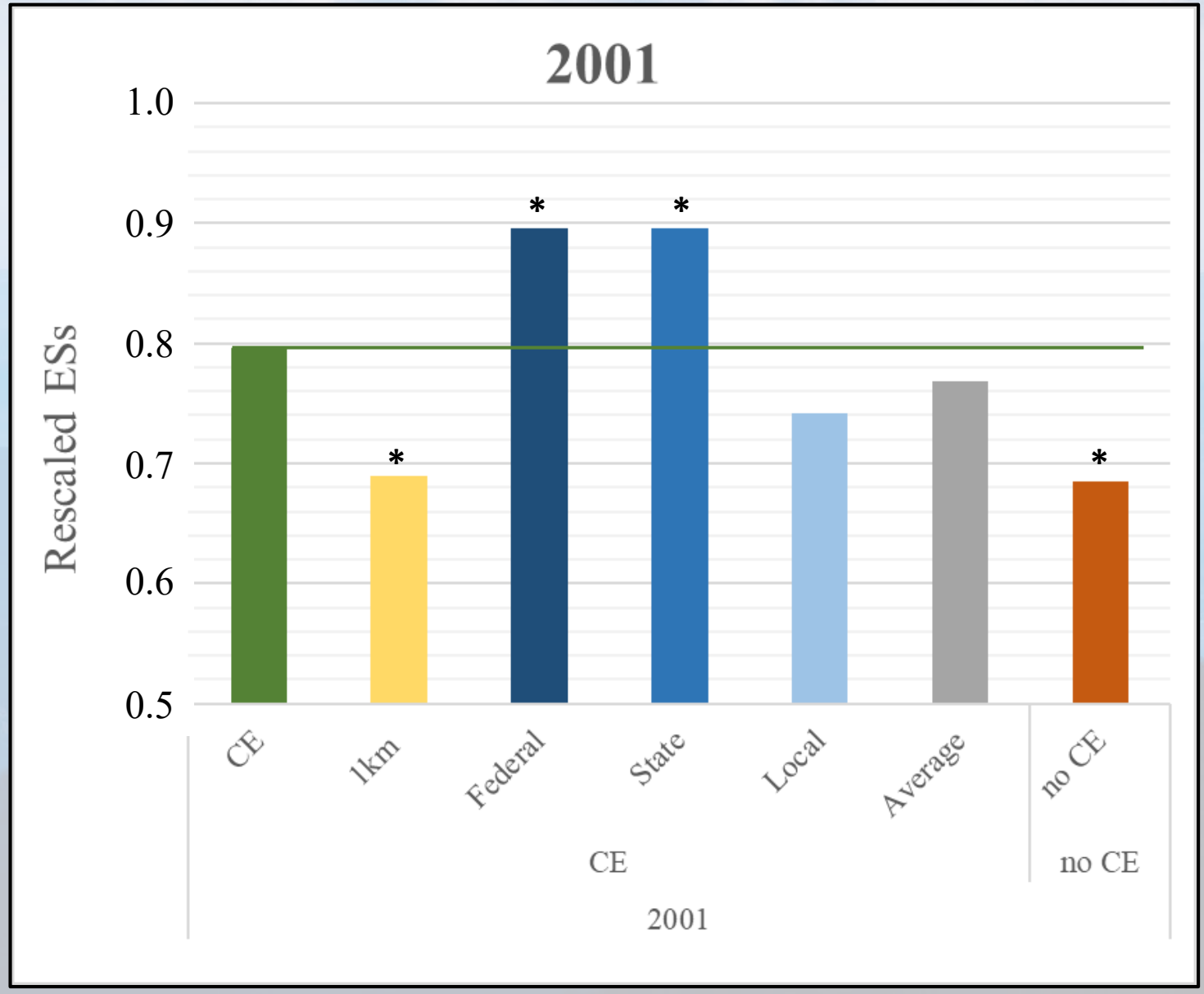
Min

Current scenario

VS

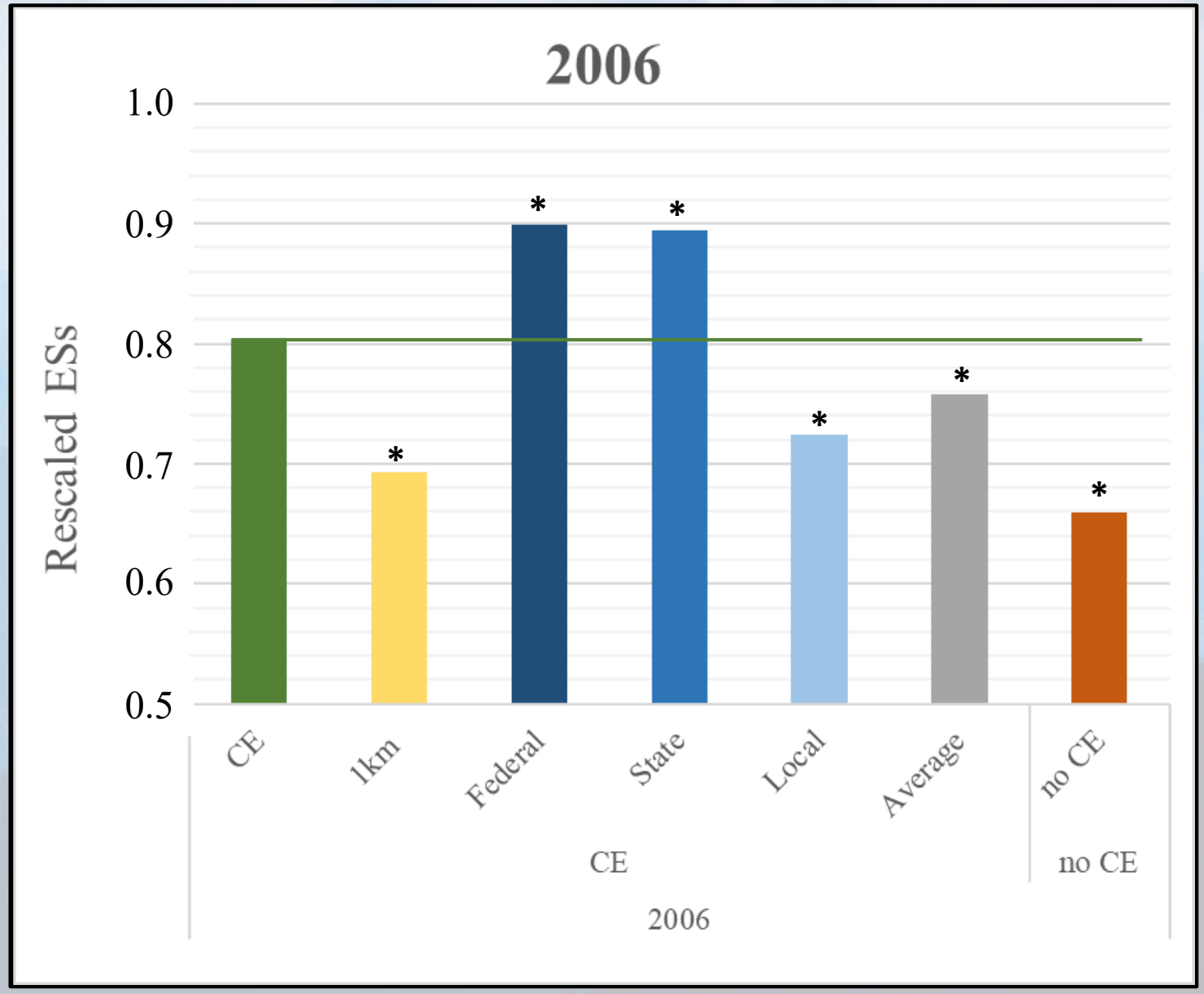
Simulated scenario (No CEs)

Average provision of ESs by land typologies



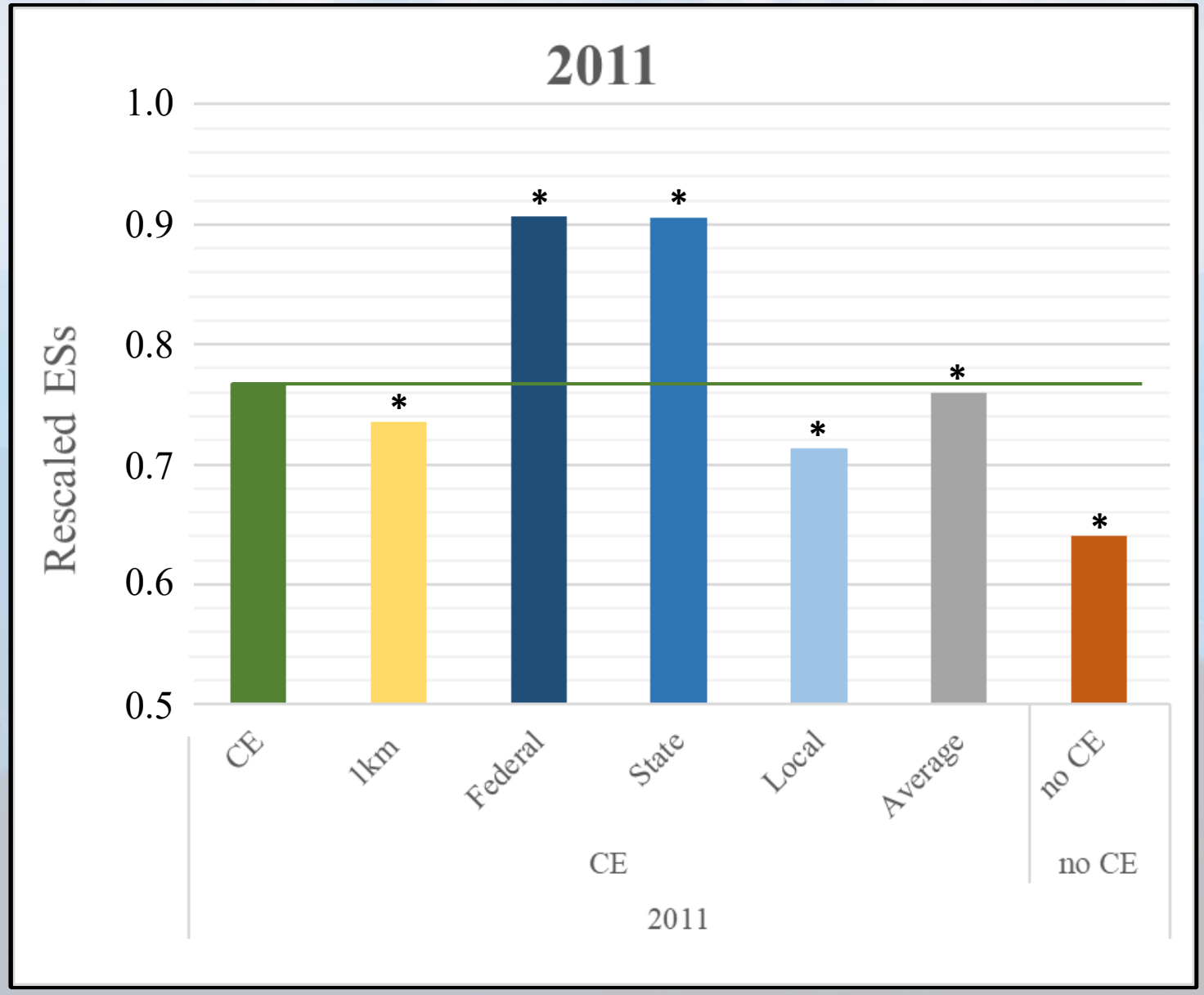
CEs in 2001: 10
*α=0.05

Average provision of ESs by land typologies



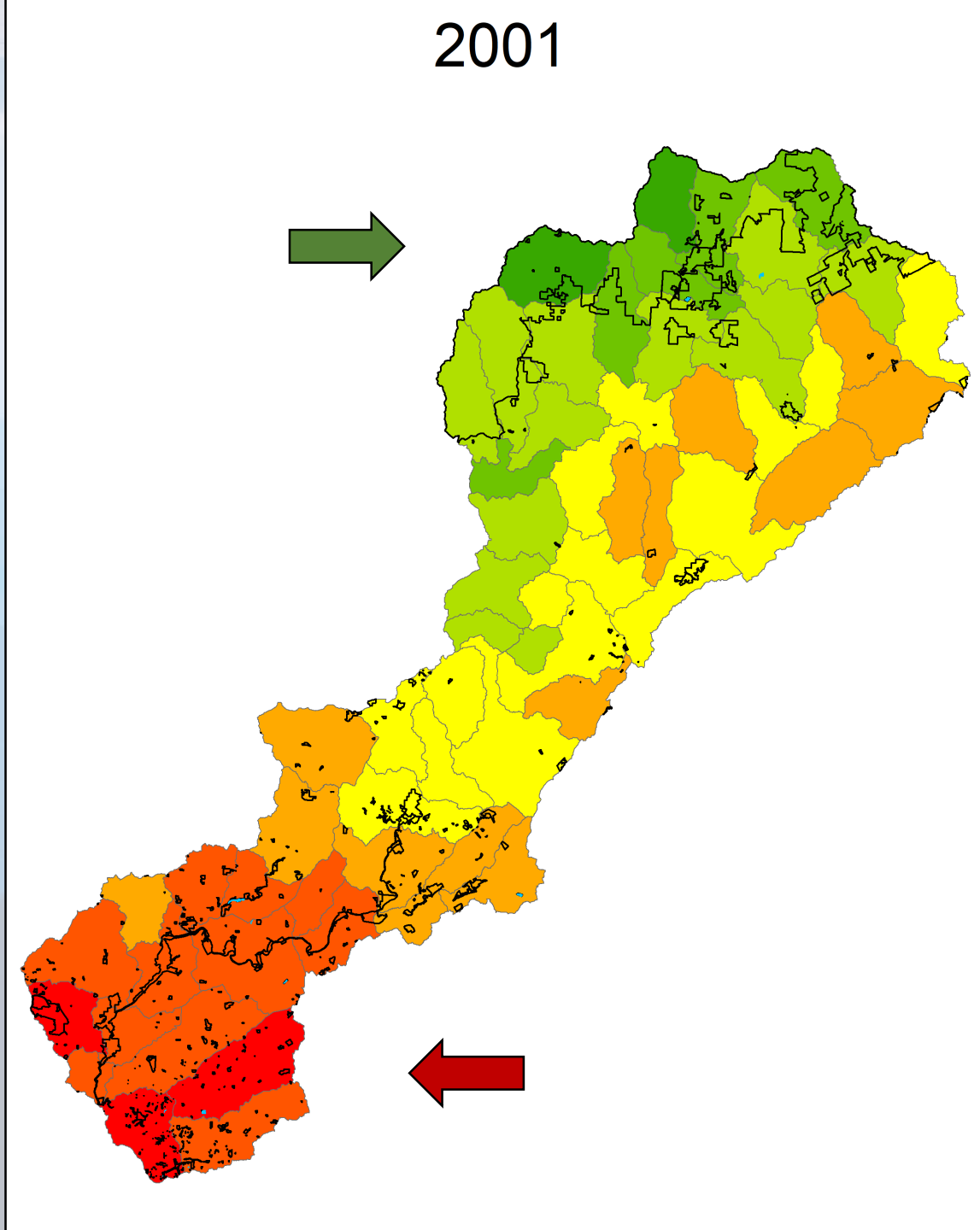
CEs in 2006: 24
*α=0.05

Average provision of ESs by land typologies



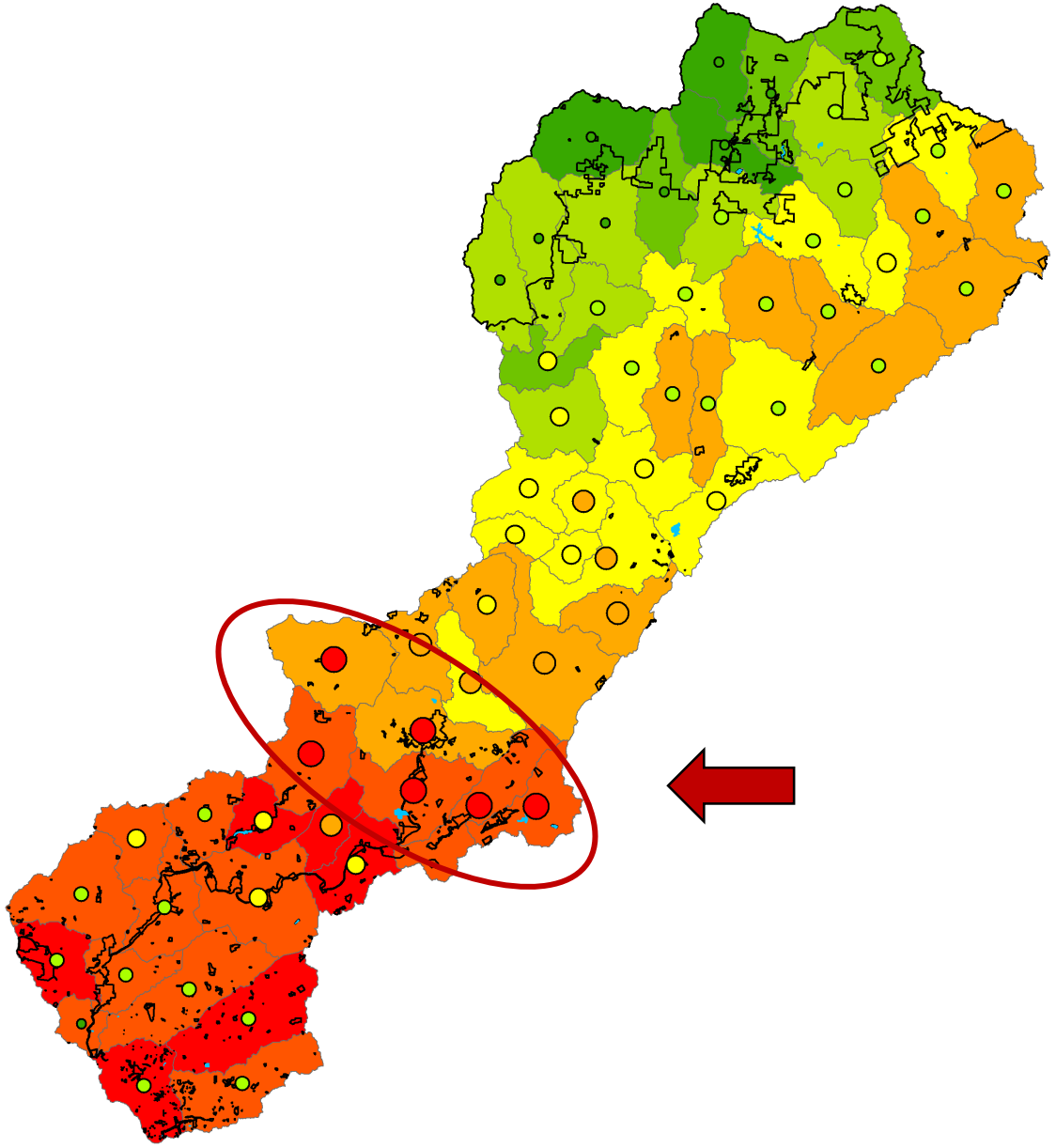
CEs in 2011: 44
*α=0.05

2001


Legend
Conservation easements
Public protected areas
Ecosystem services (ESs):
Total ESs (subwatersheds)
0.850 to 0.900
0.800 to 0.849
0.750 to 0.799
0.700 to 0.749
0.650 to 0.699
0.600 to 0.649
0.550 to 0.599

2006

Changes from 2001 to 2006



Legend

- Conservation easements
- Public protected areas

Ecosystem services (ESs):

% change in ESs

- 0.01 to 1.74
- -1.49 to 0.00
- -2.99 to -1.50
- -4.49 to -3.00
- -6.19 to -4.50

Total ESs (subwatersheds)

- 0.850 to 0.900
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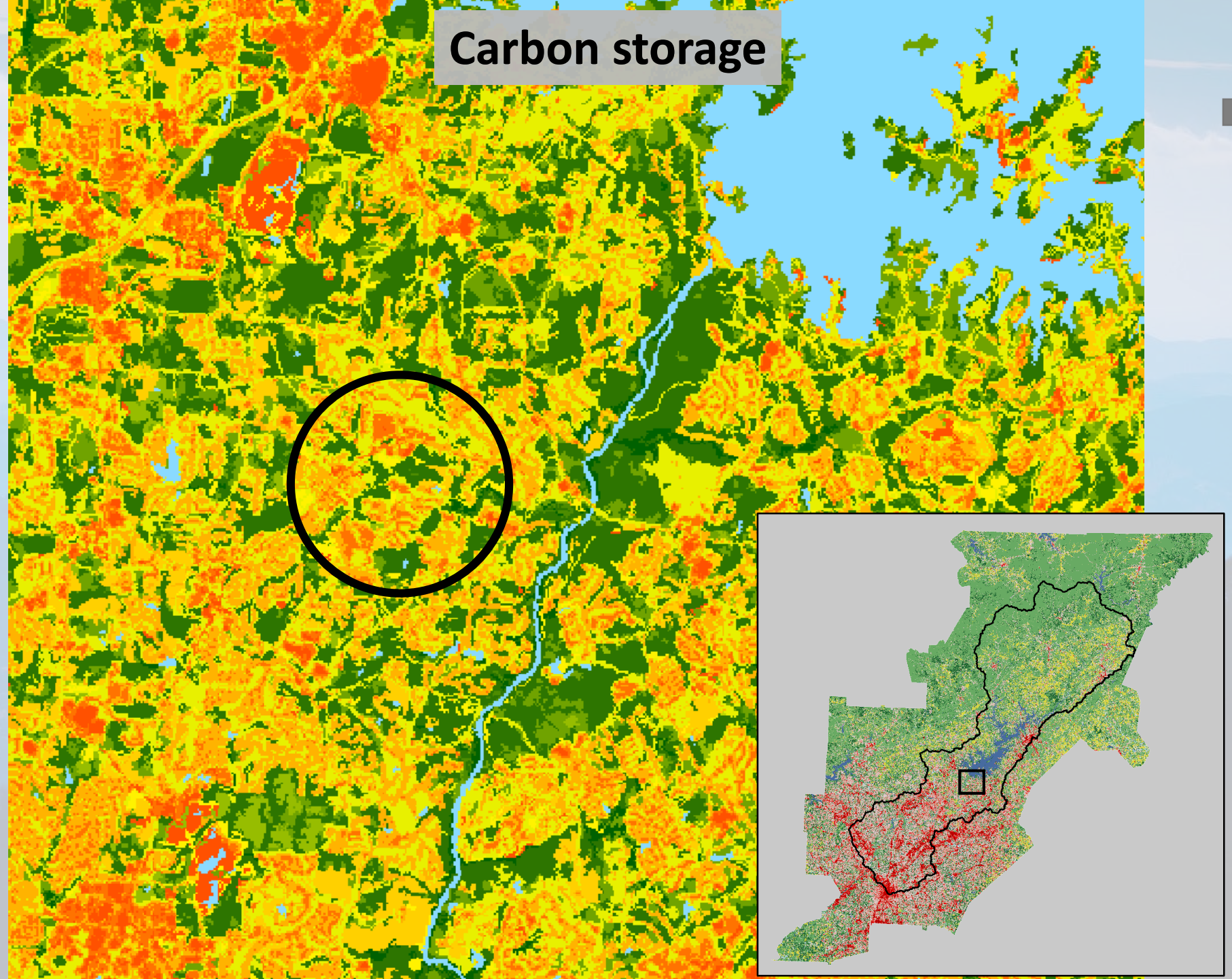
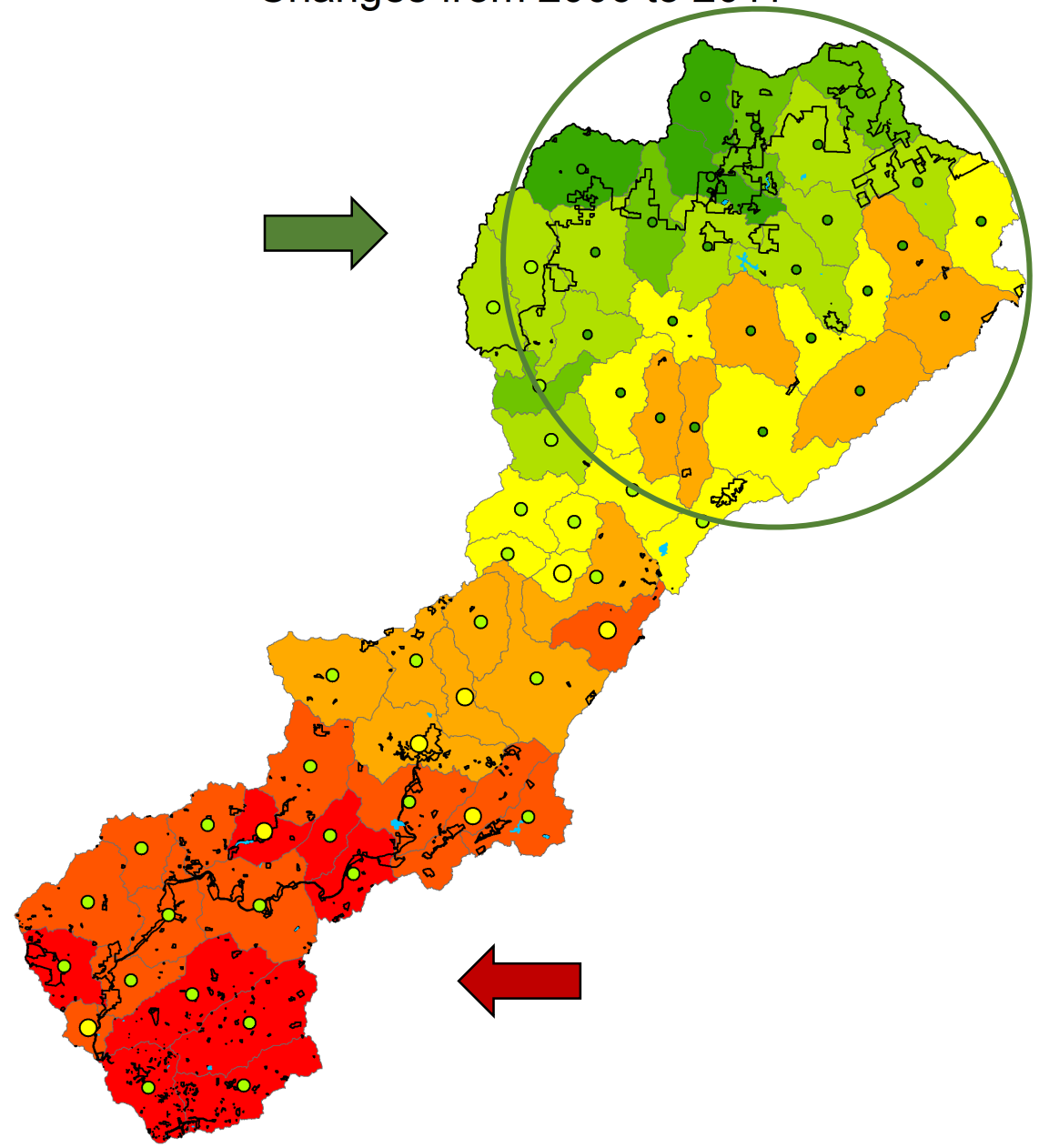

Carbon storage
Year
2001
2006
2011
Carbon storage
Max
Min

2011

Changes from 2006 to 2011



Legend

- Conservation easements
- Public protected areas

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Total ESs (subwatersheds)

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Final remarks

- Provision of ESs to local communities;
- Decline in provision of ESs in the absence of CEs;
- CEs performed better than Local Protected Areas;
- The number of CEs still small;
- An optimization program is needed;

Acknowledgments

- Dr. Puneet Dwivedi
- Warnell School of Forestry and Natural Resources
- University of Georgia

Chattahoochee National Forest


Thank you!
Questions?
Lake Lanier, GA
Contact: fabio.secanho@uga.edu

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