Methods for quantifying the functionality of wildlife habitat

(i.e., HOW "GOOD" IS A GIVEN PIECE OF LAND FOR WILDLIFE?)

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Intro – quantifying functionality

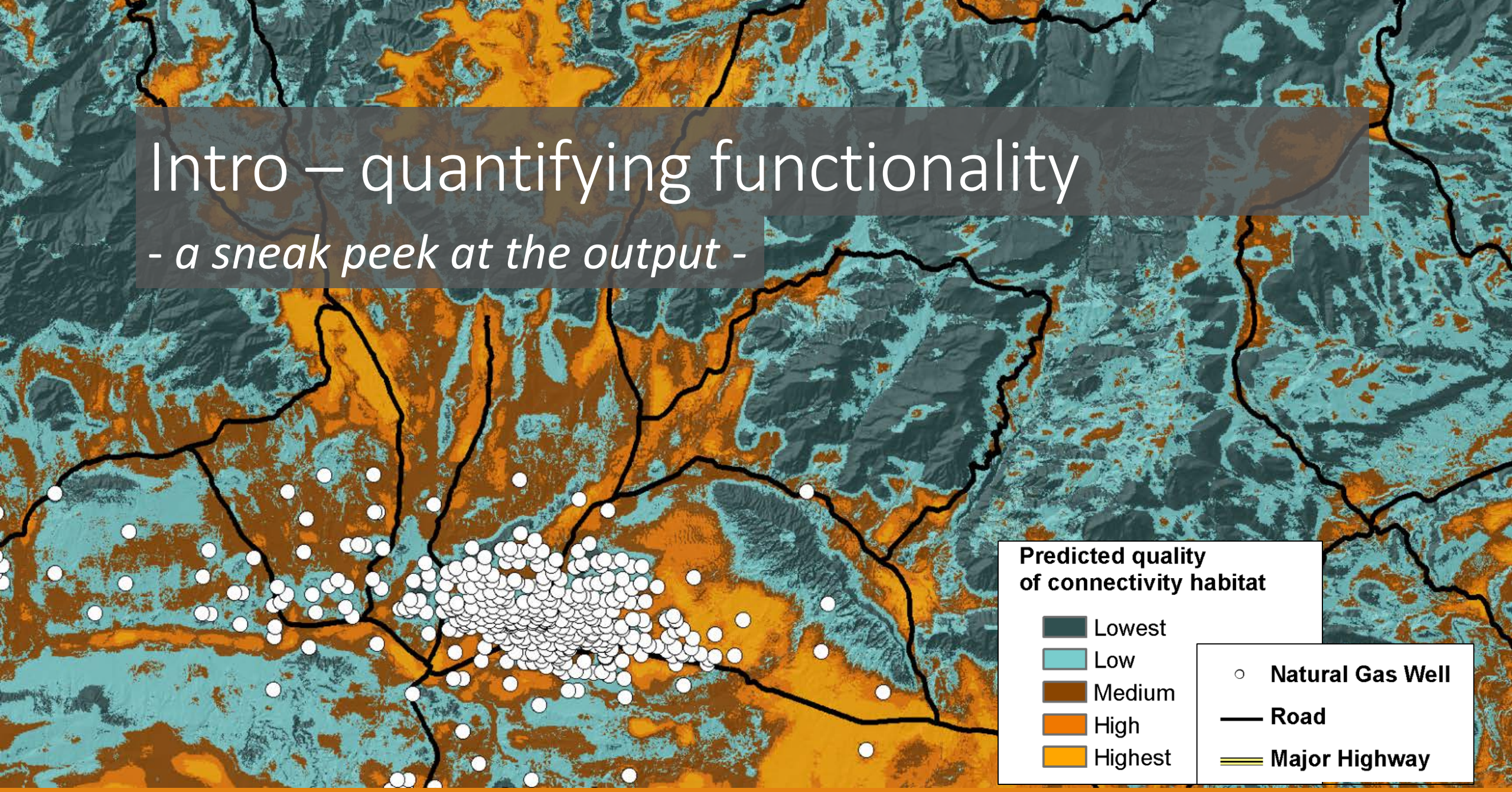
Why quantify functionality?

- An acre is not an acre is not an acre
- Ensure outcomes = expectations
- Evaluate alternative actions
- Transparent
- Objective
- Defensible

Process and concept · not a specific method

Intro – quantifying functionality

- a sneak peek at the output -



Harju, S.M., et al. 2013. A flexible approach for assessing functional landscape connectivity…. PLoS ONE 8:e82271.

Definitions:

What is…'functionality' of habitat?

Intentionally vague, flexible

How does habitat meet life history needs?

- Reproduction or survival?
- Basic occurrence?

Focus on quality

Definitions:

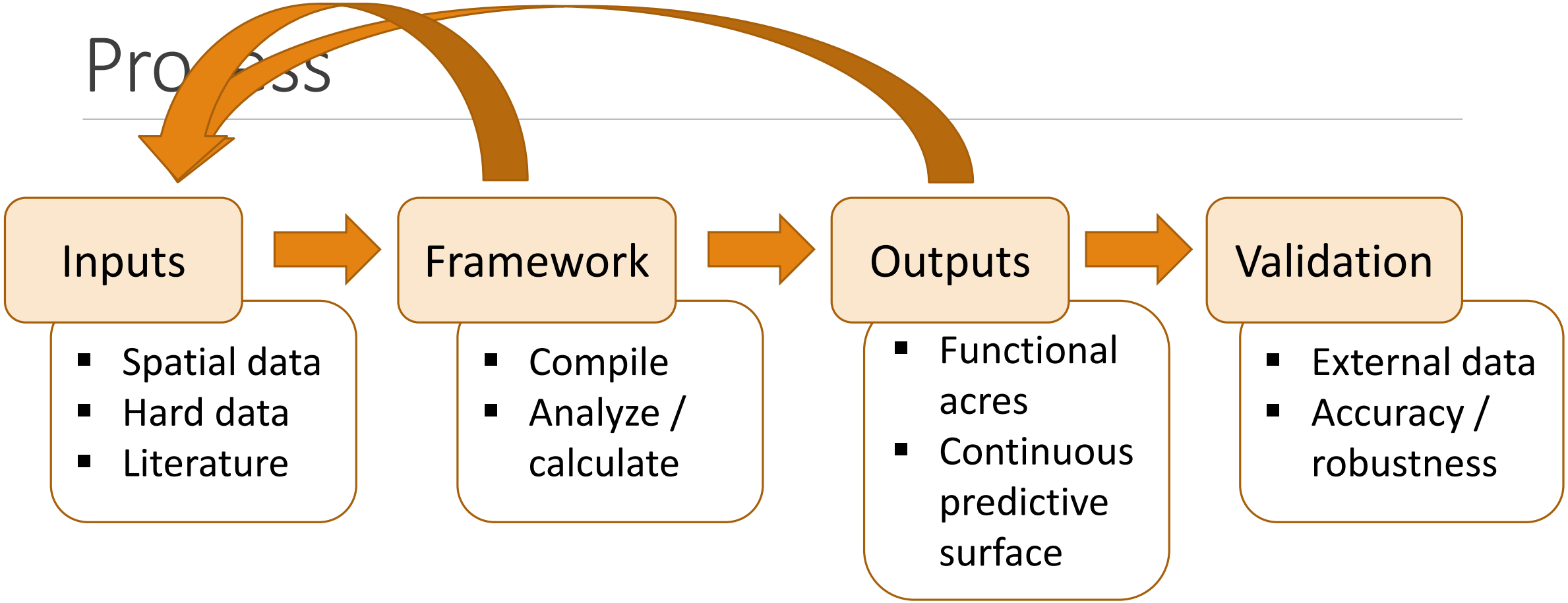
What is…a ‘model’?

A ‘model’ is an approximation of reality

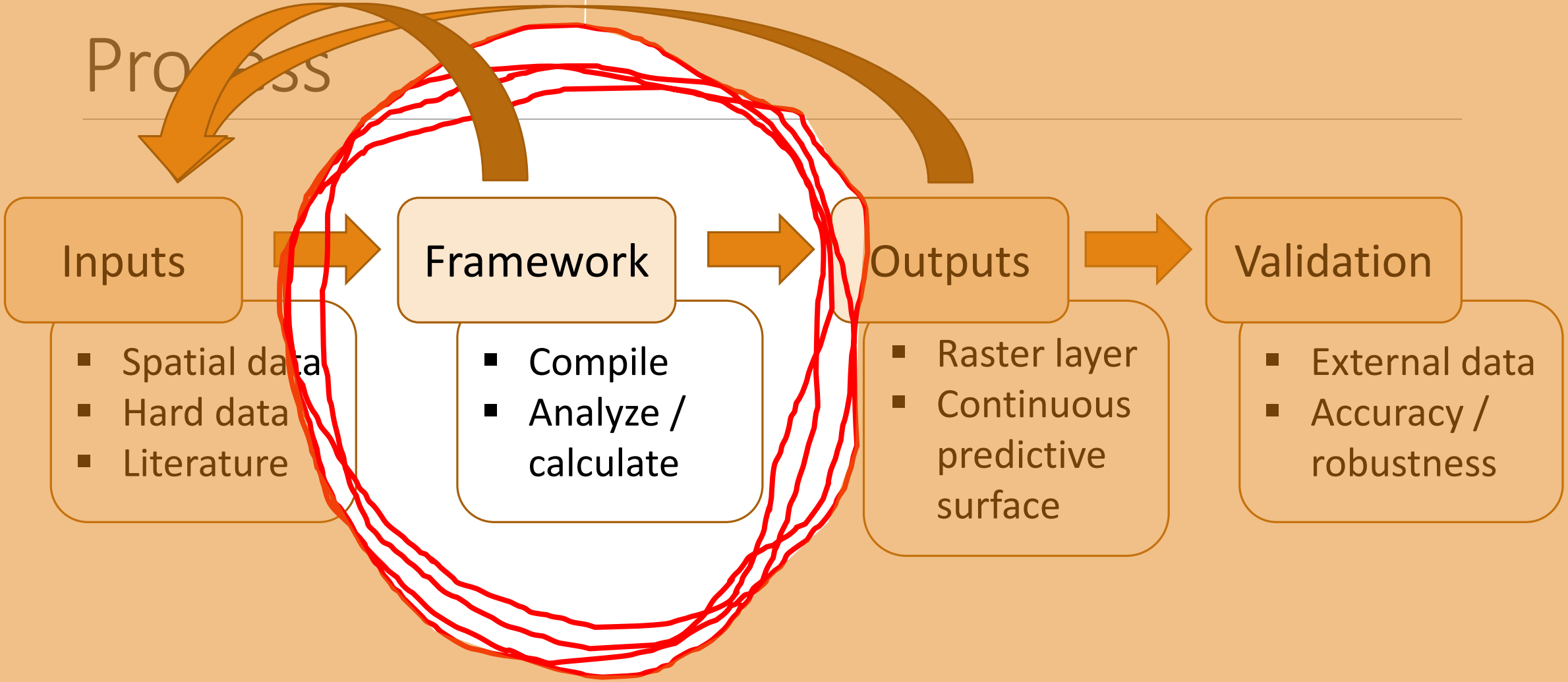
“All models are wrong, but some are useful.” –George Box 1978

We use models in everyday life

Process


Inputs
Spatial data
Hard data
Literature
Framework
Compile
Analyze / calculate
Outputs
Functional acres
Continuous predictive surface
Validation
External data
Accuracy / robustness

Process


Inputs
Spatial data
Hard data
Literature
Framework
Compile
Analyze / calculate
Outputs
Raster layer
Continuous predictive surface
Validation
External data
Accuracy / robustness

1. Two types of initial input

	Expert opinion	Data
Pros	- Quick, easy	- Robust, reliable
Cons	- Often inaccurate	- Limited to existing data or may be expensive to obtain

2. Framework for analysis and calculation

$fx = functionality$

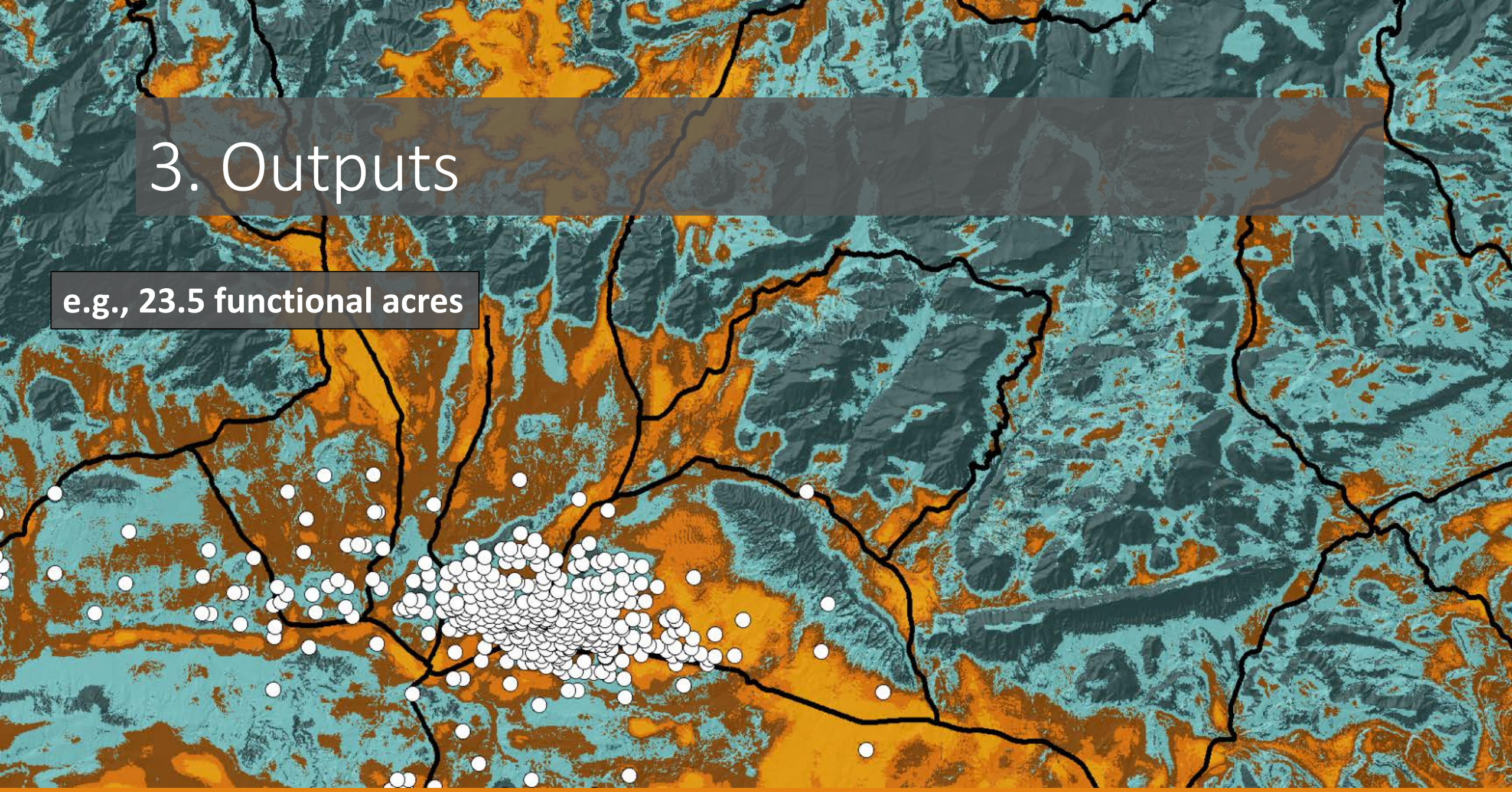
$$a * b = fx$$

$a = slope$

$b = \%\ mesquite$

Slope (%)	0-5	5-10	>10
Functionality	1.0	0.5	0.0

3. Outputs



4. Validation

Not always done, but basic requirement

Just needs independent data, may already have on hand

Examples

A few current examples:

1. NV greater sage-grouse
   - 1.1 NV sage-grouse habitat exchange
   - 1.2 Barrick Gold
2. Habitat Equivalency Analysis

Examples

1.1 NV Greater Sage-grouse Habitat Exchange

- Calculate ‘credits’ and ‘debits’ from development/conservation actions
- Functionality of a plot for breeding, late brood-rearing, and winter habitat
- Combo of field and remote-sensed data

% Cover of Invasive Annual Grass	<5%	5-10%	10-15%	15-20%	20-25%	25-30%	>30%
Percent functional	100%	80%	60%	45%	25%	15%	0%

(Nevada Conservation Credit System: Greater Sage-grouse Habitat Quantification Tool Scientific Methods Document [2014])

Examples

1.2 Barrick Gold Mine – greater sage-grouse

- Different calculation framework
- Also uses currency of credits and debits
- Ties habitat function to demographic performance

[#] Ecological Departure (ED) = 100% $- \sum_{i=1}^{R} \min\{Observed\,\%_i, NRV\%_i\}$

[@] Unified Ecological Departure (UED) = $Min(100, Max[0, ED - \sum_{i=R+1}^{U_{No-Thresh}} \min\{HRF_i \times Observed\,\%_i, 0\} - \sum_{j=U_{No-Thresh}+1}^{N} \min\{Threshold\%_j, Observed\,\%_j\}])$

(Barrick Nevada Sage-grouse Bank Enabling Agreement [2015])

Examples

2. Habitat Equivalency Analysis

- Developed for mitigating natural resource damage
- Calculates ‘like for like’ in terms of ecosystem function
- Includes discounting for present vs. future conditions

$$S'\left(\frac{1}{\alpha}-1\right)=S_M \text{ or } S'=\frac{S_M}{r} \qquad (9)$$

Thus, for time-independent values of V_j and V_p, the contribution due to perpetuity can be exactly determined. This is the form used in the current version of

(Visual_HEA: Habitat Equivalency Analysis software to calculate compensatory restoration following natural resource injury [2006])

Examples

Commonalities in these (and other) examples:

- Quantify function, not simple area
- Explicit assumptions, relationships, outcomes
- Transparent, quantitative, objective
- Defensible

- **Scientific approach to conservation**

Questions

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