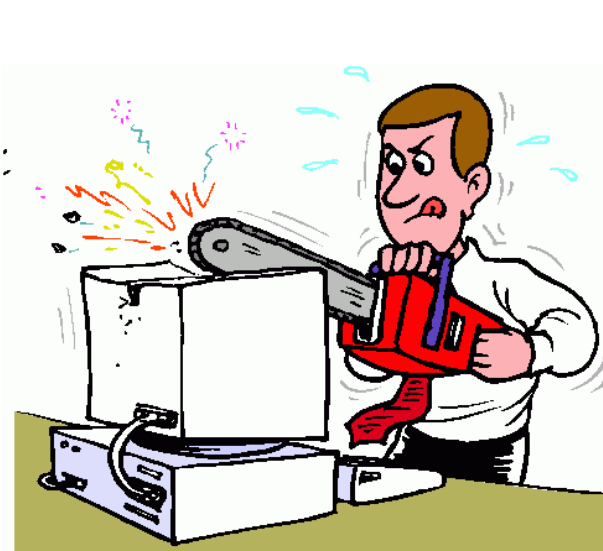


REA modelling

There are two kinds of people in the world: those who enjoy models and those who don't.

Which kind are you?



The Good, The Bad, and The Ugly...

- Geospatial analysis and models are at the core of all REAs
- All models are wrong; some models are useful
- It is worth getting to know them... seriously...
- This is intended to be a gentle introduction.



REA Modelling Outline

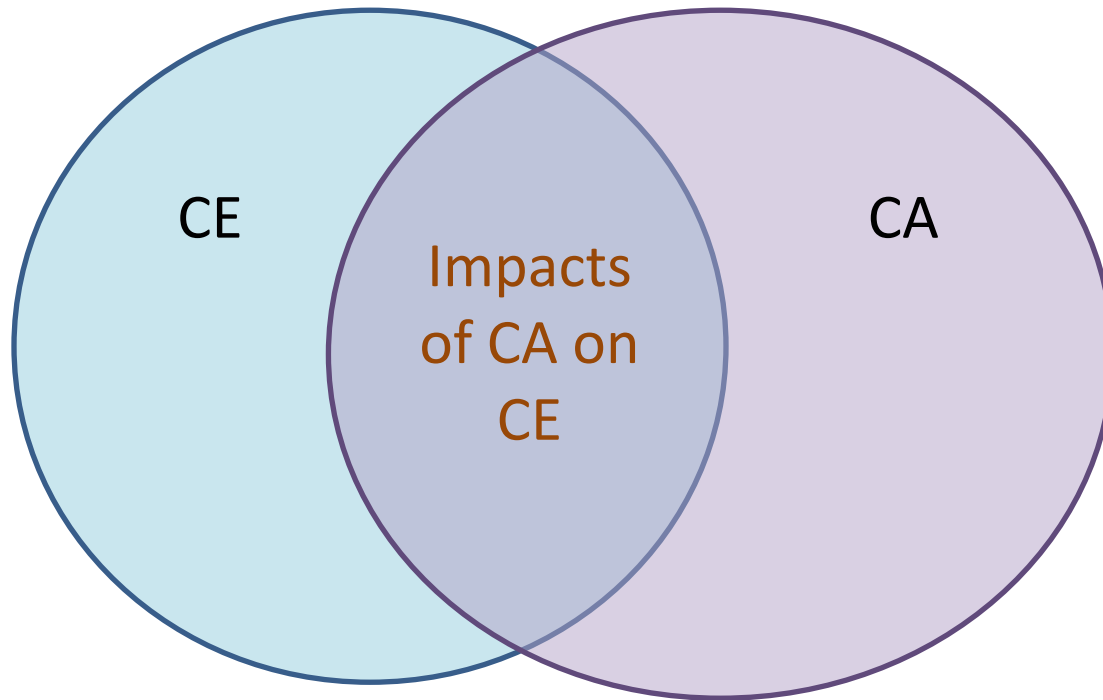
1. Model Characteristics in REAs
2. Modelling interactions between Change Agents (CAs) and Conservation Elements (CEs)
3. Modeling Landscape Intactness in the REAs
4. The Multiscale Indicator of Landscape Intactness

1. REA Model Characteristics

- Based on best *regionally* available data and information
- Scientifically sound
- Support high levels of transparency
- Assumptions and limitations provided
- Scalable – allow for multiscale assessments
- Prescriptive as well as descriptive
- Editable and flexible
- Practical – provide actionable information

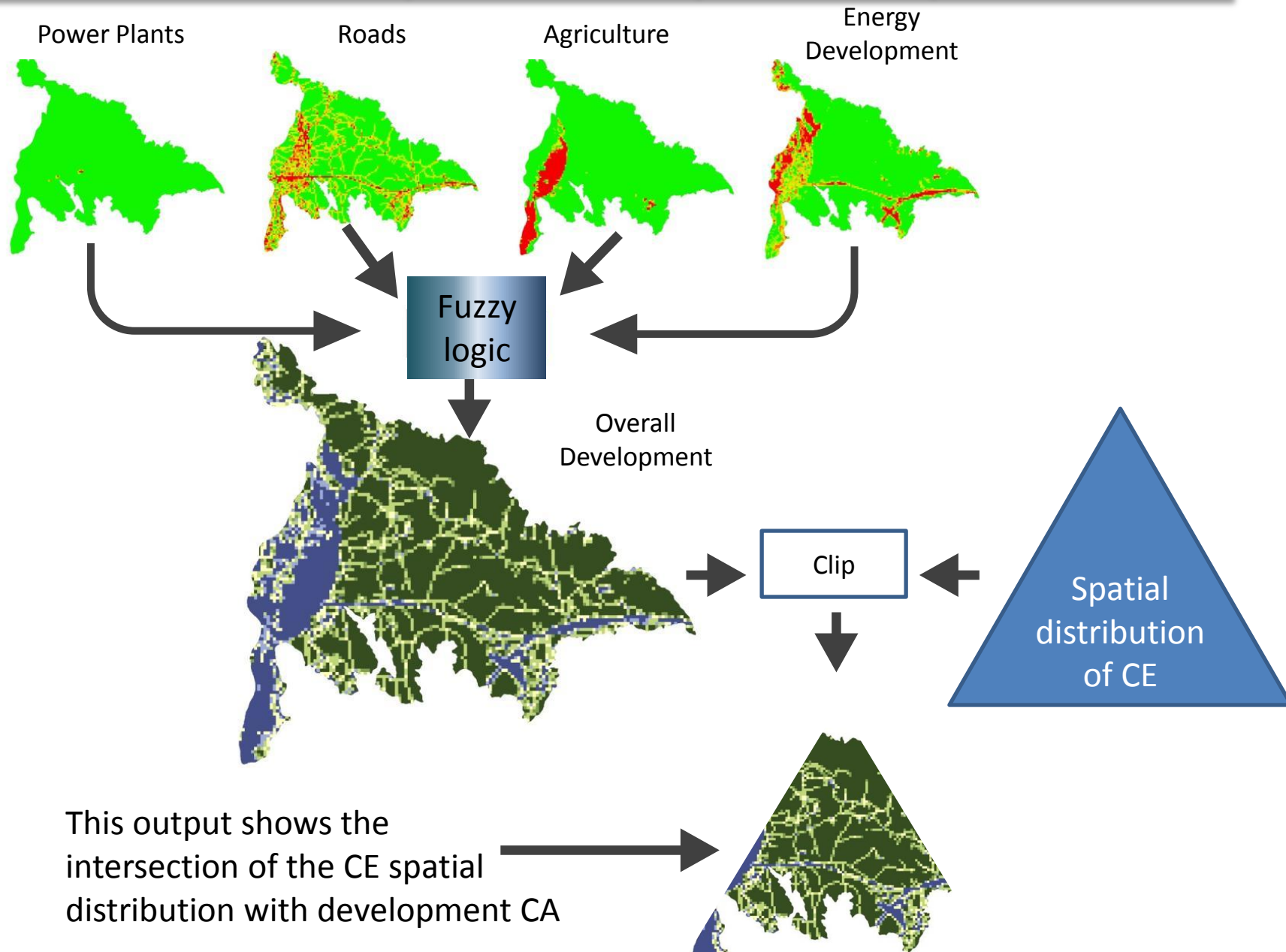
Consider the modeled datasets with these criteria in mind and when you use them in a report, be sure to communicate the characteristics that are useful in your context.

2. Consider a Venn diagram example of the spatial **interaction** between CEs and CAs



Effects of different CA's on each other were not considered. For example, the effects of climate change on invasives or the effects of development on invasives.

REA Analysis Technique Example



3. Landscape Intactness

- Ecological condition is mapped using concept of Landscape Intactness
- Possible to map with existing geospatial data
- Can track trend through time
- Map gradient of intactness v. gradient of disturbance
- Required in REAs

Intactness is a quantifiable estimate of naturalness measured on a gradient of anthropogenic influence and based on available spatial data.

REA Landscape Intactness Models

- All REAs **estimated** landscape integrity or intactness in one form or another
- Variety of analytic methods – a learning process for BLM
- Models can be applied to other areas
- There are 3 main modeling types:

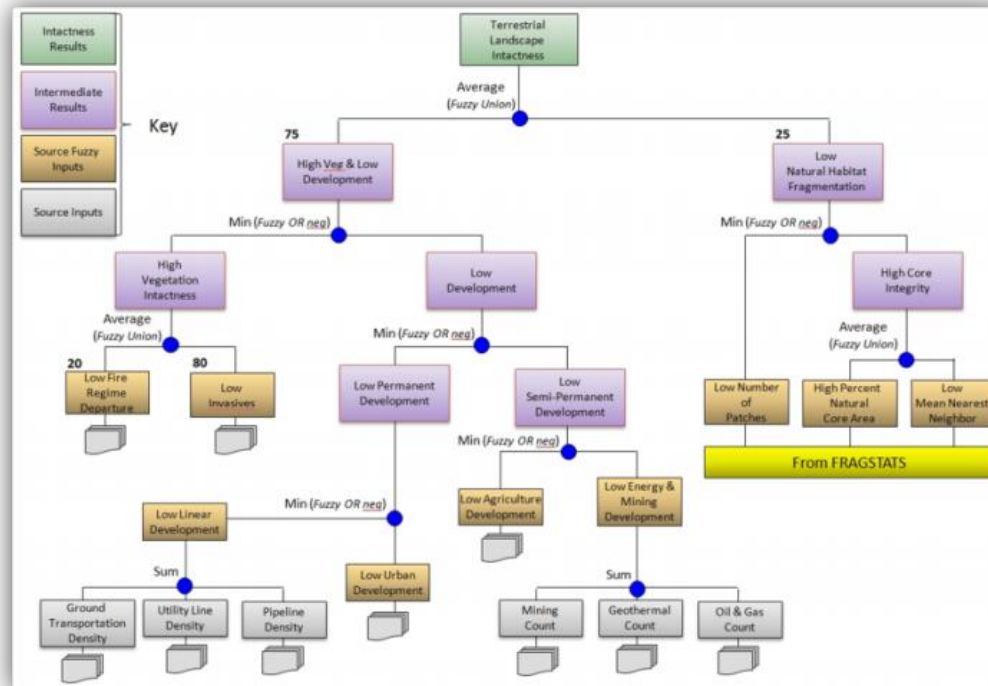
Fuzzy logic

Landscape
Condition
Model

Moving
Window

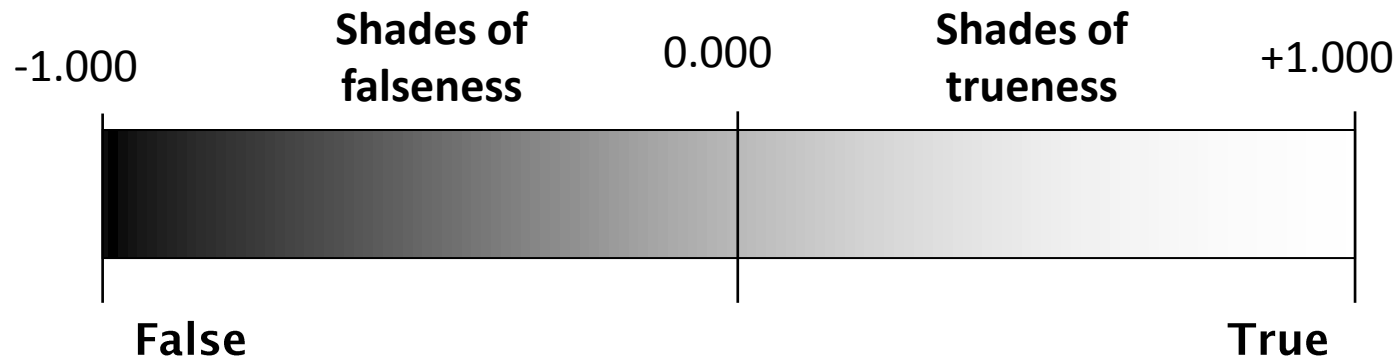
Fuzzy Logic Intactness Model

- Used to show the modeling thought process for the more complex MQs using fuzzy logic (v. Boolean logic)
- A hierarchical workflow depicting how the spatial data sets comprise the final intactness measure
- Interactive and flexible
- **Useful to understand the workflow and derivation of the data without delving into the GIS**



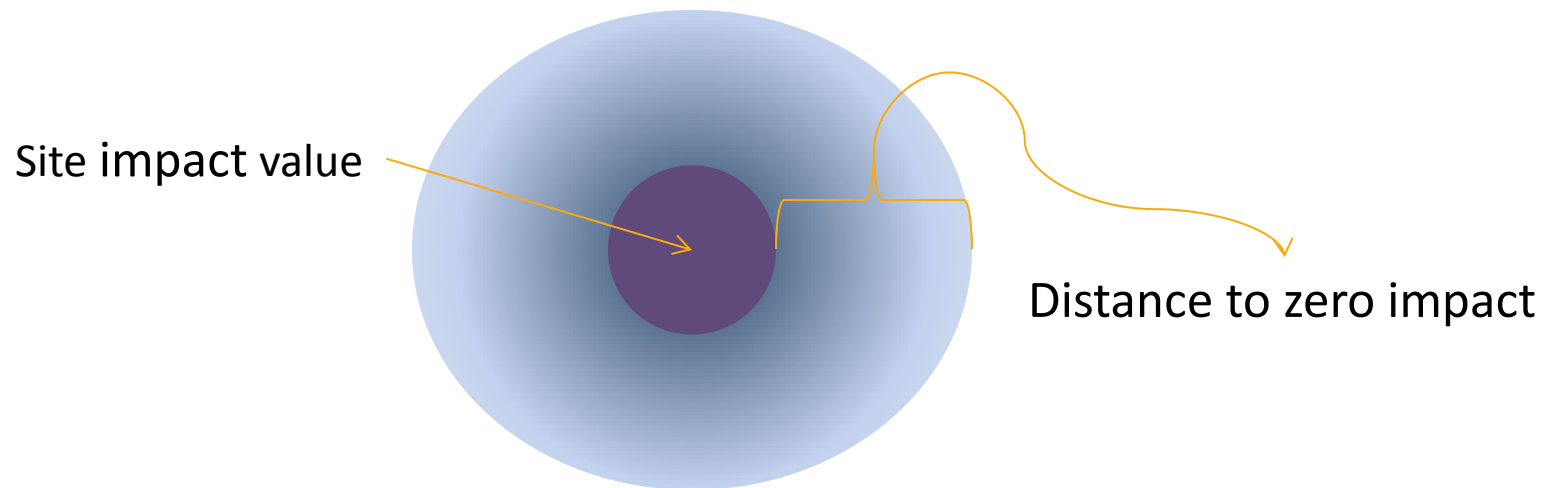
Fuzzy Logic Intactness Model

- Fuzzy Logic (COP 2010, COP 2014, SOD)
 - Data are normalized into a common range of values from -1 to +1
 - Gradient of values



Landscape Condition Model for Intactness

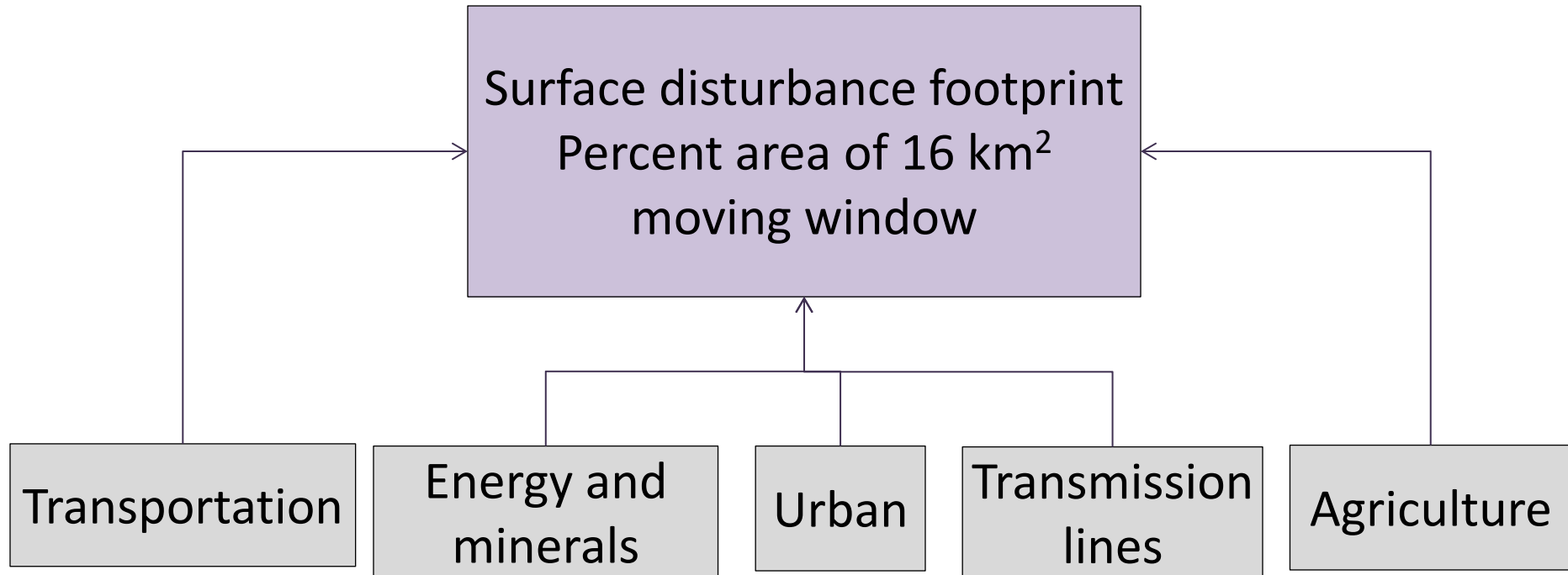
- Site Impact and distance decay away from effect



— CBR, MAR, MBR, NGB, NOS, SLV, SNK, YKL

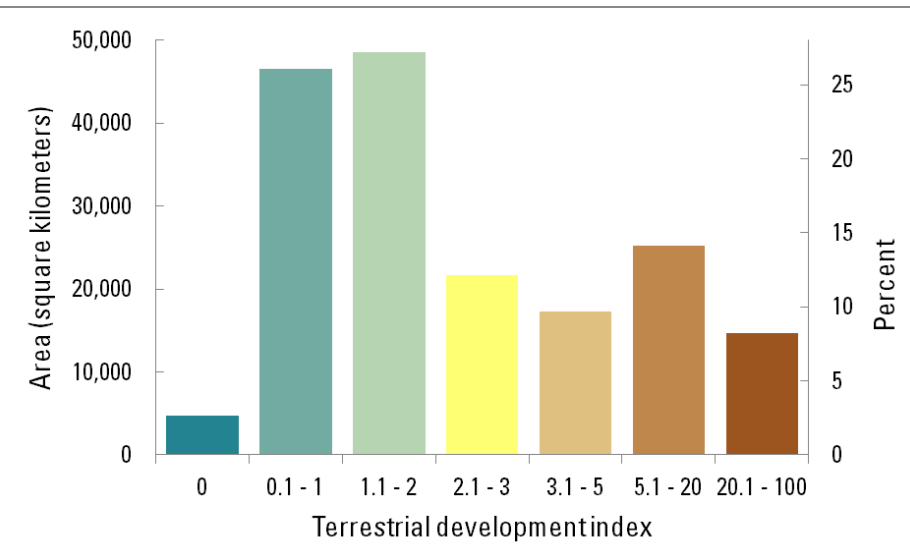
Moving Window Intactness Model

Terrestrial Development Index

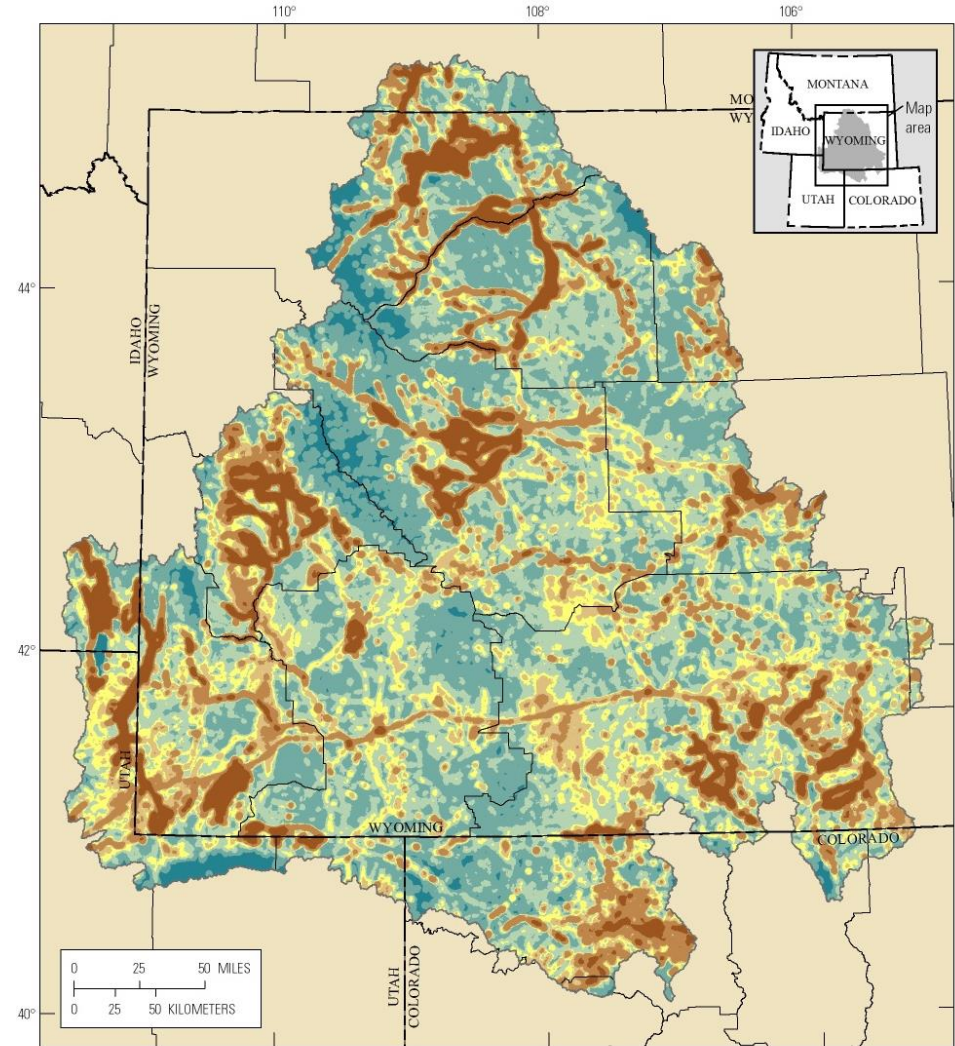
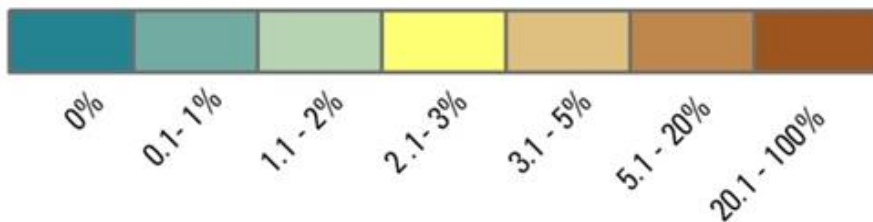


Terrestrial Development Index

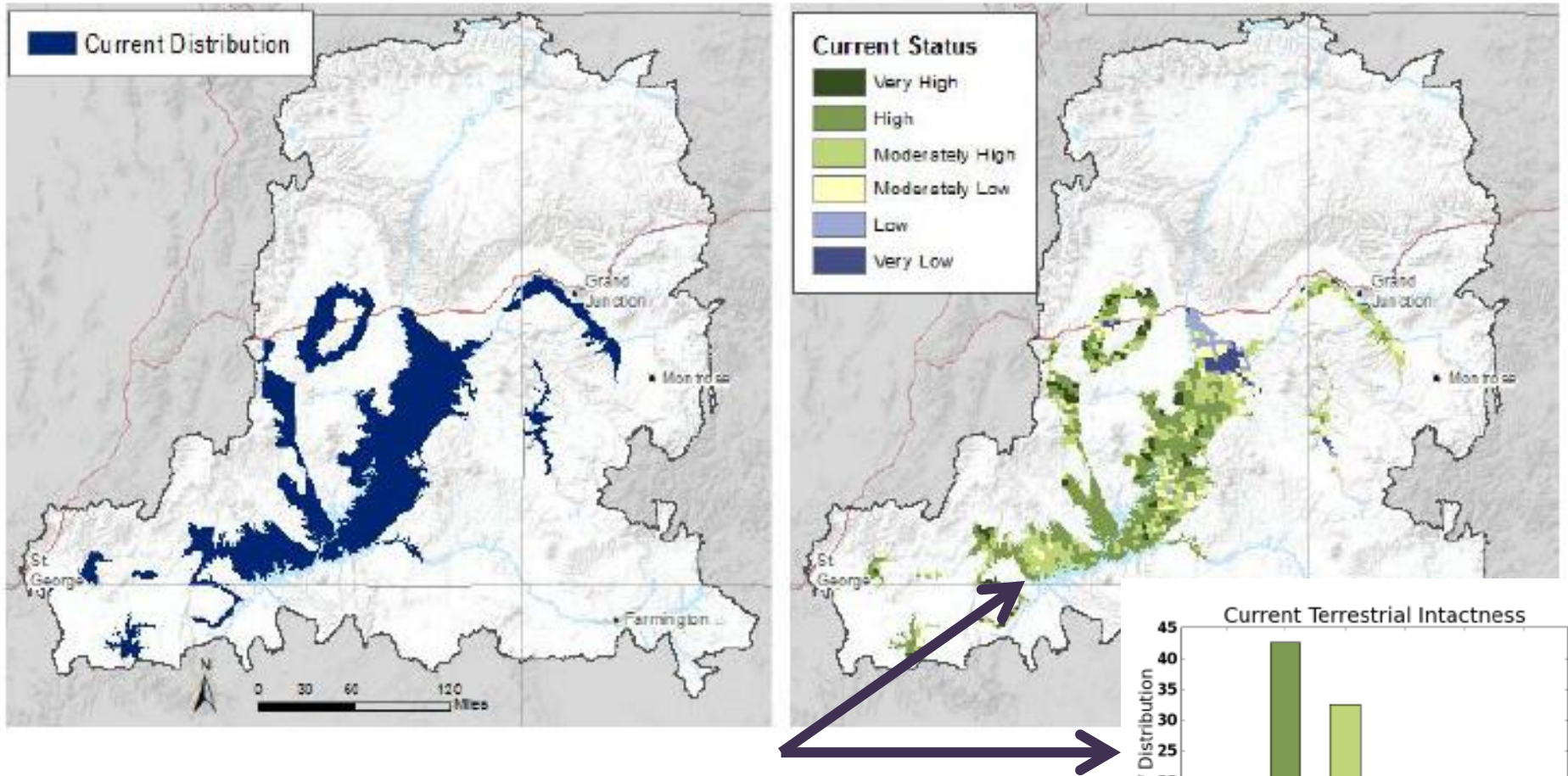
Wyoming Basin



Terrestrial development index



MQ D1. What are the current distribution and status of desert bighorn sheep (and historic occupied habitat if available), seasonal and breeding habitat, and movement corridors (as applicable)?



Overlay landscape intactness
to find the current status
and summarize

REA Model Types for Intactness

- Moving Windows Analysis (WYB, SGP)
 - Terrestrial Development Indices (TDI) = Landscape Intactness
 - Single measure of cumulative impacts of development
 - Averaging and smoothing function to remove noise
- Landscape Intactness data just released
 - West-wide coverage
 - Not in REAs but developed similarly to TDI
 - <https://www.sciencebase.gov/catalog/item/57d8779de4b090824ff9acfb#summary>

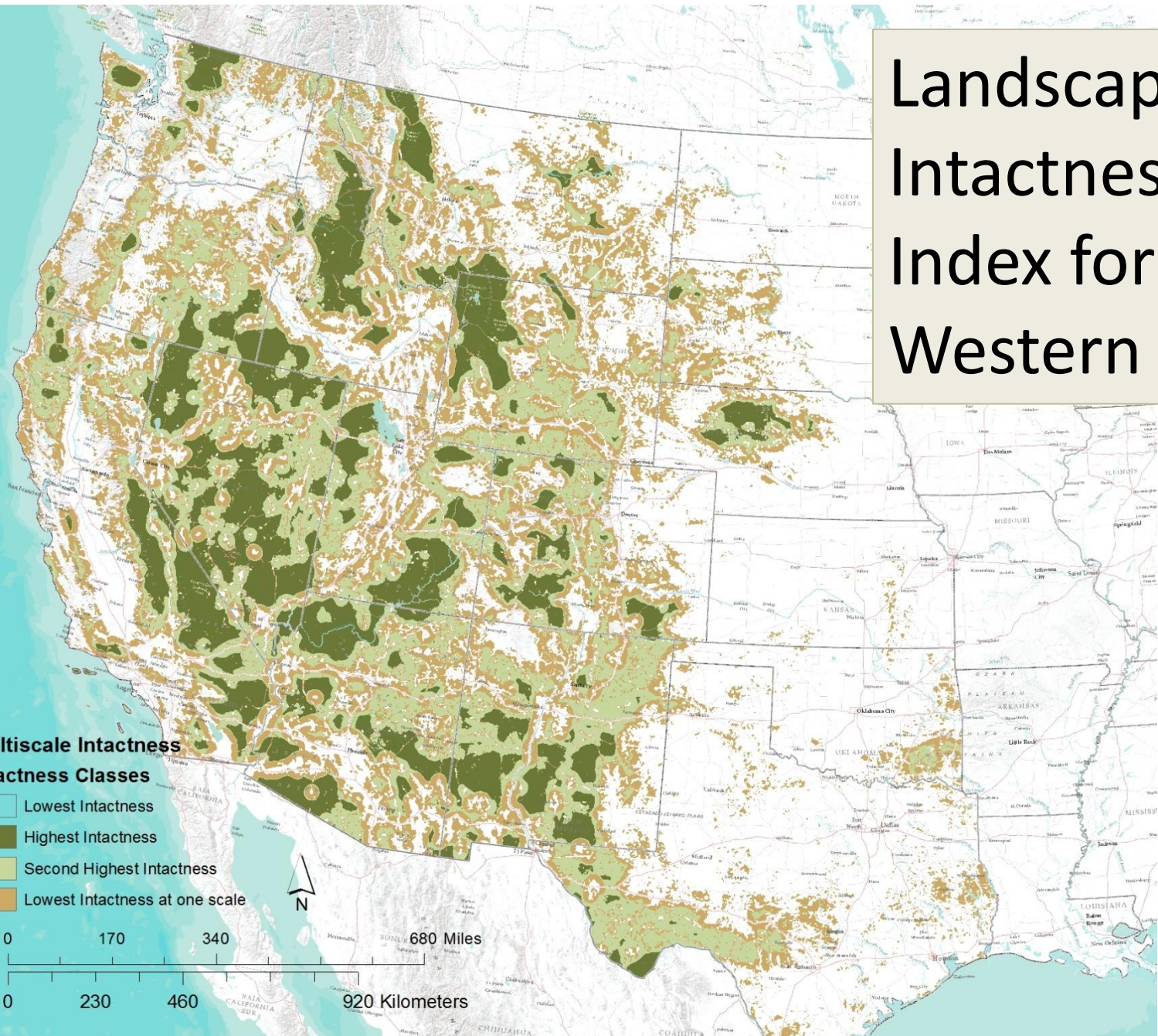


Landscape Intactness Index for the Western US

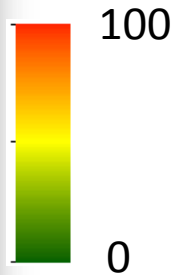
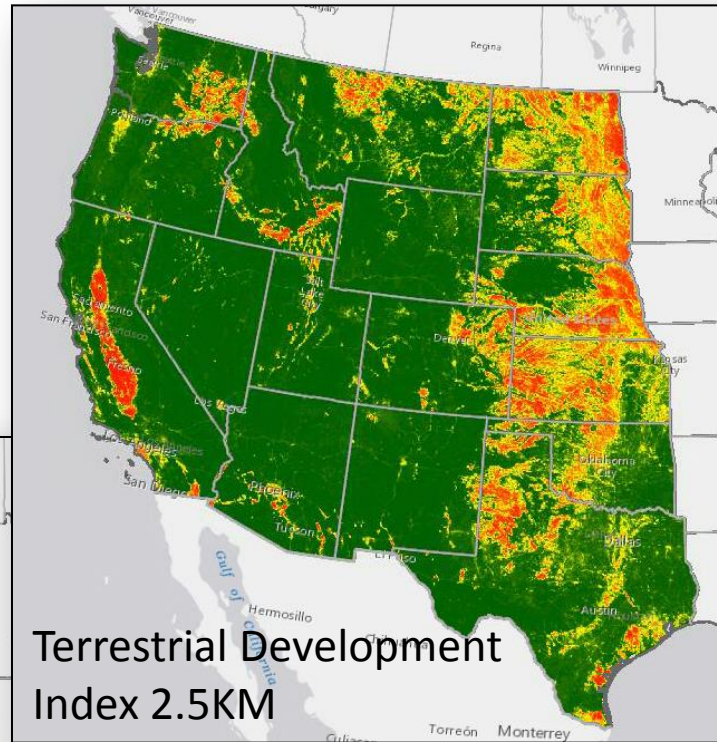
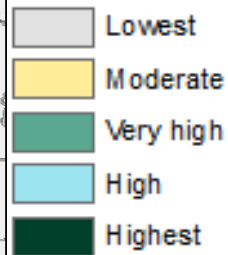
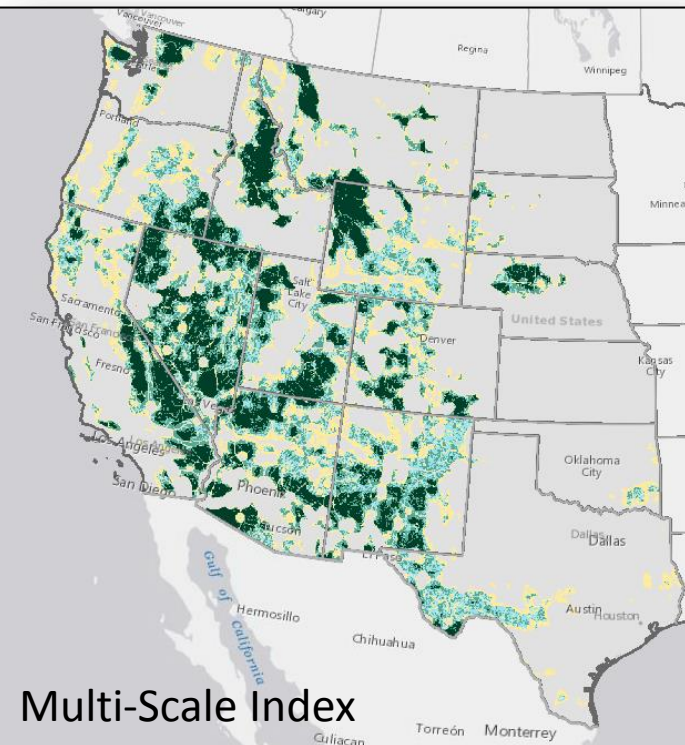
Multiscale Intactness Intactness Classes

- Lowest Intactness
- Highest Intactness
- Second Highest Intactness
- Lowest Intactness at one scale

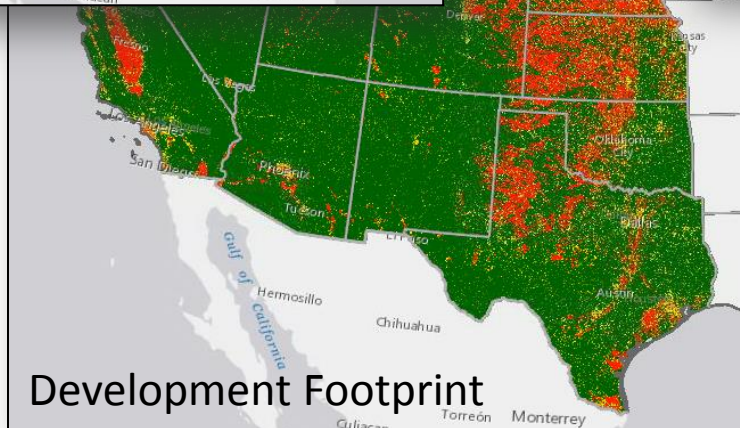
0 170 340 680 Miles
0 230 460 920 Kilometers



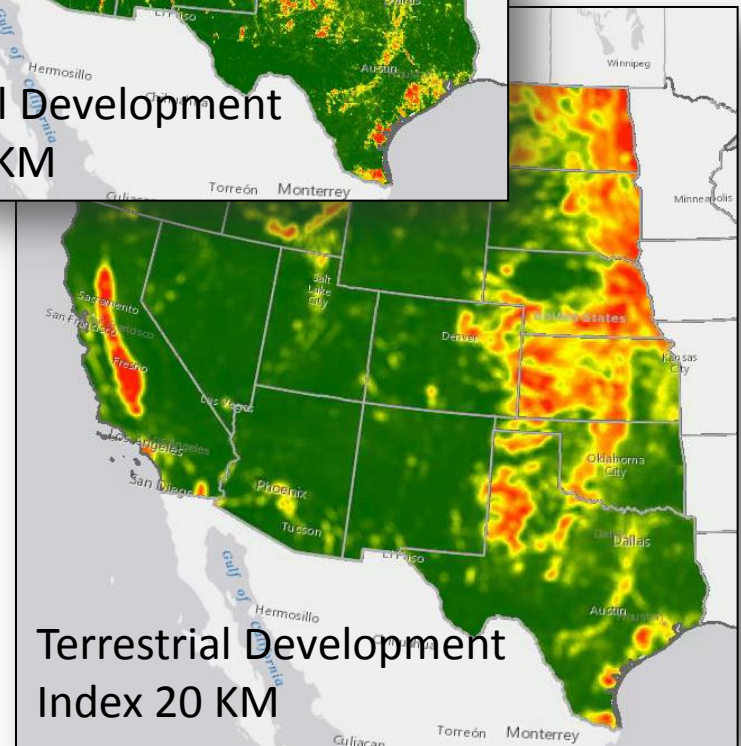
Landscape Intactness



Terrestrial Development
Index 2.5KM



Development Footprint



Terrestrial Development
Index 20 KM

Urban

Ag Areas

Energy

Minerals

Transportation

Any Questions?



All photos from BLM Flickr