PREDICTING SPECIES

Where have we been?
Where are we going?

Leona K. Svancara

Landscape Dynamics Lab

Idaho Coop. Fish and Wildlife Research Unit

University of Idaho

USGS science for a changing world

Charles Peterson

Doug Backlin

Models are a simplification of a complex biological world.

The “best” modeling approach depends on the circumstances.

What is Scale?

Grain: the smallest resolution unit of study

Extent: the area over which observations are made

Challenges to Modeling

- Mismatches between scale of hypotheses and scale of ecological processes.
- Lack of understanding of ecological processes and patterns.
- Use of inappropriate statistics.

Challenges to Modeling

- Habitats change over space and time
- Not all suitable habitats are occupied
- Very common or very rare species
- Range edges are difficult to discern
- Habitat associations may vary with sex or age of an individual.

Historical Roots

- Natural History Phase
  1850's-1950's
- Qualitative – Quantitative Transition
  1950's-1960's
- Quantitative Ecology Era
  1950's-Present

Techniques

- Expert opinion
- Correlation
- Gradient analysis
- Reciprocal averaging
- Multidimensional scaling
- Linear & nonlinear regression
- Artificial neural networks
- Fuzzy set theory

Where are we going?

- Increased complexity
- Greater reliance on GIS and remotely sensed data
- Improved technology
- Stronger links between researchers and managers

Current Challenges

- Glut of information
- Full acknowledgement of previous work
- Lack of basic life history information on many species

"19th century biology"

What are we trying to predict?

Presence / Absence

Abundance

Demographic Rates

Sensitivity to Habitat Change

Points to Ponder

- Correlation is not causation

- What is the shape of species response to a habitat variable?
  - ✓ Binary?
  - ✓ Linear?
  - ✓ Curvilinear?

The response of an organism will vary with scale.

Wiens 1989

So, the scale of the question must match the scale of the organism.

"Models of one sort or another have become our primary means of assessing habitat relationships and generating predictions of the consequences of habitat change."

Wiens, J.A. 2002

Predicting Species Occurrences: Issues of Accuracy and Scale

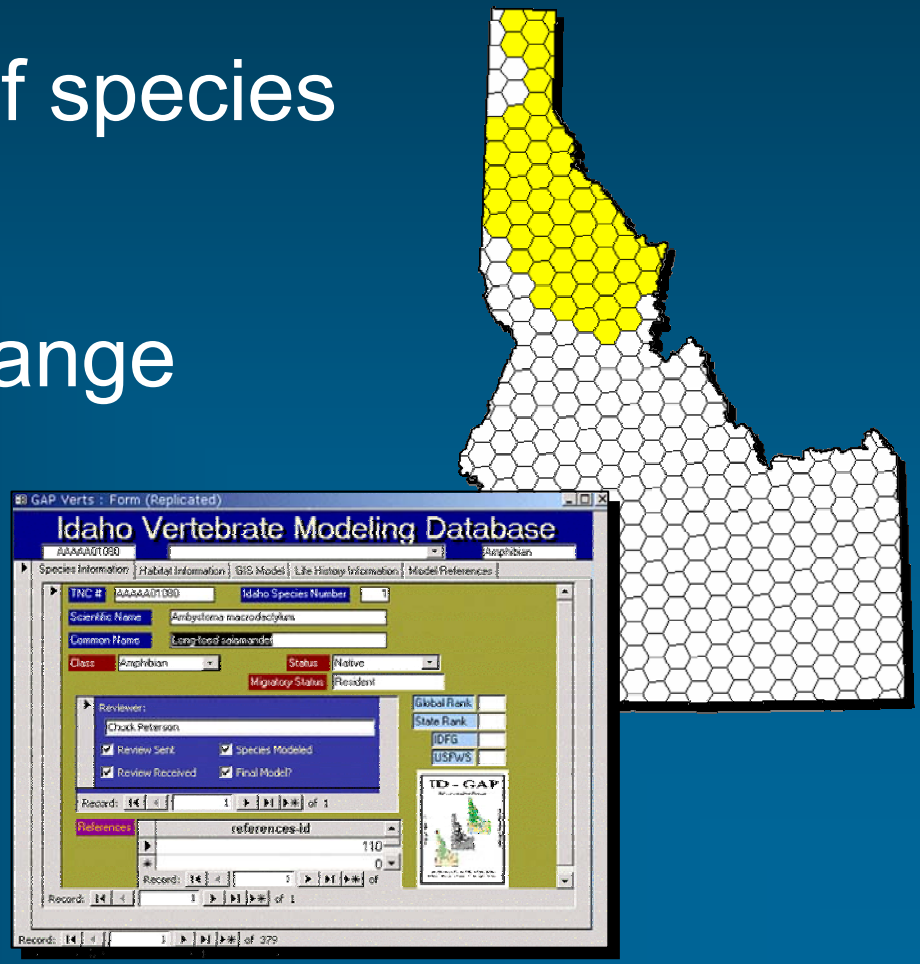
Creating a Wildlife Habitat Relationship Model

The Coeur d'Alene Salamander

Idaho Gap Analysis Project 2001

Step 1:
Gather Information

- Create a database of species habitat associations
- define the species' range
- use expert review



Idaho Gap Analysis Project 2001

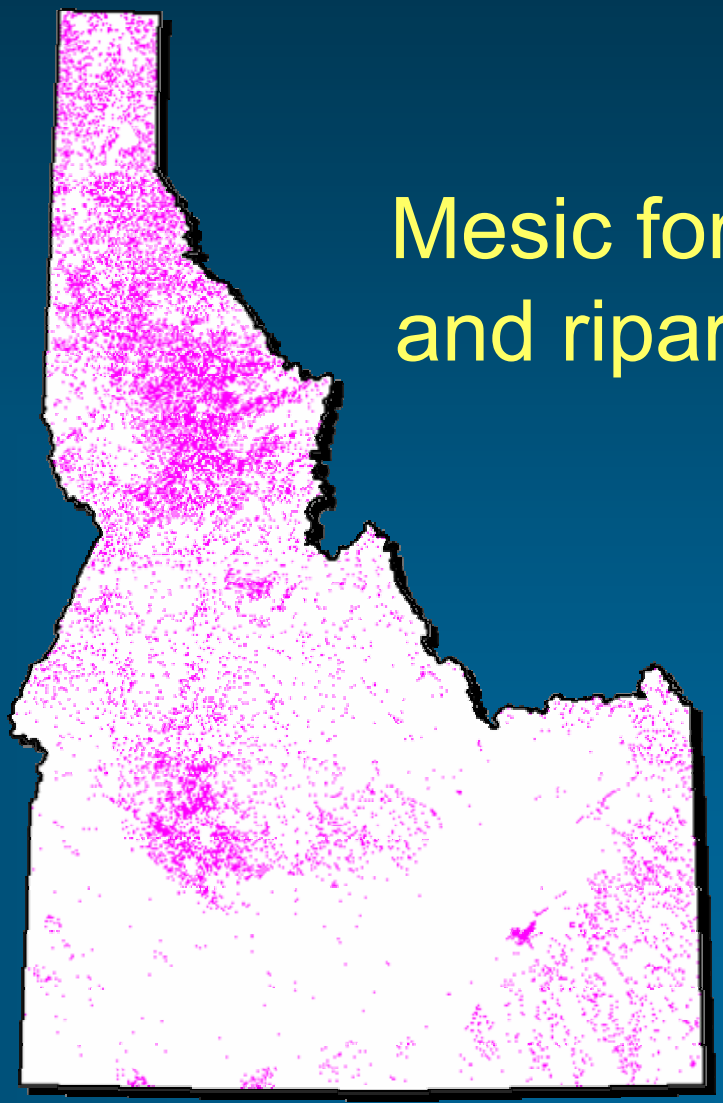
Generality vs Specificity

Conduct a broad inventory to establish links between habitat conditions or distribution and species occurrences.

Scott et al 1993 Wildlife Monograph 123

Step 2:
Select Important Vegetation

Idaho Vegetation



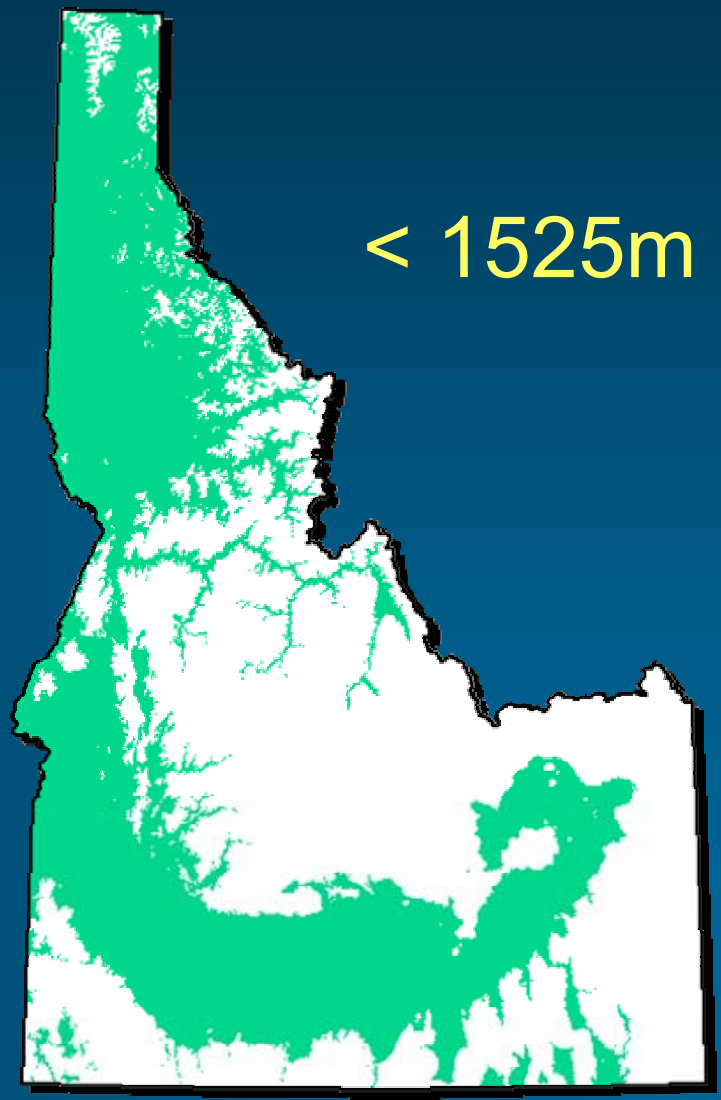
Mesic forest and riparian

Idaho Gap Analysis Project 2001

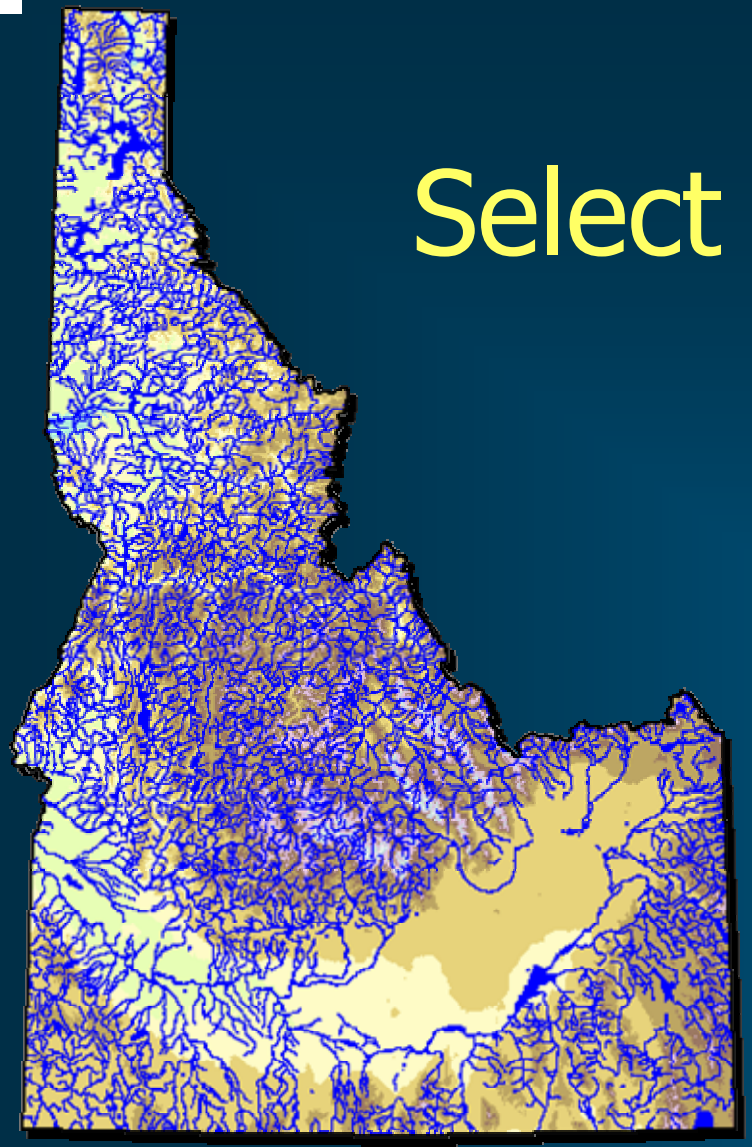
Step 3:
Select Important Elevations

Idaho Elevation

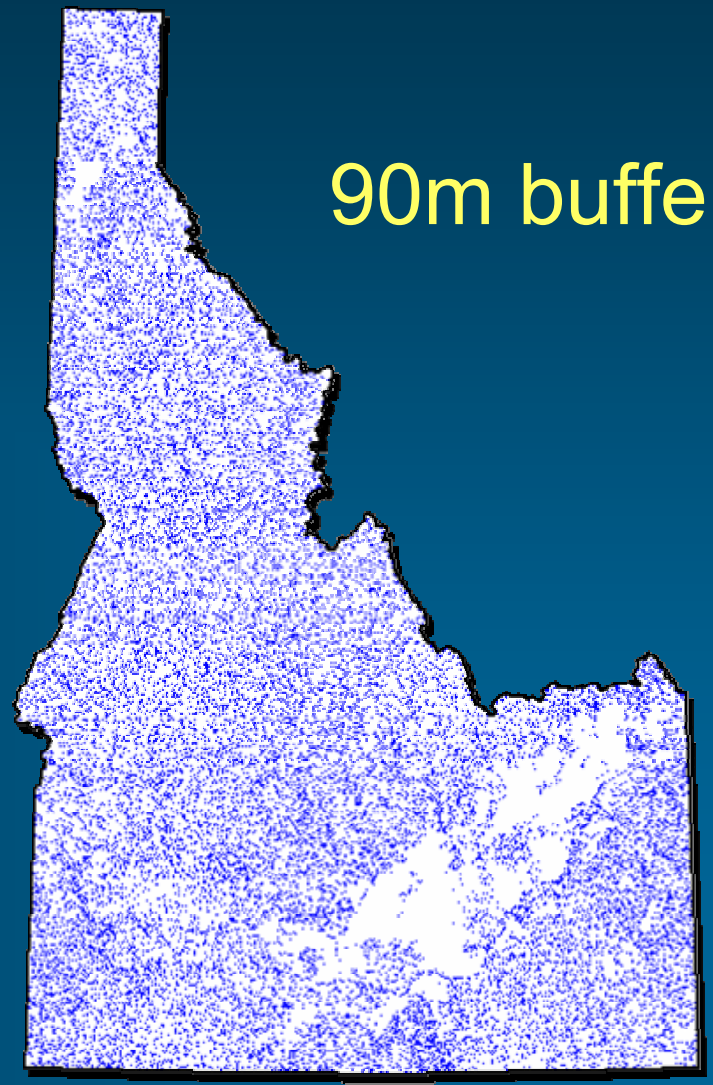
< 1525m



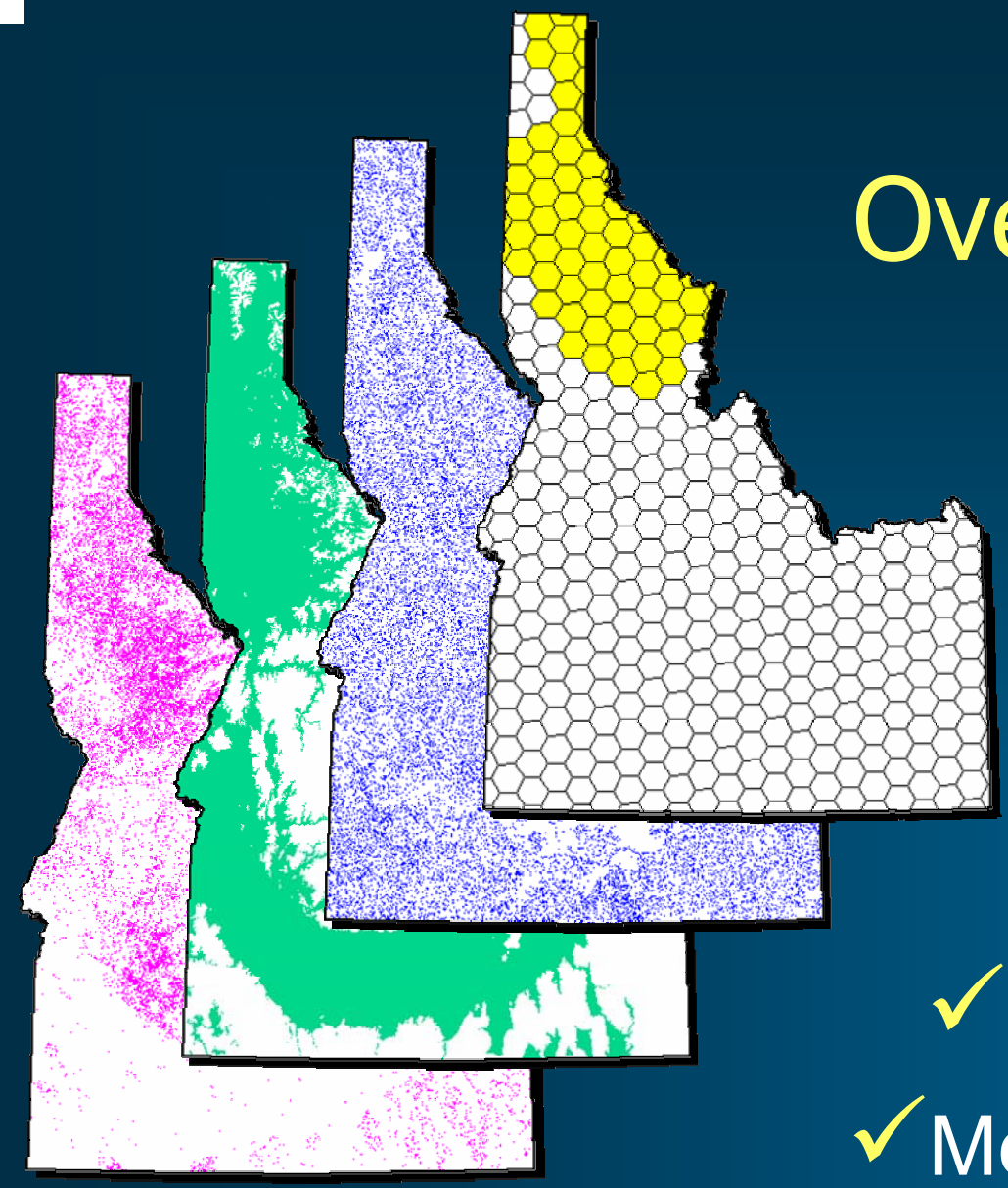
Step 4:
Select Stream Buffers



Idaho Rivers



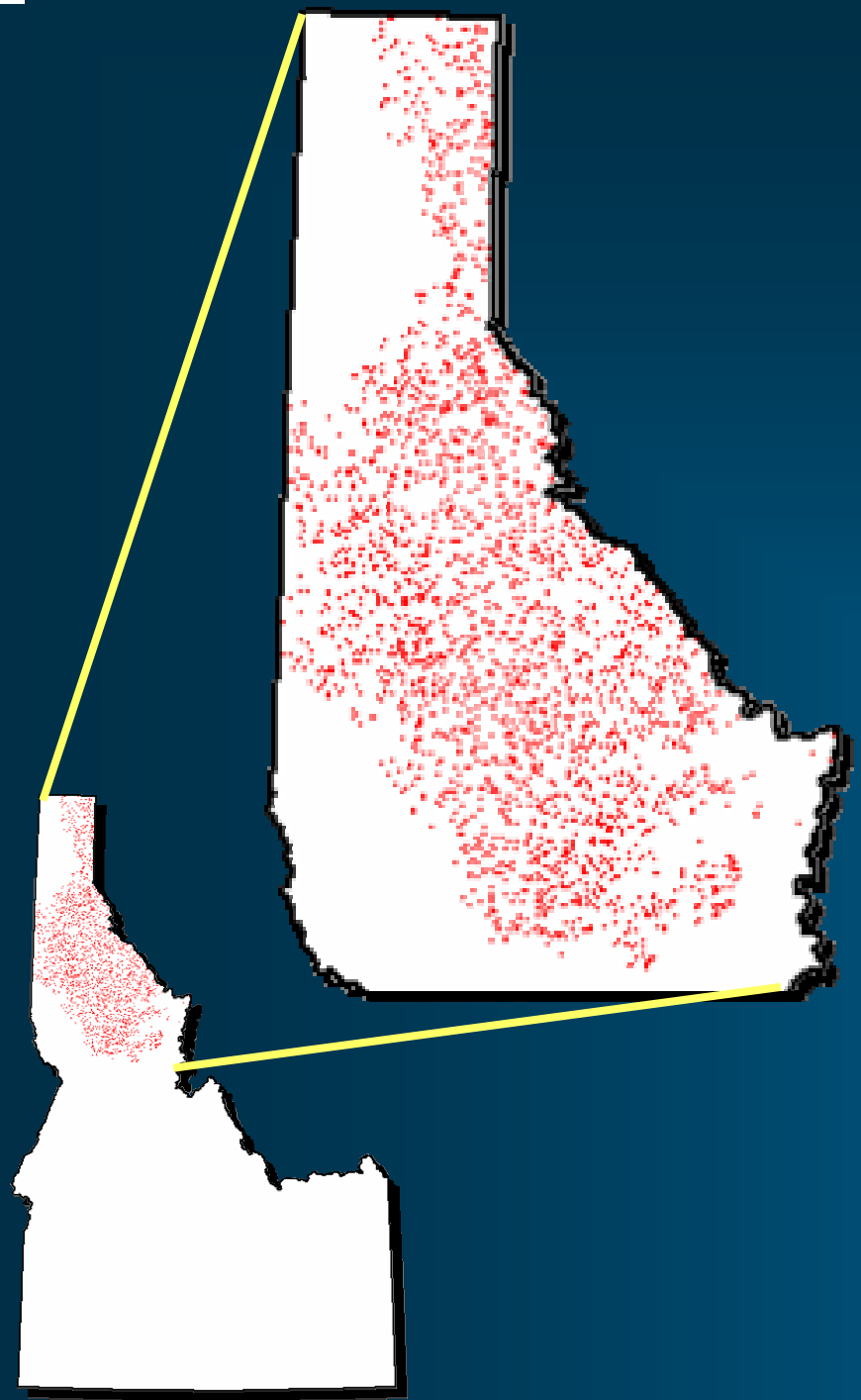
90m buffers



Step 5: Overlay & Analyze

Predicted to occur in…

- ✓ Northern Idaho
- ✓ < 90m from water
- ✓ < 1525m elevation
- ✓ Mesic forest and riparian



Coeur d'Alene Salamander Final WHR Model

Idaho Gap Analysis Project 2001

Always!

- State assumptions and simplifications necessary.
- Consider the models as testable hypotheses.

Applications

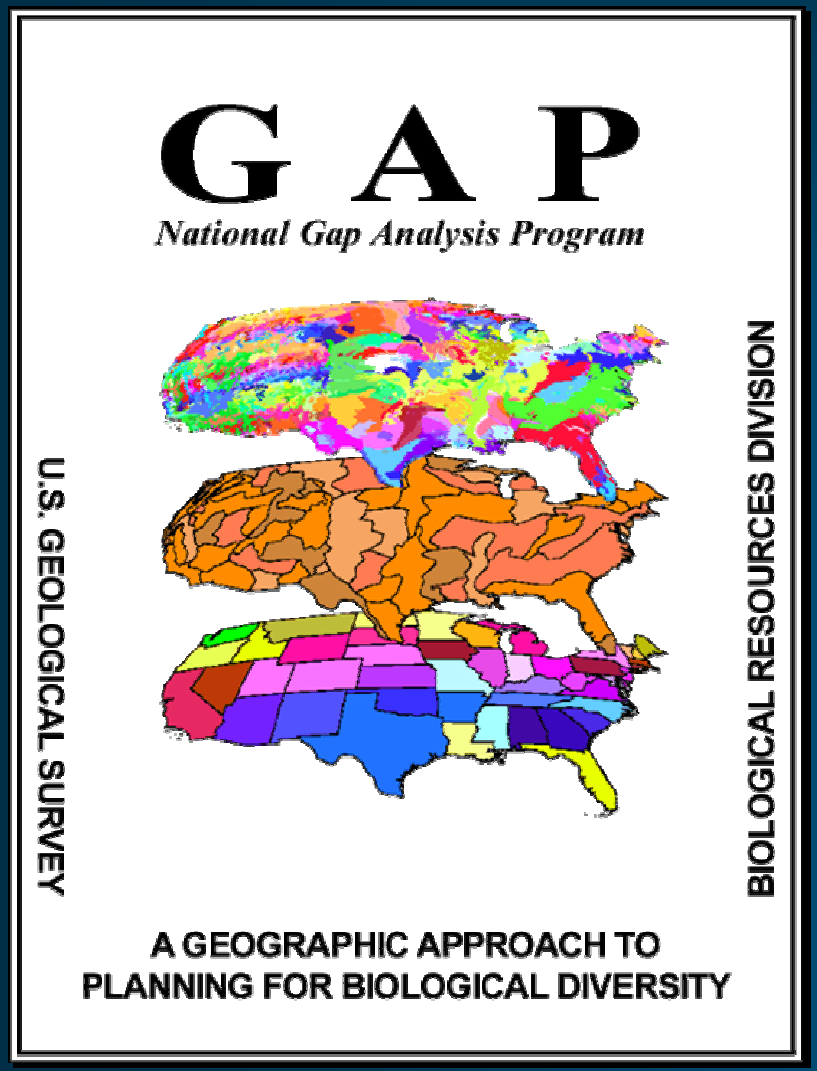
- Predicting future conditions
- Predicting impact of alternative management actions
- Identify likely occupied areas for poorly studied species

- Assess status of species relative to historical distribution

Applications

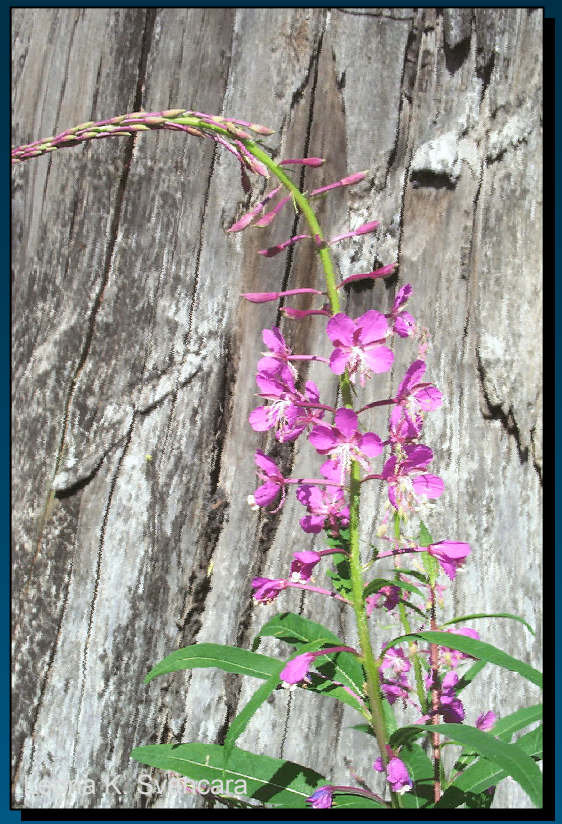
- Identify best areas for reintroducing extirpated species
- Justify protecting areas that are suitable for, but currently unoccupied
- Identify areas of possible conservation concern

Gap Analysis



A process to keep
common
species
common
by plugging the gaps in
our network of lands
managed for
biodiversity.

What is a "Gap"?



The lack of representation of an element of biodiversity in an area intended for its long term maintenance.

Why GAP?

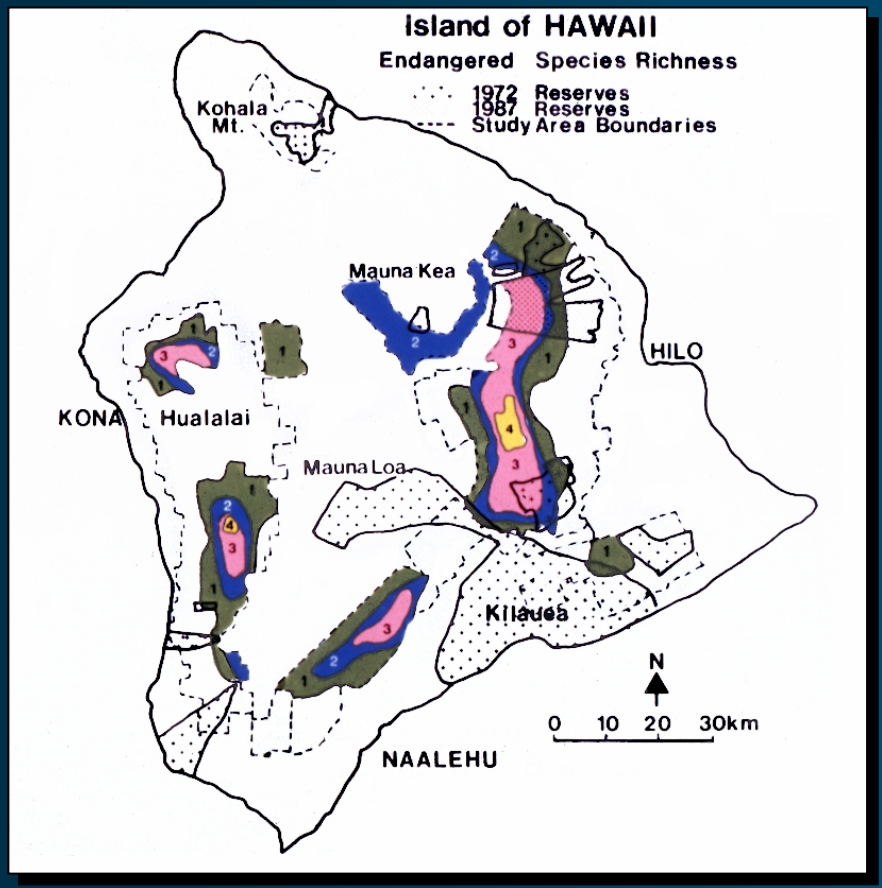
- Waiting until species are endangered to protect them will perpetuate the extinction crisis.

- Lack of information leads to poor management decisions despite the best intentions.

- Rangewide information on elements is required for proper decision-making.

Origins

Conceived in the 1980s, the roots of GAP originated with application to Hawaiian bird conservation by J. Michael Scott.



Later he and other researchers at the University of Idaho Cooperative Fish and Wildlife Research Unit initiated Idaho GAP as the first pilot under the USFWS.

Assumptions of GAP

Conceptual

- the best time to save species is while they are still common

- it is less costly to maintain natural populations rather than intensely managing endangered populations

- terrestrial elements are necessary, though imperfect, surrogates for biodiversity until other taxa are mapped

Assumptions of GAP

Technical

- maps are a display of a database
- provides contextual information vs site content
- mapped boundaries are approximations
- species distributions are testable hypotheses
- predicted presence/absence does not imply habitat quality

GAP Management Categories

Status 1:

Highest level of management intent for biodiversity

Status 2:

High level of intent but allows some use

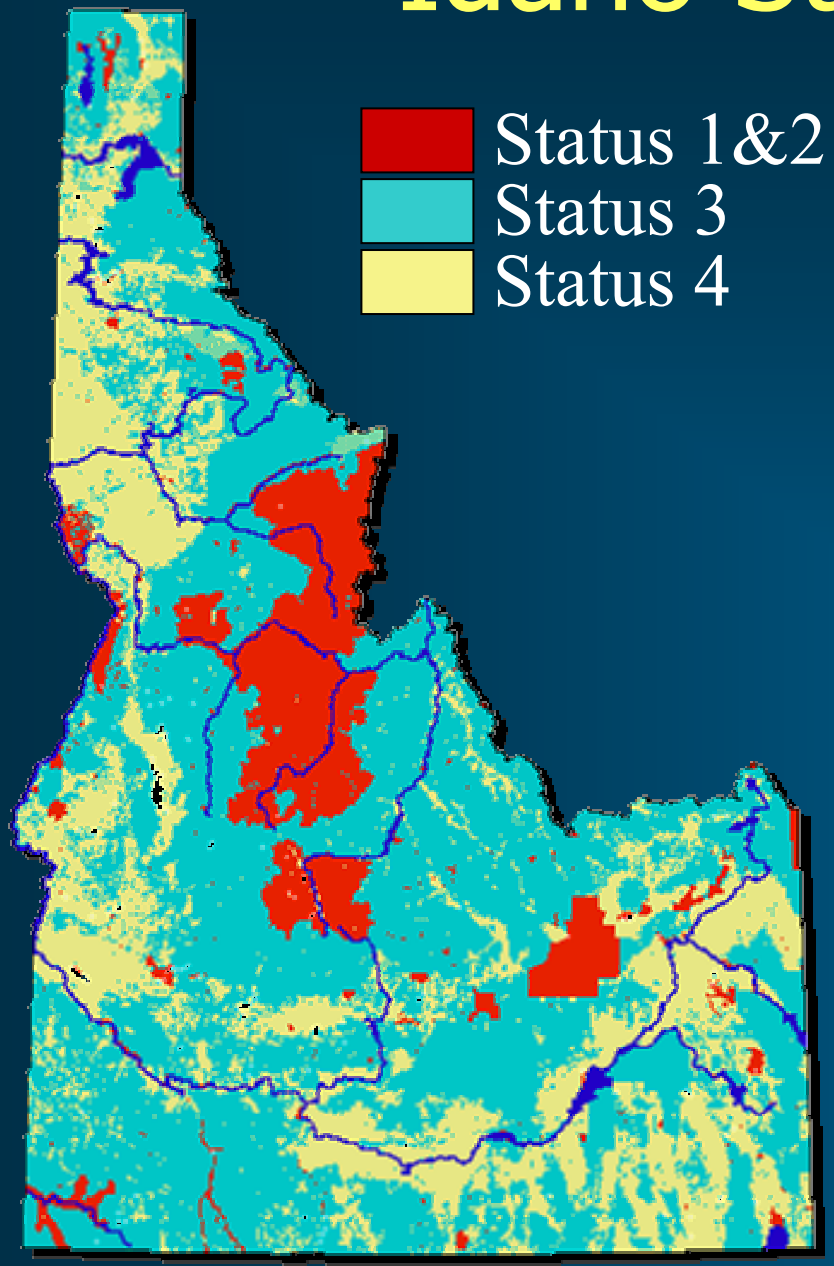
Status 3:

Intent to preserve special features in context of human use

Status 4:

No known intent to maintain biodiversity

Idaho Stewardship



- Almost 70% of Idaho is in public ownership.
- Status 1 & 2 lands cover 6.3 million acres (12%).

Conservation Status of Coeur d'Alene Salamander