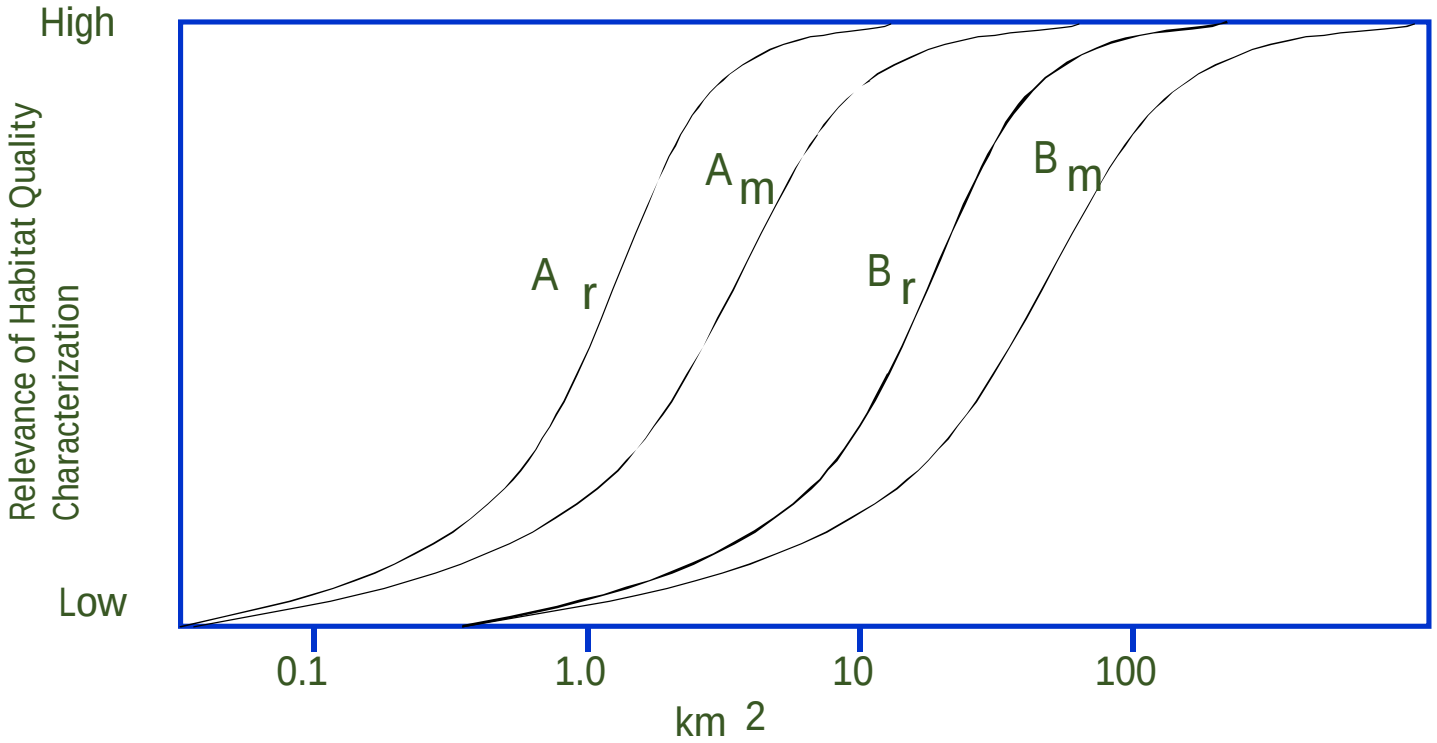
Supplemental Slides

Landscape Perspective

Choices for EcoRA focus

spatial scale	temporal scale	pathways	consequences
site reach watershed region global	acute episodic chronic generational	biotic abiotic combined	organism (statistical population) population (biological) species ecological system



A= species with small home range; resident (r), migrant (m)

B= species with large home range; resident (r), migrant (m)

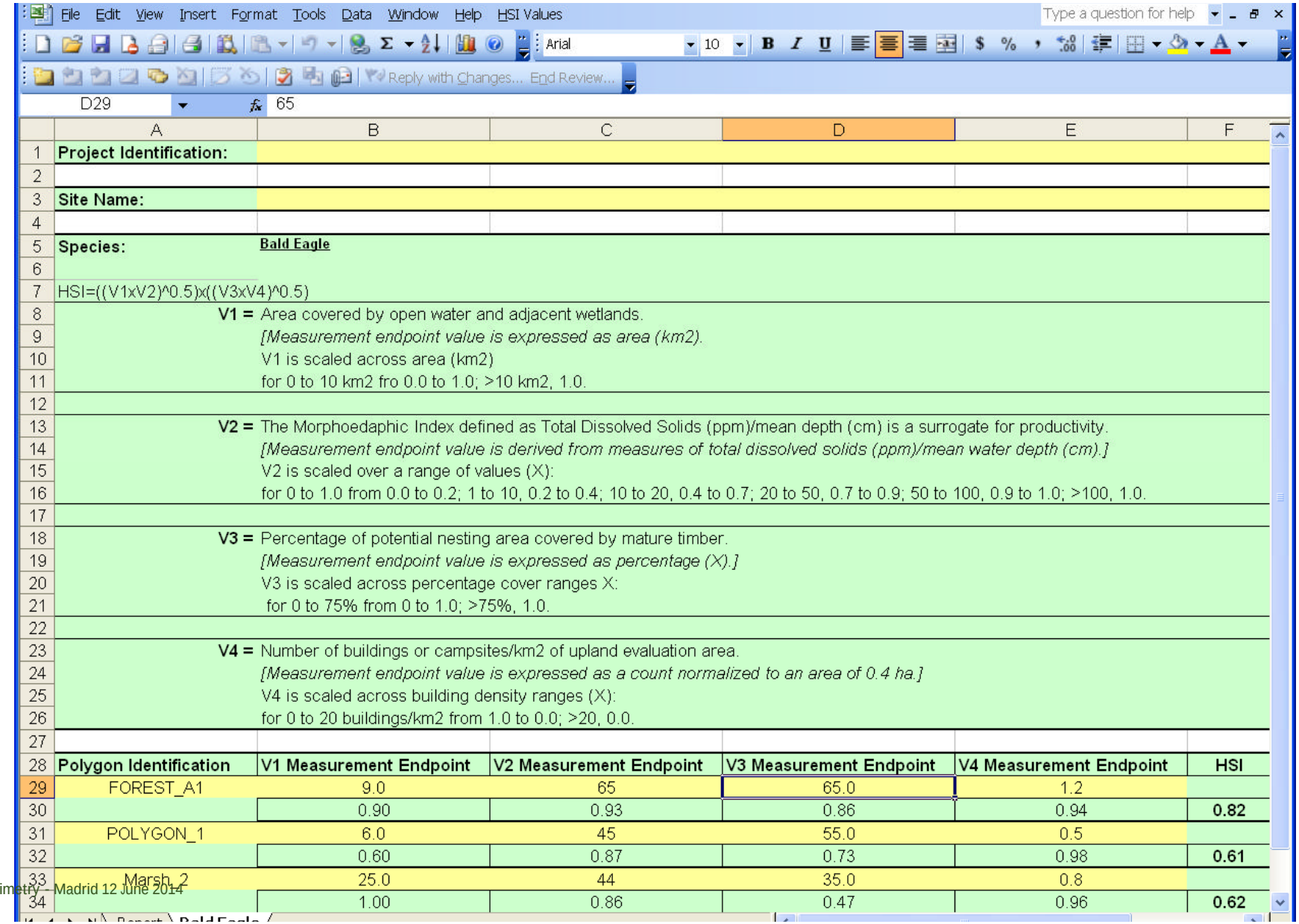
Current Risk Paradigm

- Developed to address chemicals in the environment
  - Forensic Ecology
  - Future Scenarios
- Expanding to biological and physical agents
  - Exotic species
  - Genetically Modified Organisms
  - Physical Alterations (yellow metal, flood, avalanche, …)

Habitat Suitability Indices

General Process (Typically)

- reflect best professional judgment of a panel of experts
- developed by fitting population density data to landscape components
- explanatory, correlative, or surrogate variables identified
- models constructed using simple algebraic and graphic expressions



File Edit View Insert Format Tools Data Window Help HSI Values

Type a question for help

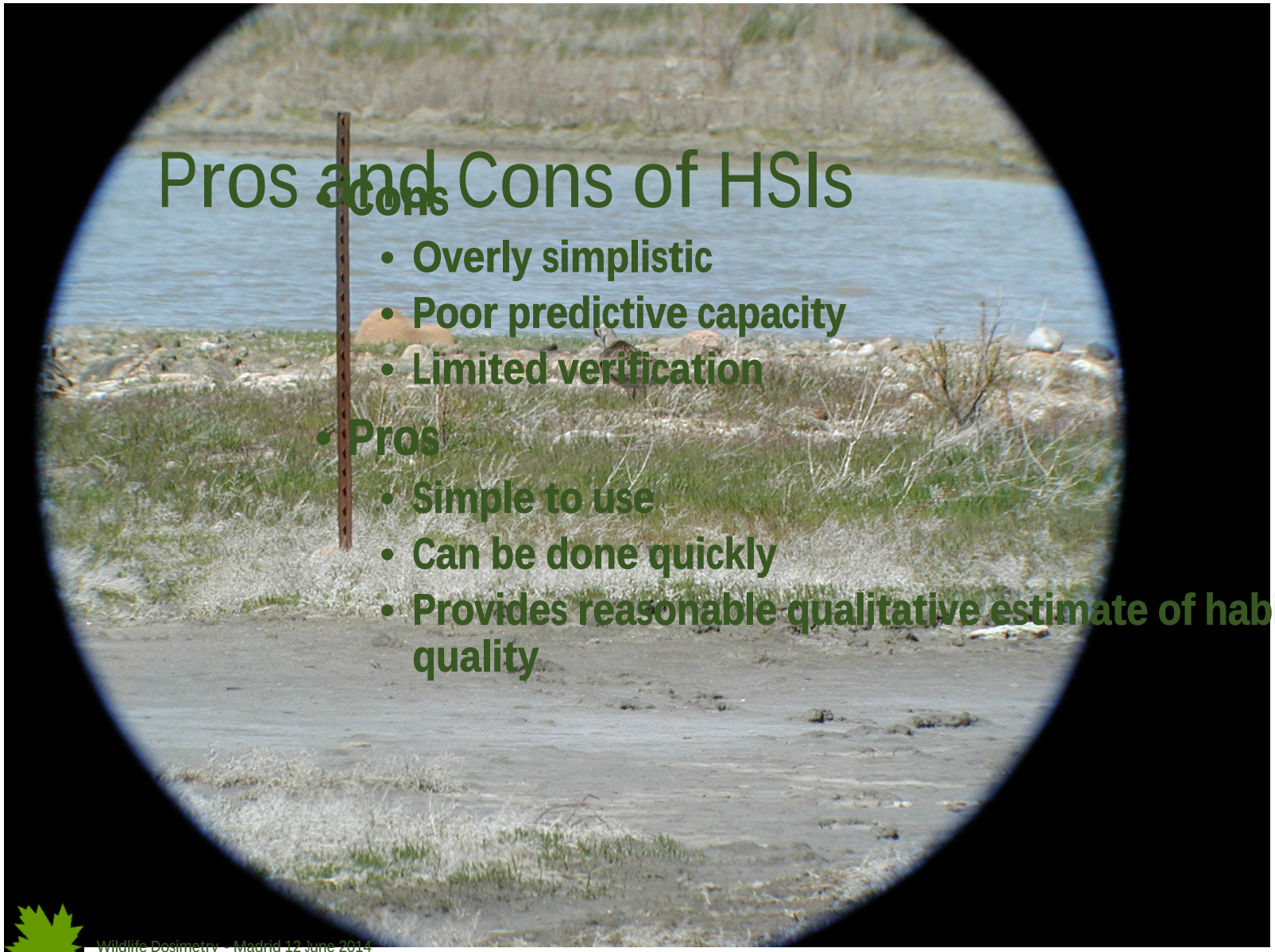
Arial 10

Reply with Changes... End Review...

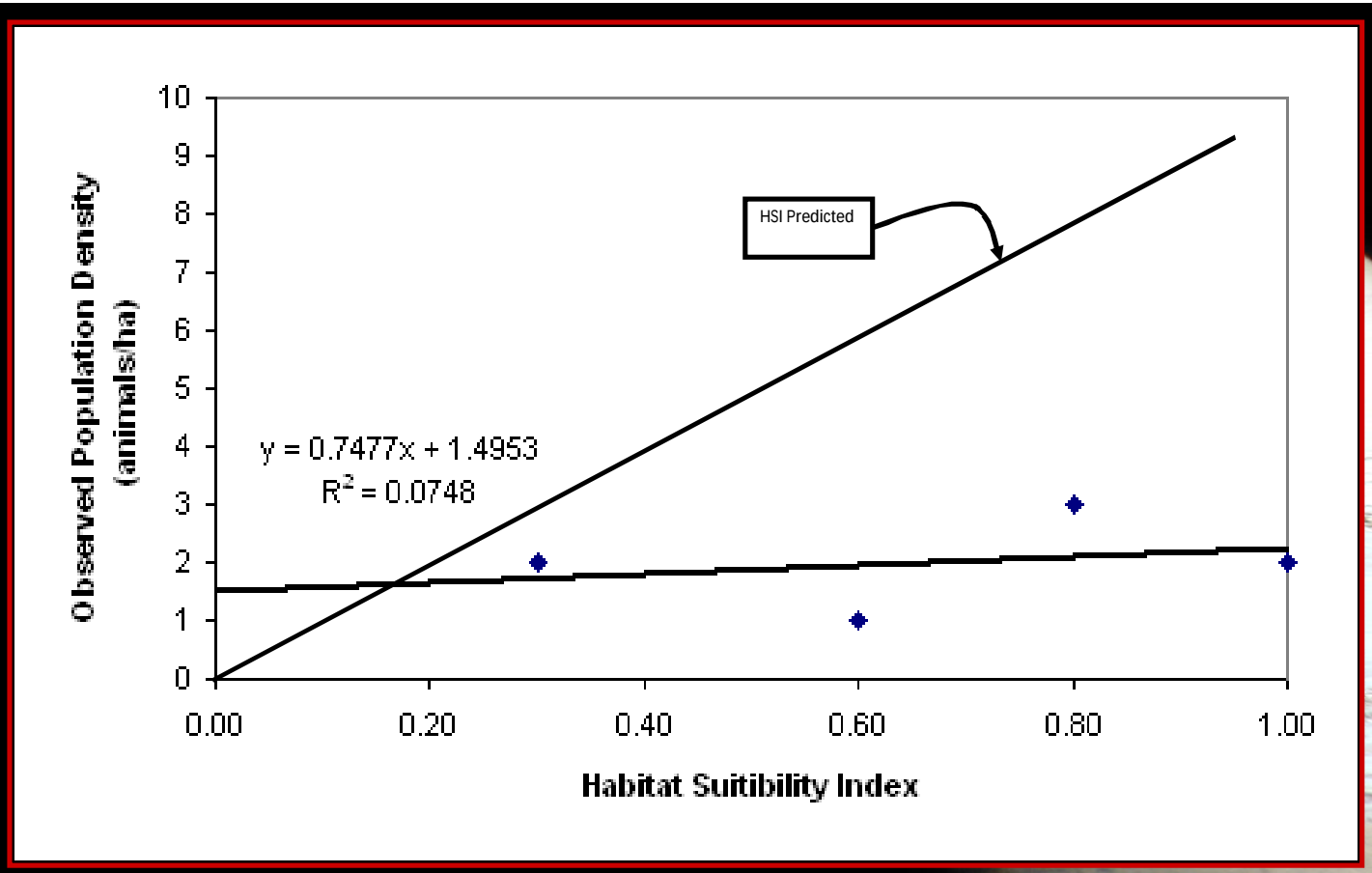
D29 65

	A	B	C	D	E	F
1	**Project Identification:**					
2						
3	**Site Name:**					
4						
5	**Species:**	**Bald Eagle**				
6						
7	HSI=((V1xV2)^0.5)x((V3xV4)^0.5)					
8	**V1 =**	Area covered by open water and adjacent wetlands.				
9		*[Measurement endpoint value is expressed as area (km2).*				
10		V1 is scaled across area (km2)				
11		for 0 to 10 km2 fro 0.0 to 1.0; >10 km2, 1.0.				
12						
13	**V2 =**	The Morphoedaphic Index defined as Total Dissolved Solids (ppm)/mean depth (cm) is a surrogate for productivity.				
14		*[Measurement endpoint value is derived from measures of total dissolved solids (ppm)/mean water depth (cm).]*				
15		V2 is scaled over a range of values (X):				
16		for 0 to 1.0 from 0.0 to 0.2; 1 to 10, 0.2 to 0.4; 10 to 20, 0.4 to 0.7; 20 to 50, 0.7 to 0.9; 50 to 100, 0.9 to 1.0; >100, 1.0.				
17						
18	**V3 =**	Percentage of potential nesting area covered by mature timber.				
19		*[Measurement endpoint value is expressed as percentage (X).]*				
20		V3 is scaled across percentage cover ranges X:				
21		for 0 to 75% from 0 to 1.0; >75%, 1.0.				
22						
23	**V4 =**	Number of buildings or campsites/km2 of upland evaluation area.				
24		*[Measurement endpoint value is expressed as a count normalized to an area of 0.4 ha.]*				
25		V4 is scaled across building density ranges (X):				
26		for 0 to 20 buildings/km2 from 1.0 to 0.0; >20, 0.0.				
27						
28	**Polygon Identification**	**V1 Measurement Endpoint**	**V2 Measurement Endpoint**	**V3 Measurement Endpoint**	**V4 Measurement Endpoint**	**HSI**
29	FOREST_A1	9.0	65	65.0	1.2	
30		0.90	0.93	0.86	0.94	**0.82**
31	POLYGON_1	6.0	45	55.0	0.5	
32		0.60	0.87	0.73	0.98	**0.61**
33	Marsh_2	25.0	44	35.0	0.8	
34		1.00	0.86	0.47	0.96	**0.62**

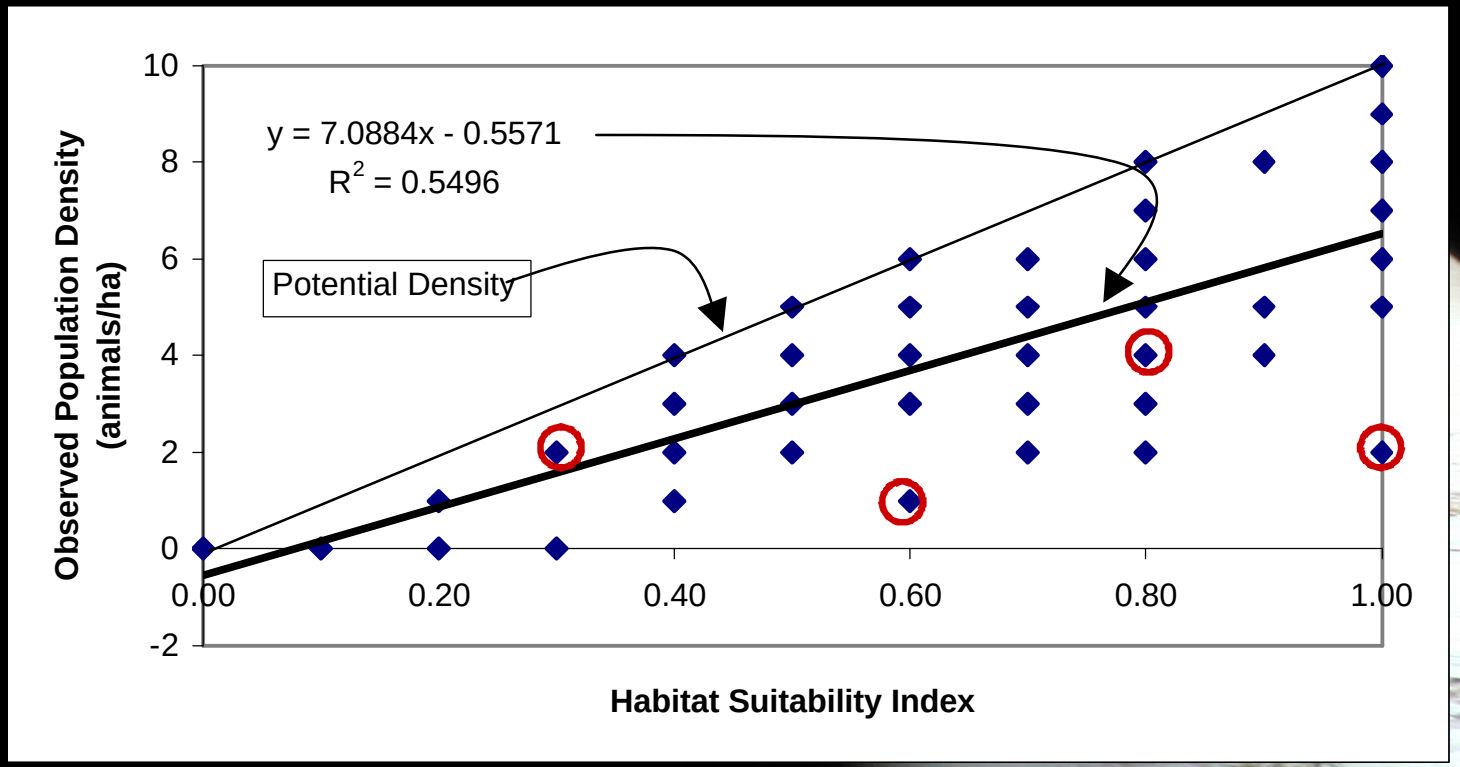
Pros and Cons of HSIs



- Cons
  - Overly simplistic
  - Poor predictive capacity
  - Limited verification
- Pros
  - Simple to use
  - Can be done quickly
  - Provides reasonable qualitative estimate of habitat quality

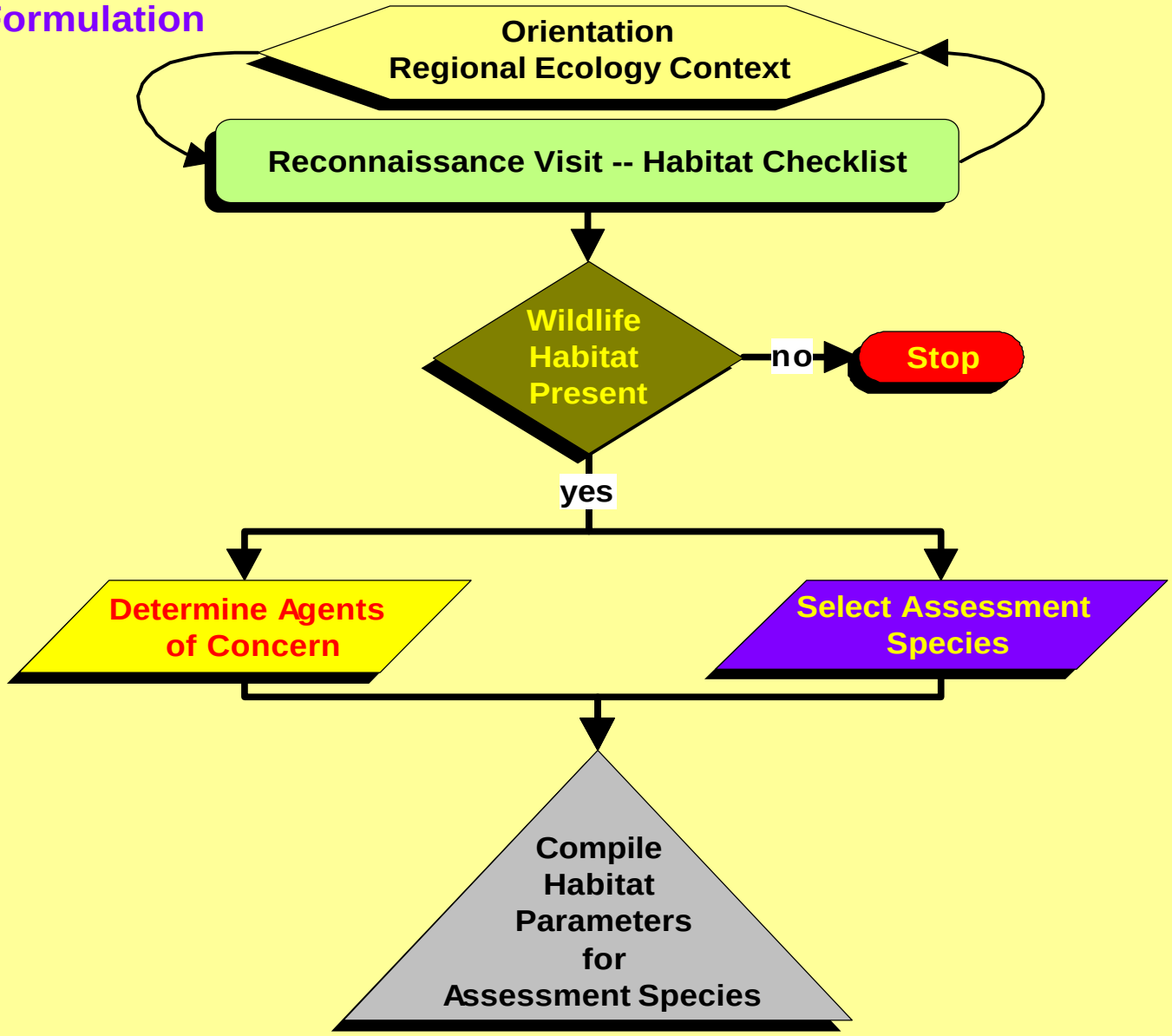


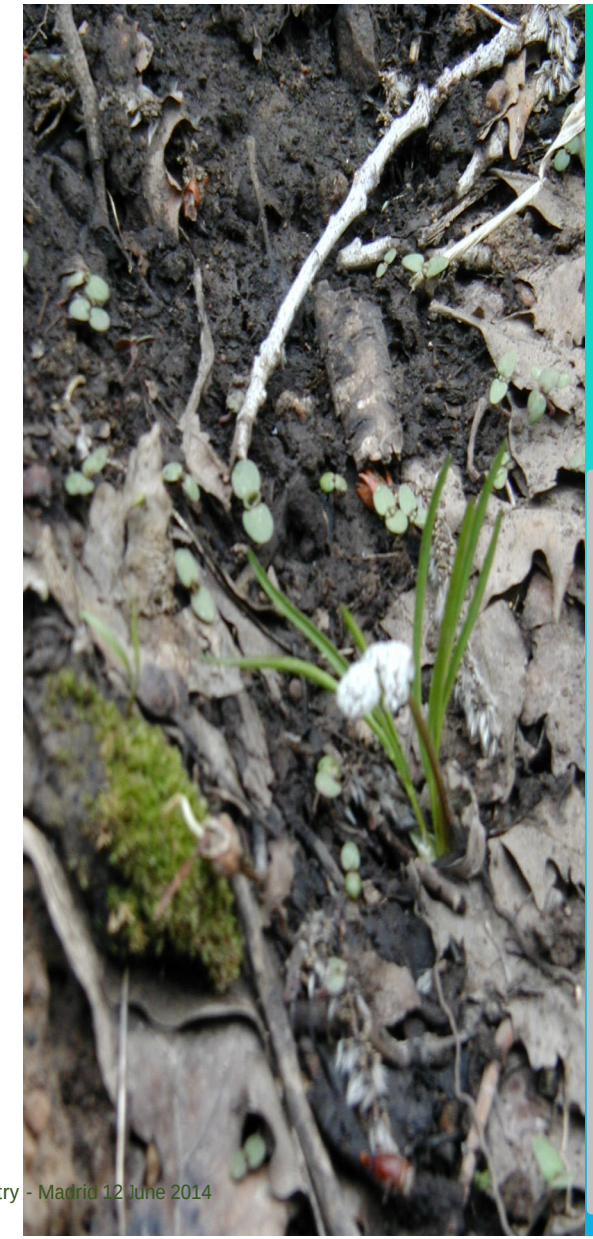
Common observance with limited field verification of HSI predictions.

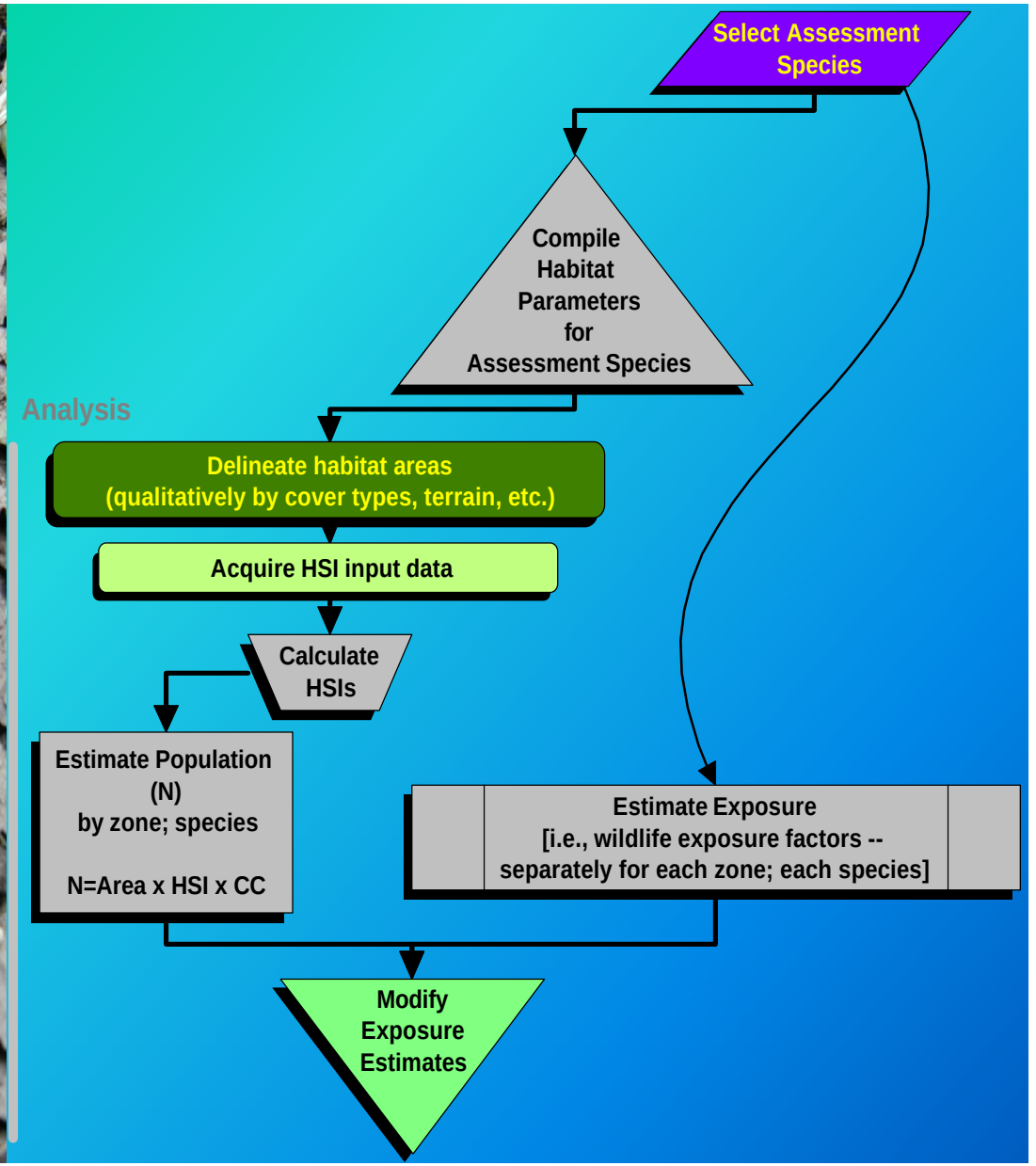


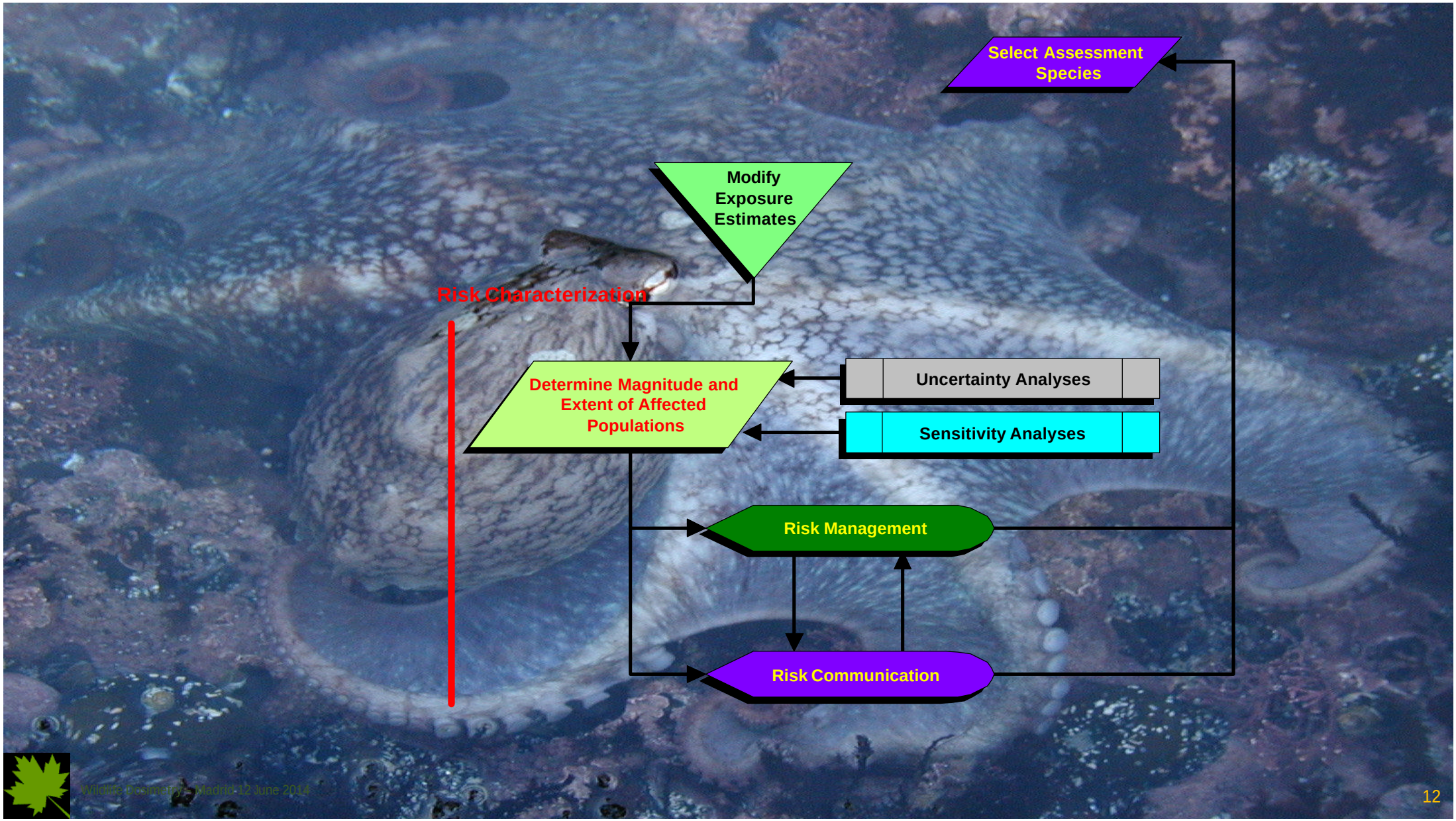
Adapted from presentation by A. Farmer, Wildlife Habitat Modeling: How far has it come and how much farther can it go? ASTM Symposium on *Landscape Ecology and Wildlife Habitat Evaluation: Critical Information for Ecological Risk Assessment, Land-Use Management Activities, and Biodiversity Enhancement Practices*, 7-9 April 2003, Kansas City, MO. (Kapustka 2004)

Problem Formulation






Select Assessment Species
Compile Habitat Parameters for Assessment Species
Analysis
Delineate habitat areas (qualitatively by cover types, terrain, etc.)
Acquire HSI input data
Calculate HSIs
Estimate Population (N) by zone; species
N=Area x HSI x CC
Estimate Exposure [i.e., wildlife exposure factors -- separately for each zone; each species]
Modify Exposure Estimates


Select Assessment Species
Modify Exposure Estimates
Risk Characterization
Determine Magnitude and Extent of Affected Populations
Uncertainty Analyses
Sensitivity Analyses
Risk Management
Risk Communication

Equation 1. For use with home range data

$$N_s = \frac{A_s}{HR_s}$$

Equation 2. For use with density data.

$$N_s = A_s \times CC_s$$

Where:

N_s = the number of individuals likely to inhabit the subdivision

A_s = the area of the subdivision

HR_s = the approximate home range size of the animals within the subdivision

CC_s = the approximate carrying capacity of the subdivision where carrying capacity is an expected density estimate

From: ASTM E2385 Standard Guide for Estimating Wildlife Exposure using Measures of Habitat Quality

Equation 3. Time allocation as a function of habitat quality

$$P_s = \frac{A_s / HR_s}{\sum_{s=1}^{n} \left(A_s / HR_s \right)}$$

Where:

P_s = Proportion of time spent foraging in sub-area *s*

A_s = Area of sub-area *s*

HR_s = home range size associated with habitat quality in sub-area *s*

From: ASTM E2385 Standard Guide for Estimating Wildlife Exposure using Measures of Habitat Quality

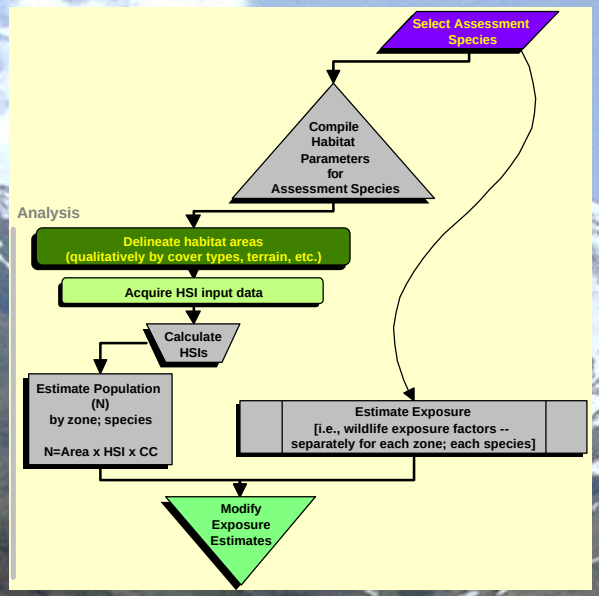
Equation 4. The basic exposure estimate used to calculate daily dose modified to incorporate Habitat Quality.

$$ADD_{pot} = \sum_{s=1}^{m} P_s \left[\sum_{j=1}^{n} (C_{js} \times FR_{js} \times NIR_j) + (D_s \times FS \times FIR_{total}) \right]$$

Where:

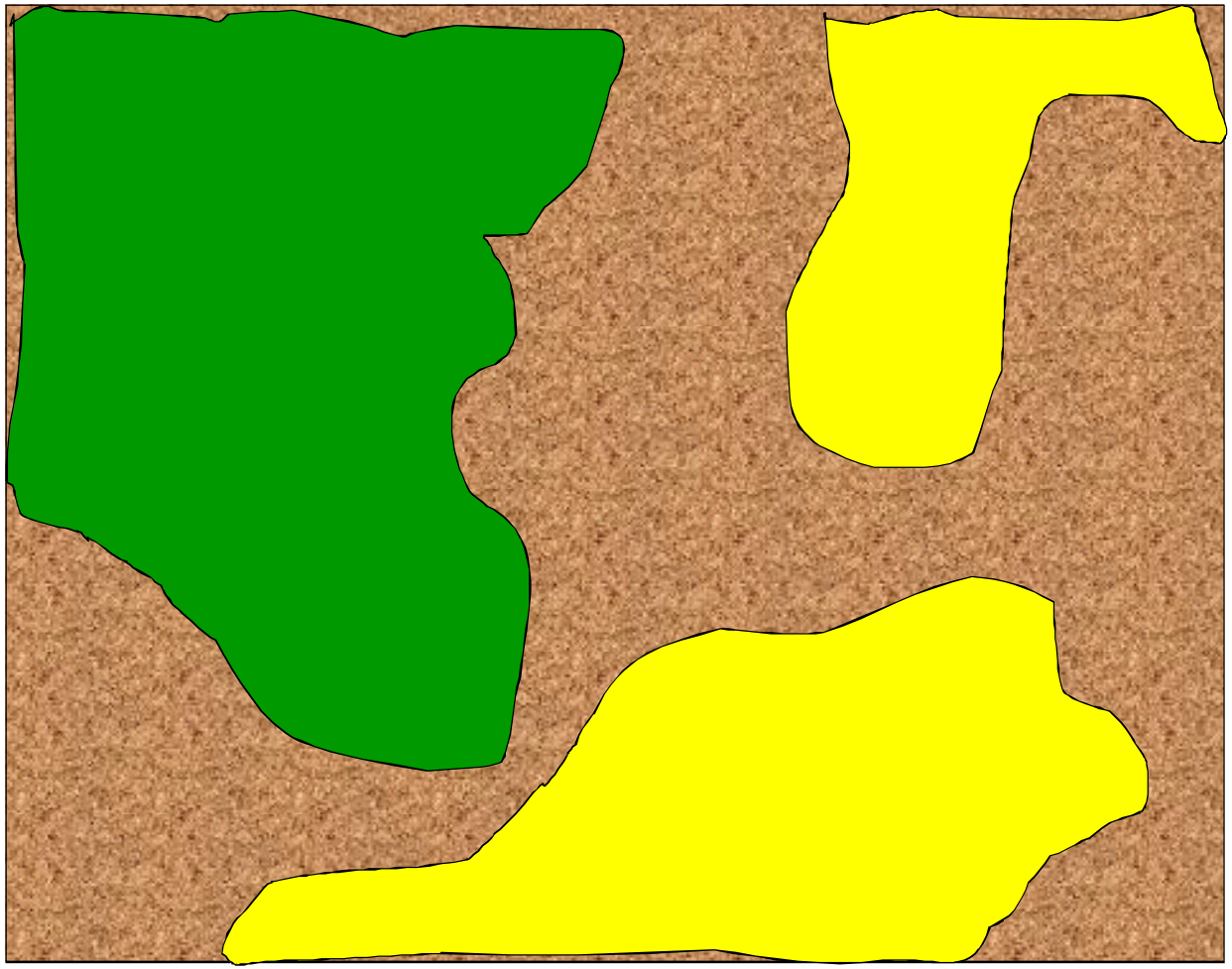
ADD_{pot}	=	Potential average daily dose
P_s	=	AUF; the proportion of time spent foraging in sub-area *s* (equation 2)
C_{js}	=	Average concentration of contaminant in food type *j* in sub-area *s*
FR_{js}	=	Fraction of food type *j* contaminated in sub-area *s*
NIR_j	=	Normalized ingestion rate of food type *j*
Ds	=	Average contaminant concentration in soils in sub-area *s*
NIR_{total}	=	Normalized ingestion rate summed over all foods
FS	=	Fraction of soil in diet

From: ASTM E2385 Standard Guide for Estimating Wildlife Exposure using Measures of Habitat Quality

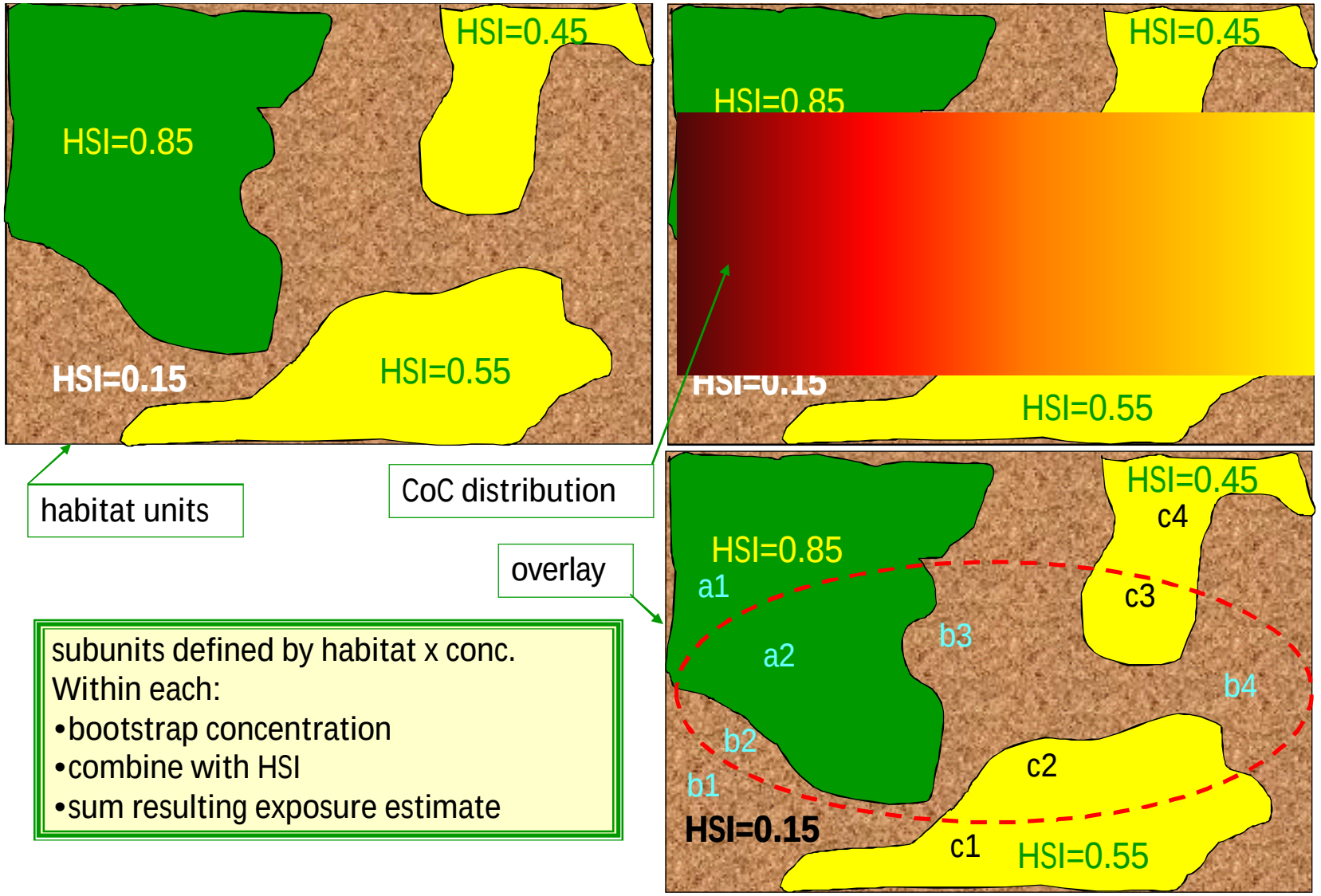


Risk Trace

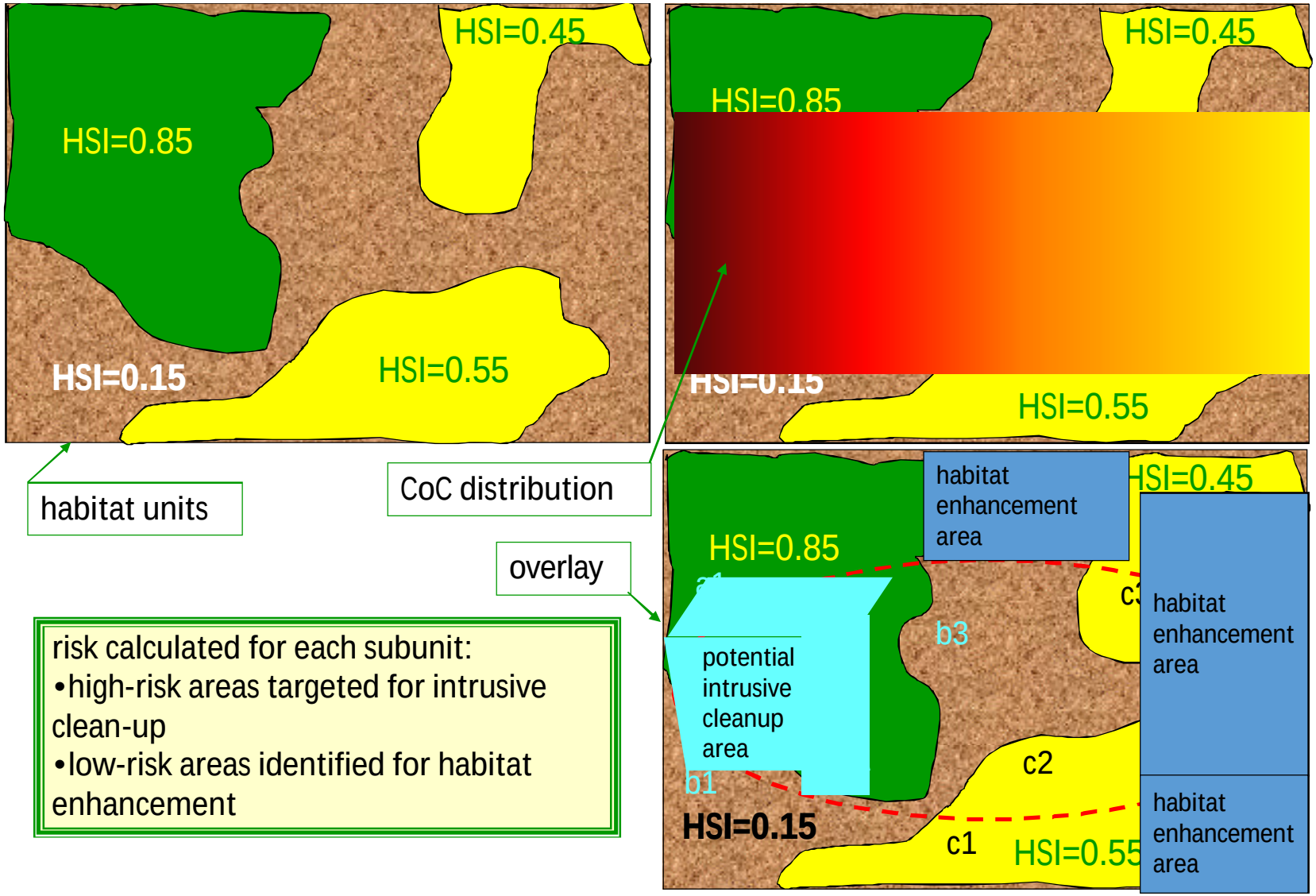
- *Probabilistic receptor migration model*.
  - Generates receptor movement influenced by habitat quality.
- *Spatially explicit exposure assessment model*.
  - Calculates internal exposure resulting from ingestion of contaminated food, as well as any other applicable routes of exposure (*e.g.*, soil).
- *Screening-level risk assessment model.*
  - Calculates Hazard Quotients (HQs) for each contaminant; these are equal to the site contaminant concentration divided by the selected safe benchmark concentration for ecological receptors (toxicity reference values, TRVs).



habitat units defined on recognizable polygons of vegetation cover and physiognomy



subunits defined by habitat x conc.
Within each:
- bootstrap concentration
- combine with HSI
- sum resulting exposure estimate



risk calculated for each subunit:
- high-risk areas targeted for intrusive clean-up
- low-risk areas identified for habitat enhancement