

Using a Broad-scale Spatial Analysis to Balance Use at the Landscape Scale.

Dr. Ashley D'Antonio, Oregon State University

Dr. Kevin Gutzwiller, Baylor University

Dr. Christopher Monz, Utah State University

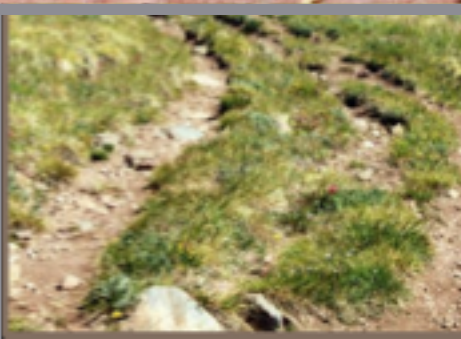


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What is *recreation ecology*?

the study of the **environmental consequences** of **outdoor recreation/nature-based tourism** activities and their **effective management**.

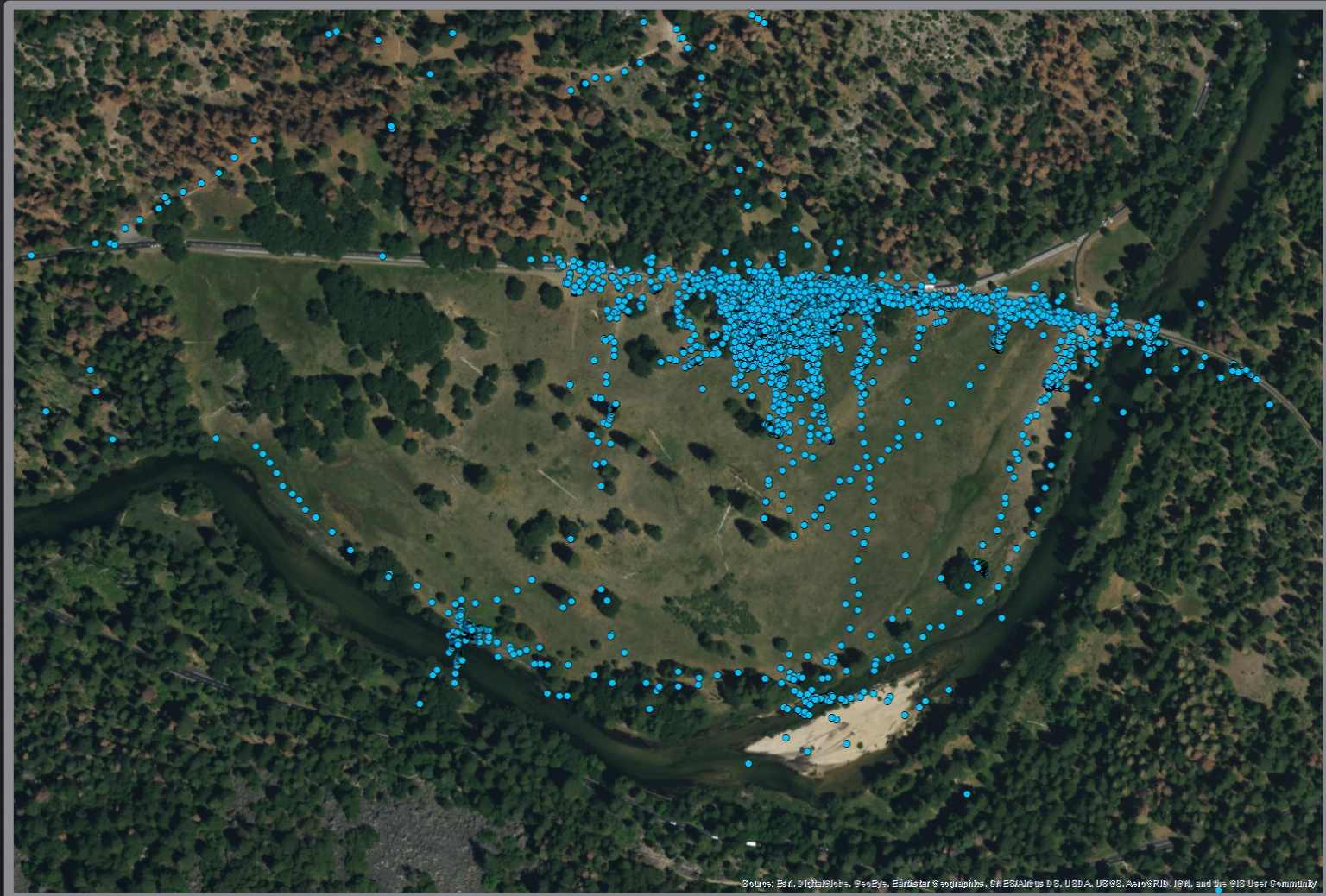




How do we measure recreation disturbance?



Tracking Visitors in El Capitan Meadow, Yosemite NP



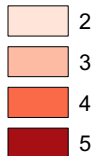
Recreation Impacts at Lake Haiyaha, Rocky Mountain NP

Legend

— Designated Trail

Visitor-Created Site (Large)

Condition Class



Visitor-Created Site (Small)

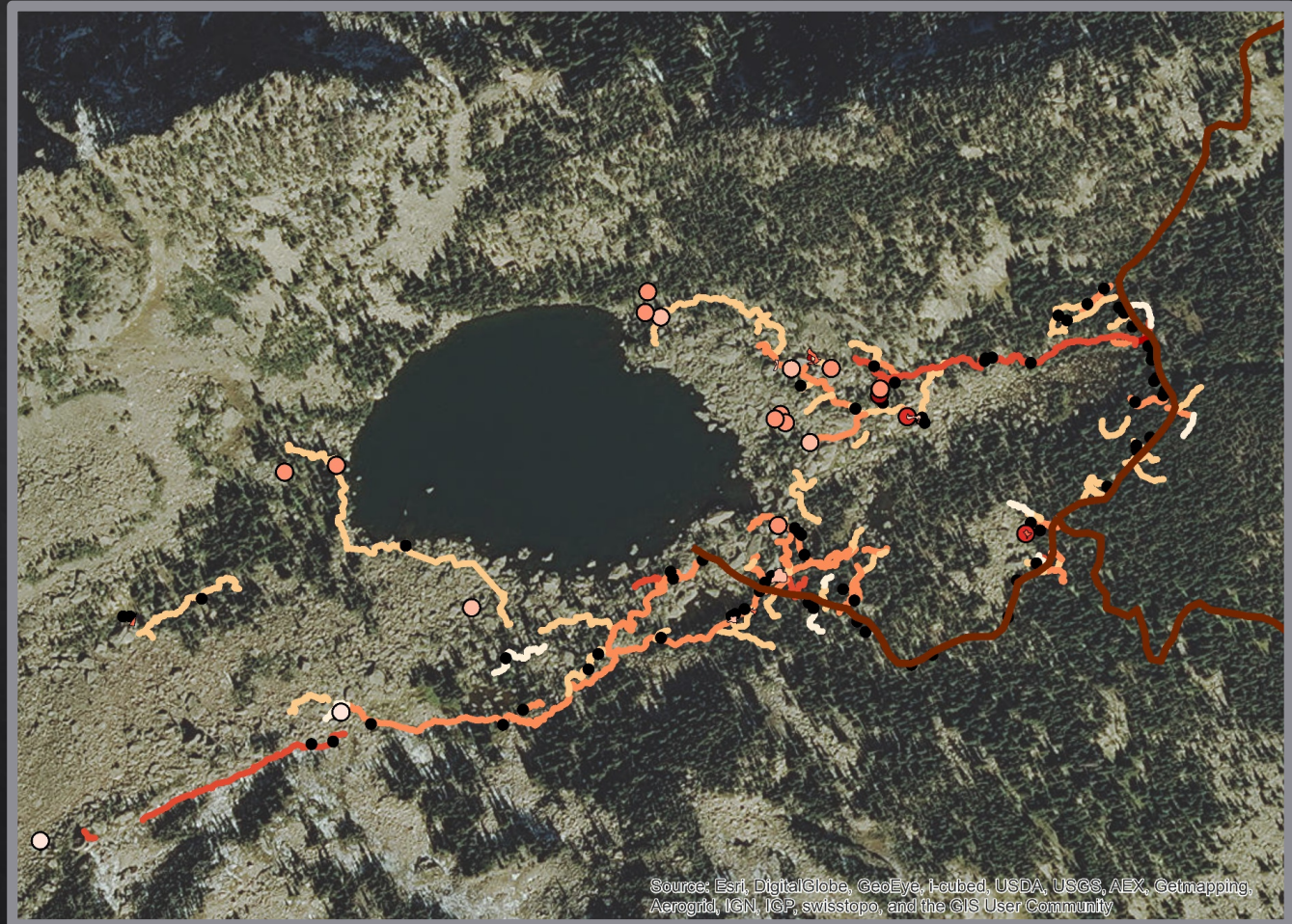
Condition Class



! Informal Trail Spur

Informal Trail

Condition Class



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Limitations/ Opportunities in Recreation Ecology



Impacts to wildlife

Limitations/ Opportunities in Recreation Ecology



RESEARCH ARTICLE

Effects of Recreation on Animals Revealed as Widespread through a Global Systematic Review

Biological Conservation 211 (2017) 10–19

Contents lists available at [ScienceDirect](#)

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon



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Review

Are negative effects of tourist activities on wildlife over-reported? A review of assessment methods and empirical results



Philip W. Bateman^{a,*}, Patricia A. Fleming^{b,*}

^a Department of Environment and Agriculture, Curtin University, Bentley WA 6845, Perth, Australia

^b School of Veterinary and Life Sciences, Murdoch University, Murdoch WA 6150, Perth, Australia

Limitations/ Opportunities in Recreation Ecology



Scale of Analysis

Limitations/ Opportunities in Recreation Ecology



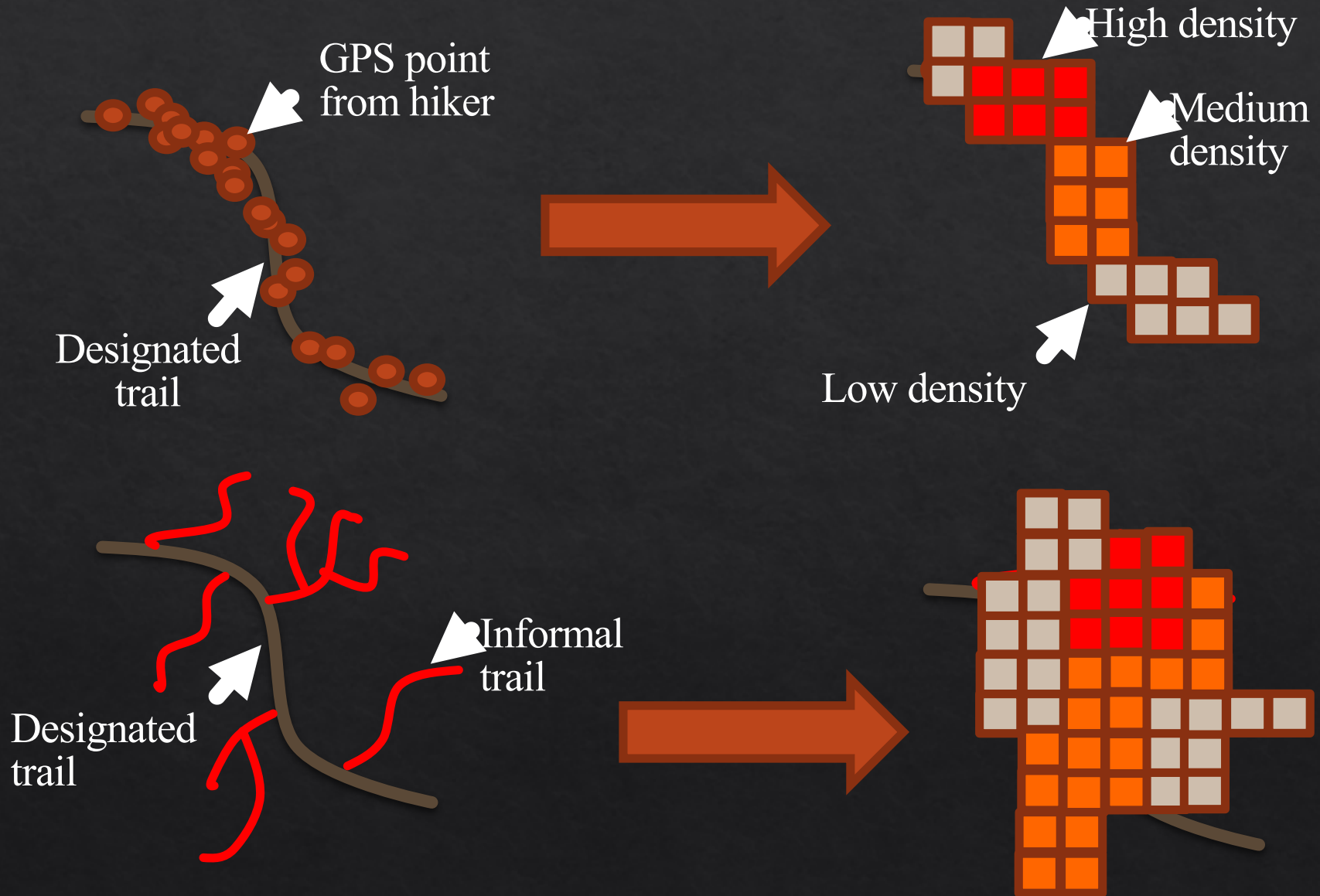
Larger spatial scales

Research Questions

- ◇ Can we use tools from other scientific fields to begin to understand recreation disturbance at broad spatial scales?
- ◇ How can we incorporate wildlife data into spatial examinations of recreation disturbance?



Recreation disturbance = a landscape attribute



ArcGIS

- % of total landscape impacted by different disturbance levels



FRAGSTATS

- # of patches of each disturbance level

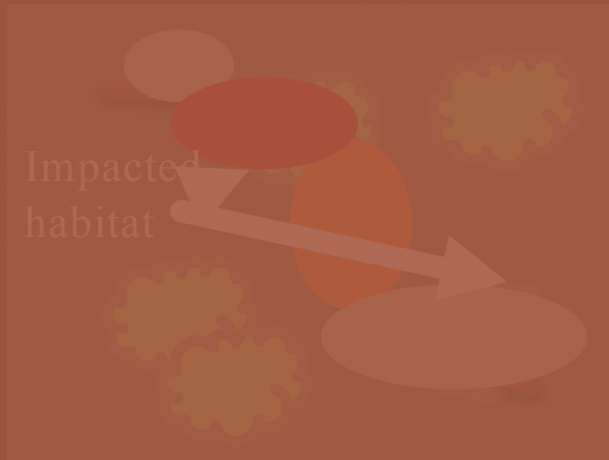
- Euclidean Nearest Neighbor Distance (ENND)



Conefor

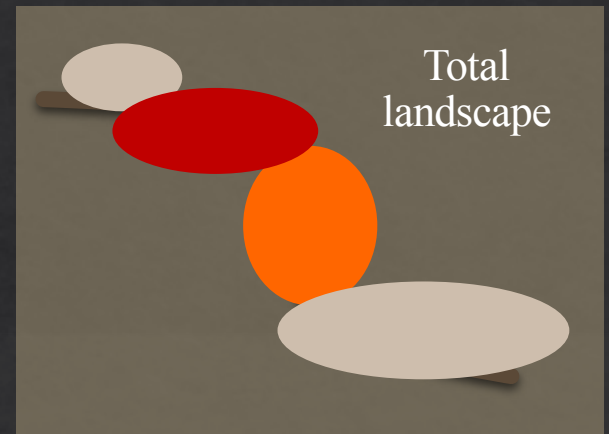
- Habitat connectivity; incorporates aspects of patch size & distance between

- % change in EC(IIC) and EC(PC)



ArcGIS

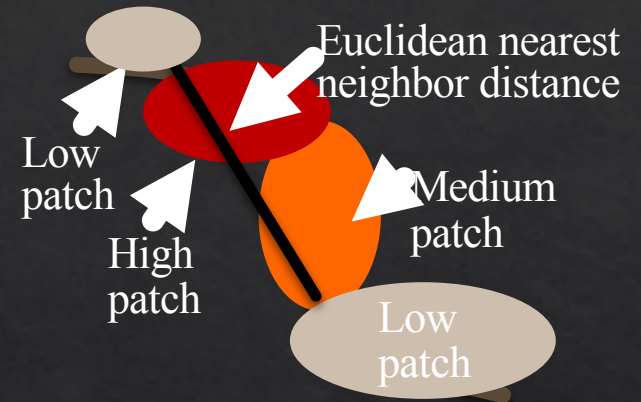
- % of total landscape impacted by different disturbance levels



FRAGSTATS

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Conefor

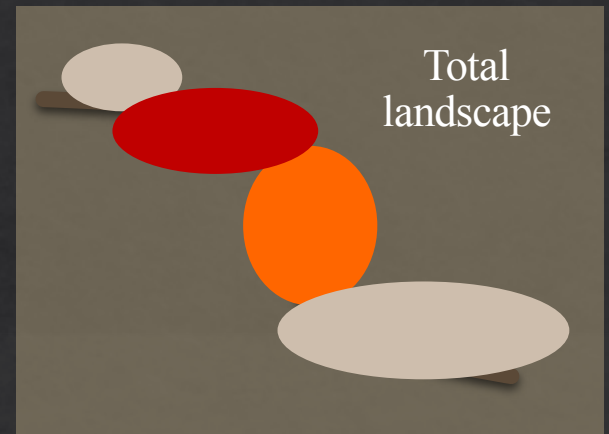
- Habitat connectivity; incorporates aspects of patch size & distance between

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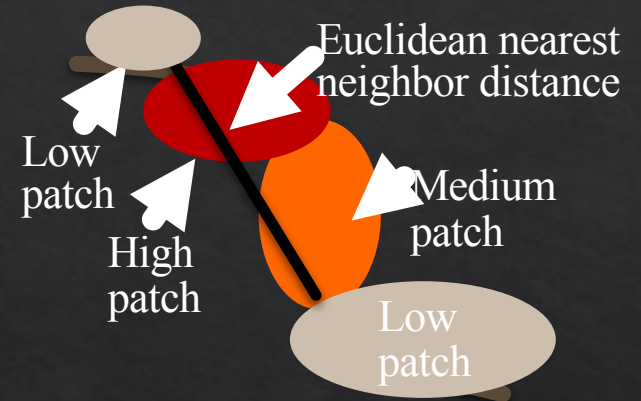
ArcGIS

- % of total landscape impacted by different disturbance levels



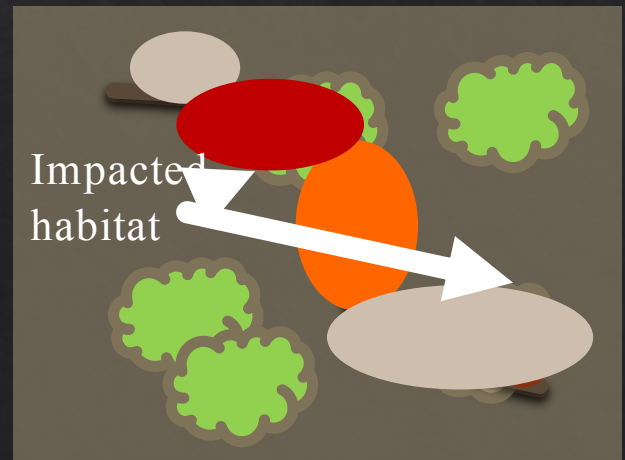
FRAGSTATS

- # of patches of each disturbance level
- Euclidean Nearest Neighbor Distance (ENND)



Conefor

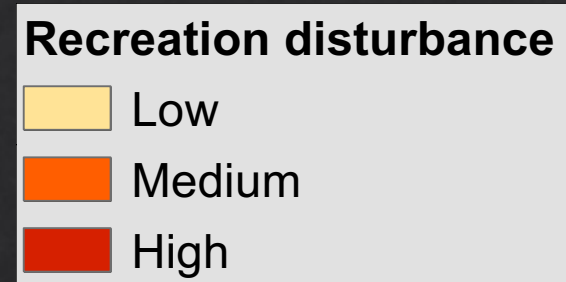
- Habitat connectivity; incorporates aspects of patch size & distance between
- % change in EC(IIC) and EC(PC)



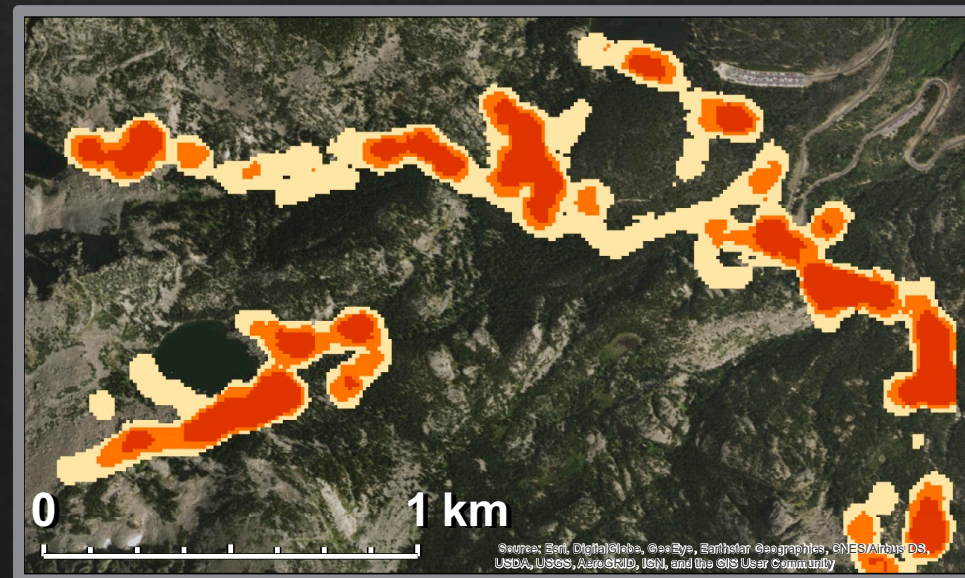
Lesson 1: Recreation disturbance made up a **small percentage** of the areas examined.



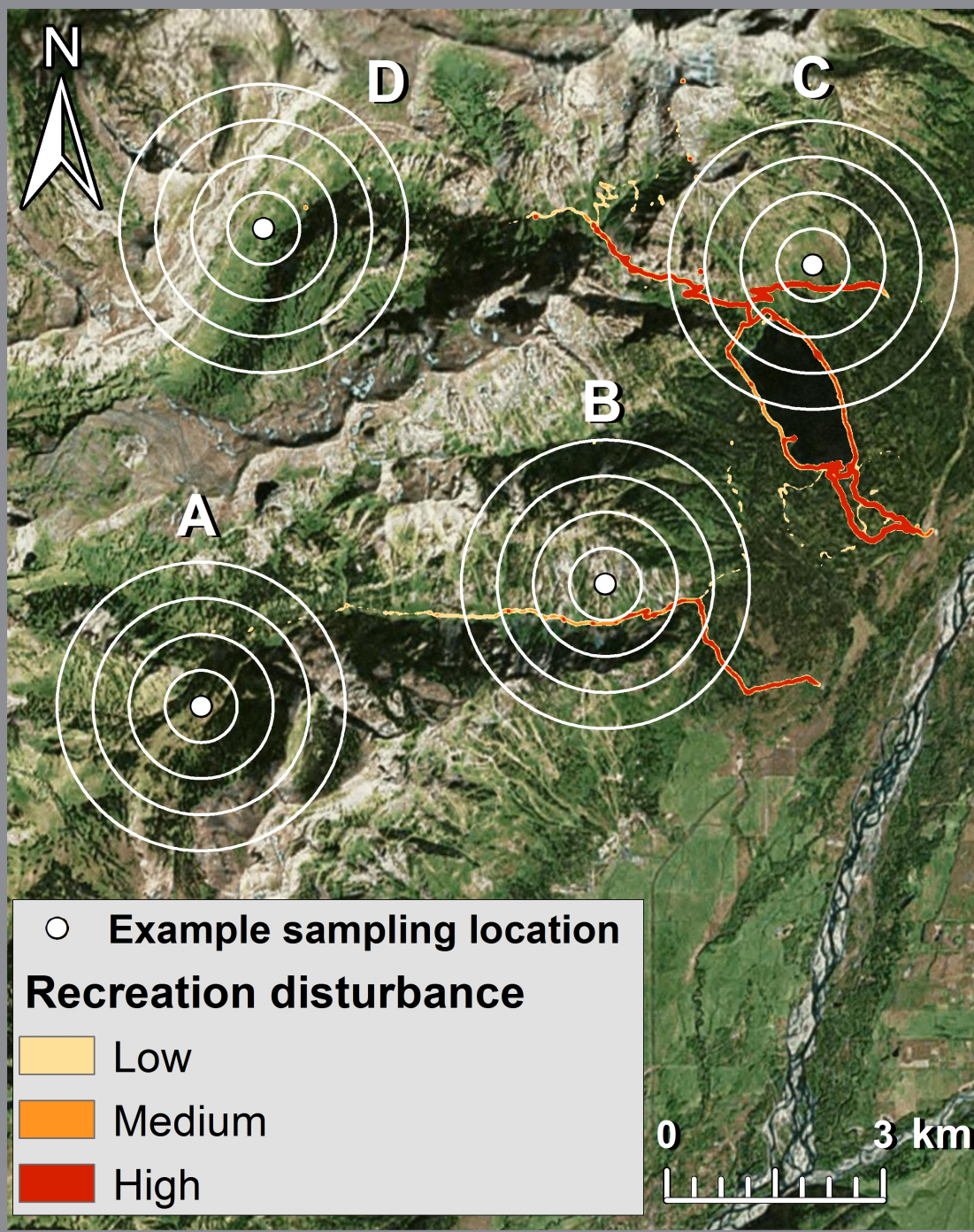
Disturbance from hikers



Bear Lake Road Corridor,
Rocky Mountain NP



Disturbance from informal trails



Lesson 2: On many landscapes, wildlife can find **refuges** from recreation disturbance.

Moose-Wilson Road
Corridor, Grand Teton NP

Lesson 3: The **location** of recreation disturbance is important for understanding the **level of impact**.

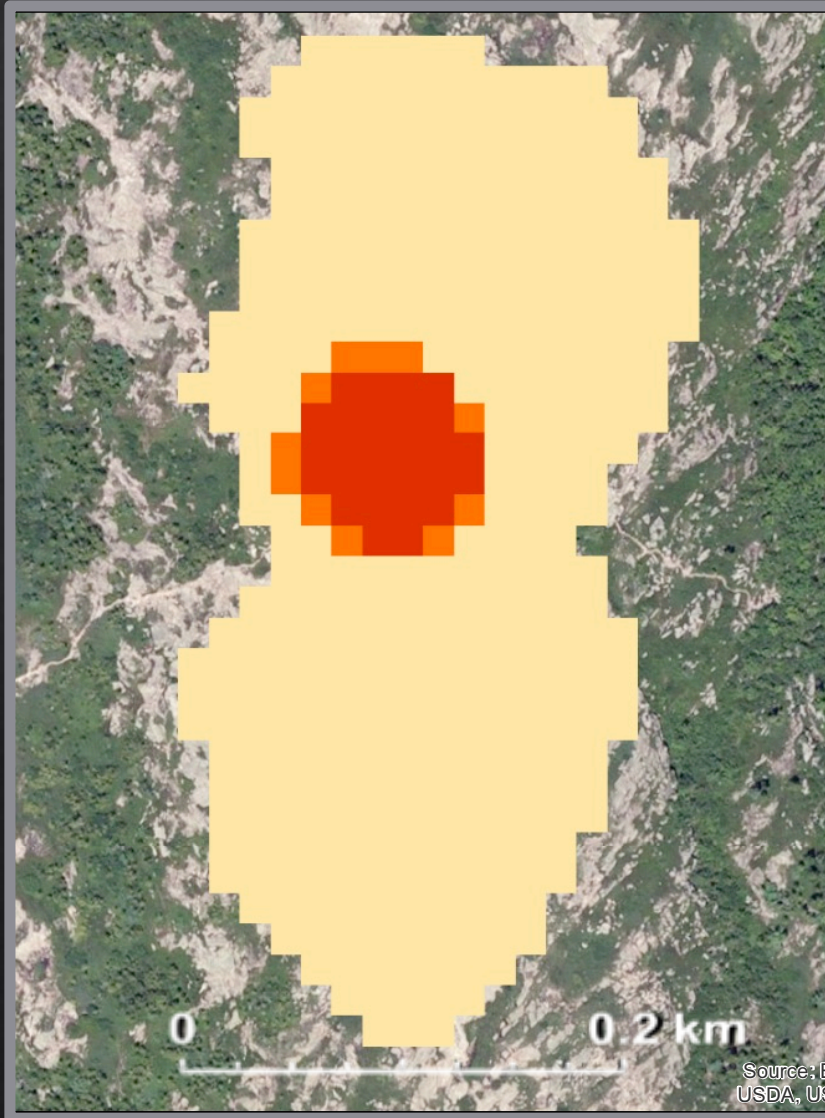
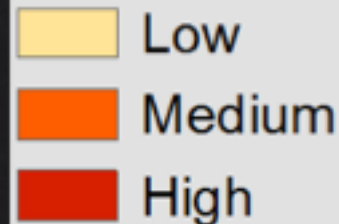
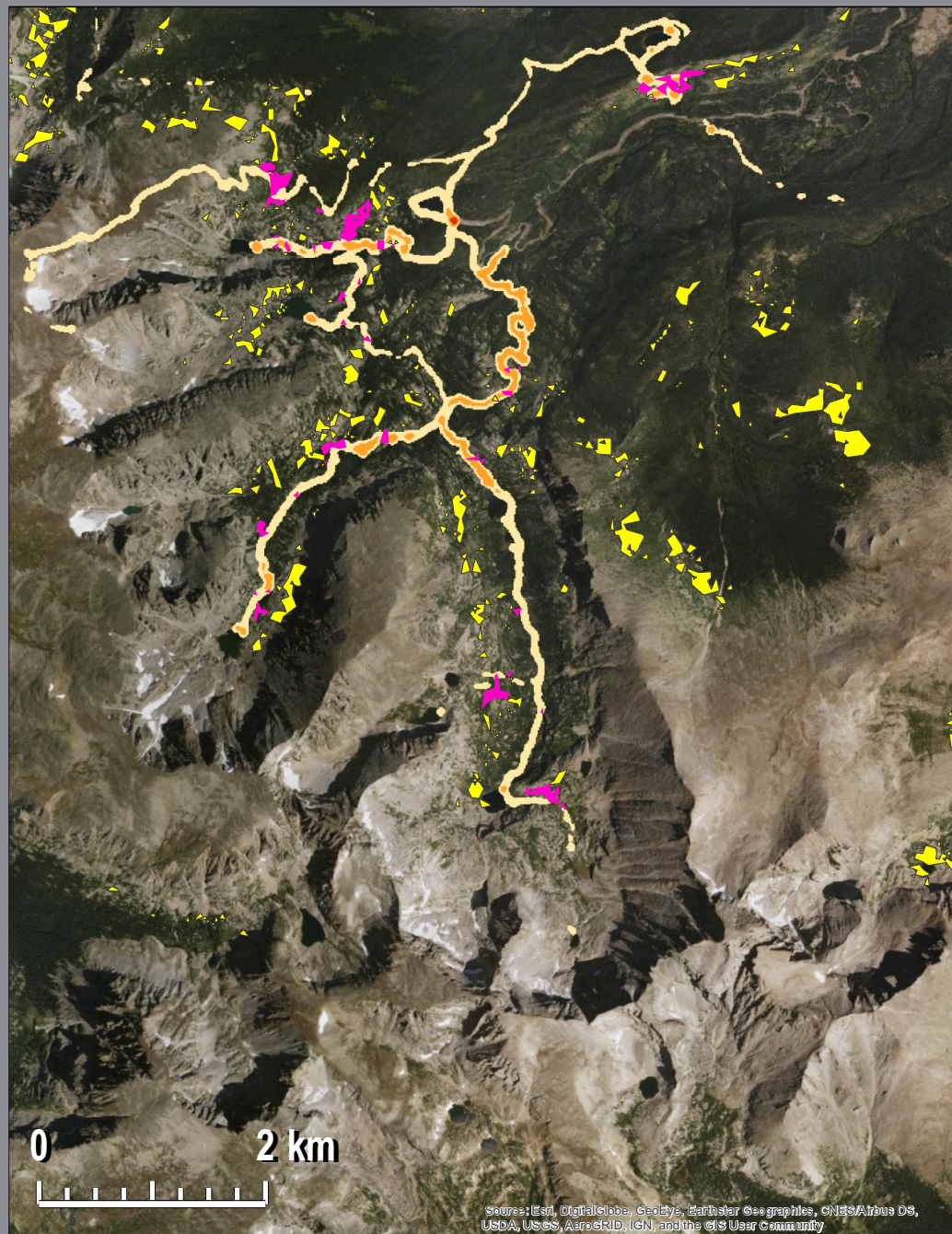


Photo credit: Abby Sisneros -Kidd

Recreation disturbance



Lesson 4: The **pattern** of recreation disturbance is important for understanding the **level of impact**.



- Grass/forb habitat
- Impacted grass/forb habitat
- Recreation disturbance**
 - Low
 - Medium
 - High

Conefor Analysis:
Bear Lake Road Corridor,
Rocky Mountain NP

Where do we go from here?

- ◇ What scale is most relevant for individual species or the species response we are interesting in?
- ◇ What other variables/interactions are important for understanding the relationship between recreation and wildlife?
- ◇ How do we bring all of this together into meaningful, predictive, and useful models for management?



Take Home Message

- ◆ We have tools and approaches that allow for **analysis of recreation disturbance at landscape scales**.
 - ◆ ...but recreation ecologists need to measure disturbance at larger spatial scales & **work collaboratively with scientists from other fields**.
- ◆ **Management implications** → understanding recreation use at broader spatial scales is **important for protecting ecosystems and wildlife**.



Funded by:



@AshRecEco

Ashley.D'Antonio@oregonstate.edu



Oregon State University
College of Forestry



BAYLOR
UNIVERSITY



S.J. & JESSIE E. QUINNEY
COLLEGE of
NATURAL RESOURCES
Utah State University