

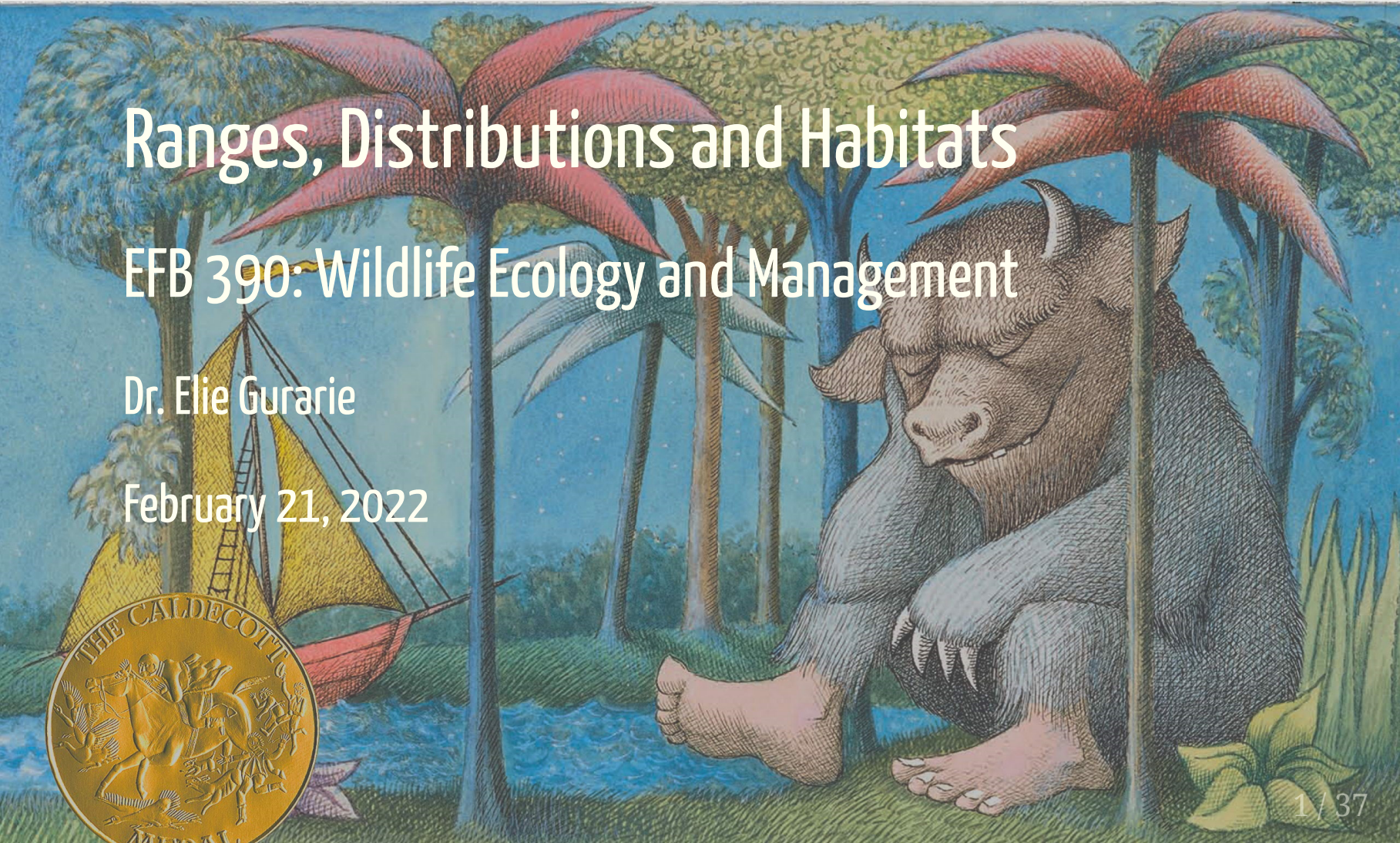
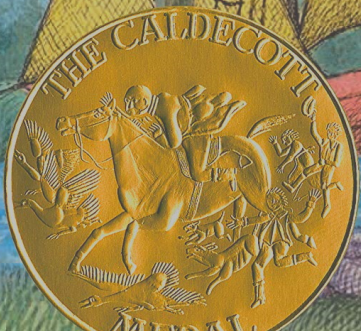
WHERE THE WILD THINGS ARE

Ranges, Distributions and Habitats

EFB 390: Wildlife Ecology and Management

Dr. Elie Gurarie

February 21, 2022



Definition:

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some ranges are small



aye-aye
(*Daubentonia madagascariensis*)



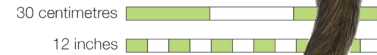
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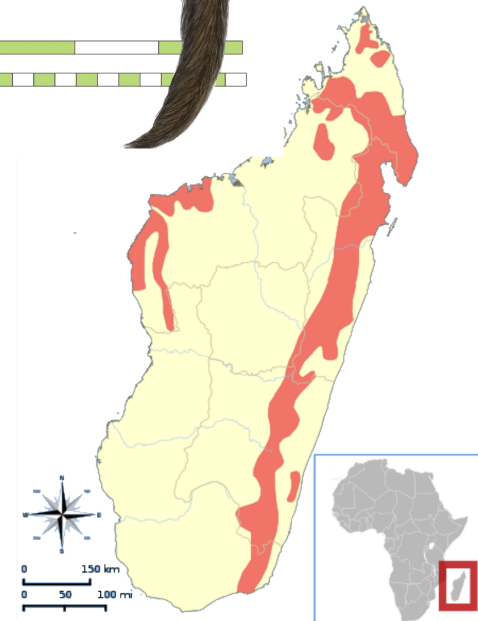
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some ranges are large



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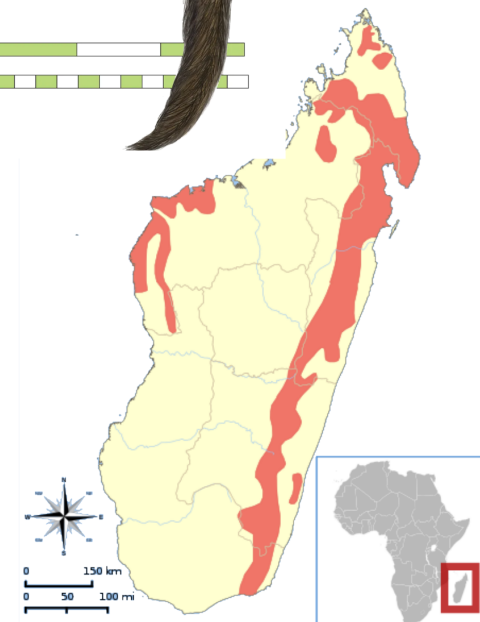
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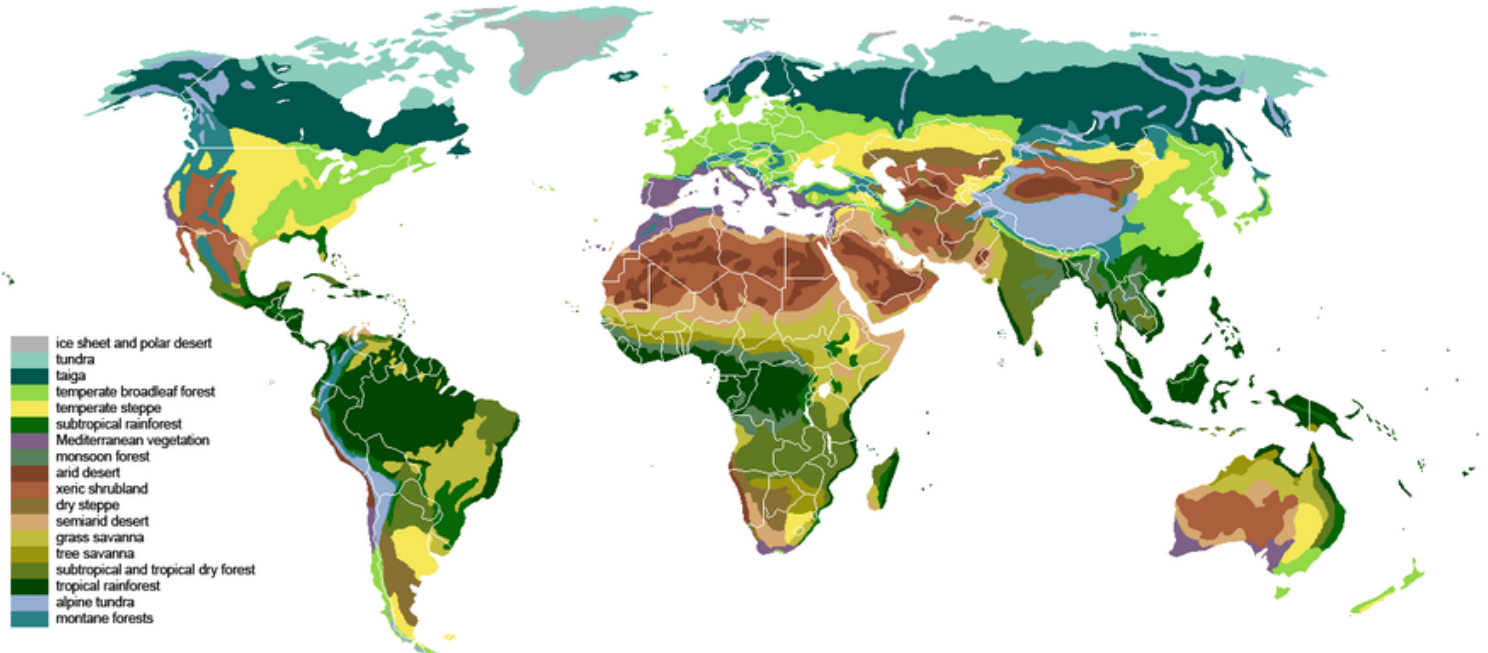
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some ranges are large

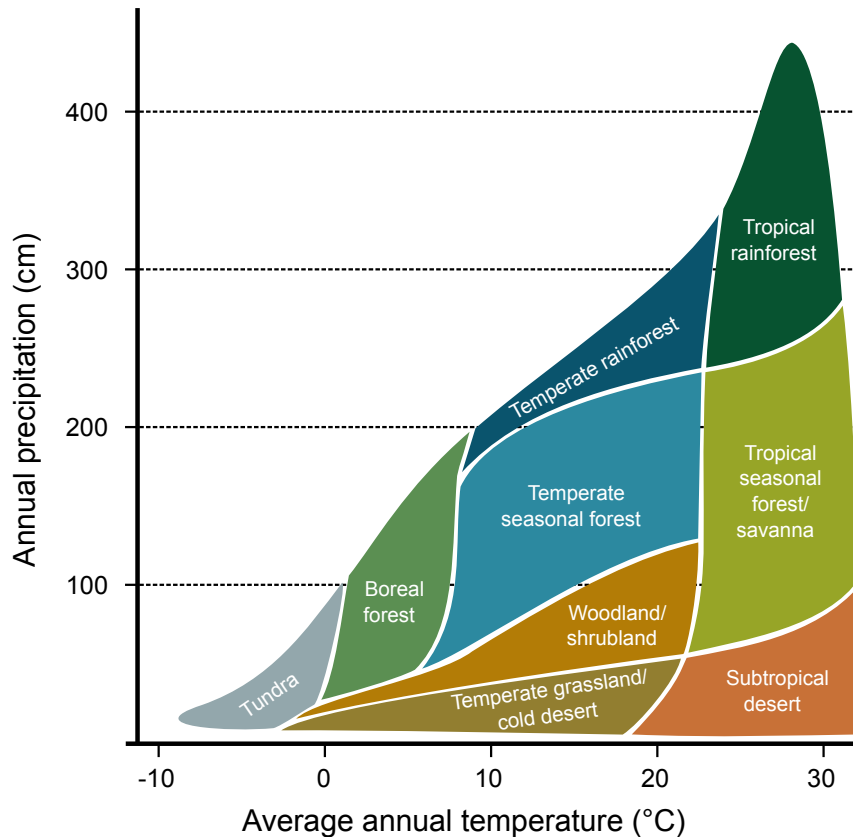


At the broadest scale



the world is divided into *biomes*

Constrained by climate



This (mainly) constrains / determines vegetation communities.

Which is reflected in the wildlife that inhabits those biomes.

Example: **Muskox** (*Ovibos moschatus*)

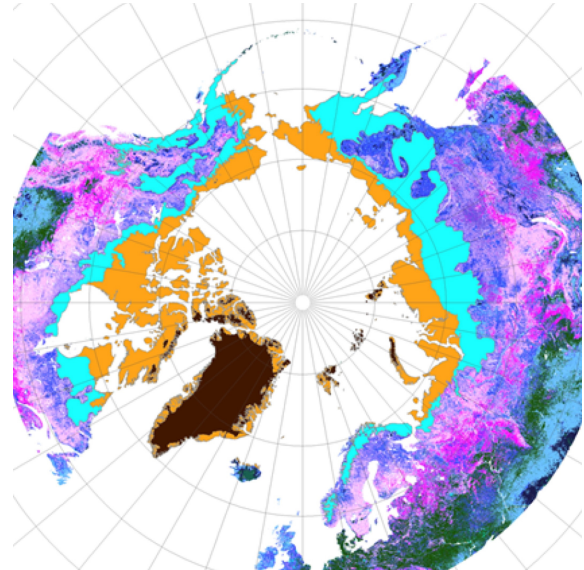


pretty much only found in Arctic Tundra.

Range



Tundra and **treeless**



Example: Muskox



Spider monkey (*Ateles fusciceps*)

Sometimes it's hard to tell which is the **range** and which is the **biome**.



Other animals laugh at your adorable biomes

Quiz: What mammal has the most common names?*

Puma concolor

Cougar. Catamount. Painter. Panther. Ghost Cat.
Puma. Shadow Cat. Mountain lion. Nittany lion.



The **Erie People** (victims of the beaver wars) are the "long-tailed" (cat people), named after the puma that inhabited areas in western New York / Ohio / Ontario.

*- according to Guinness

To think about:

Why does *Puma concolor* have such a large range?

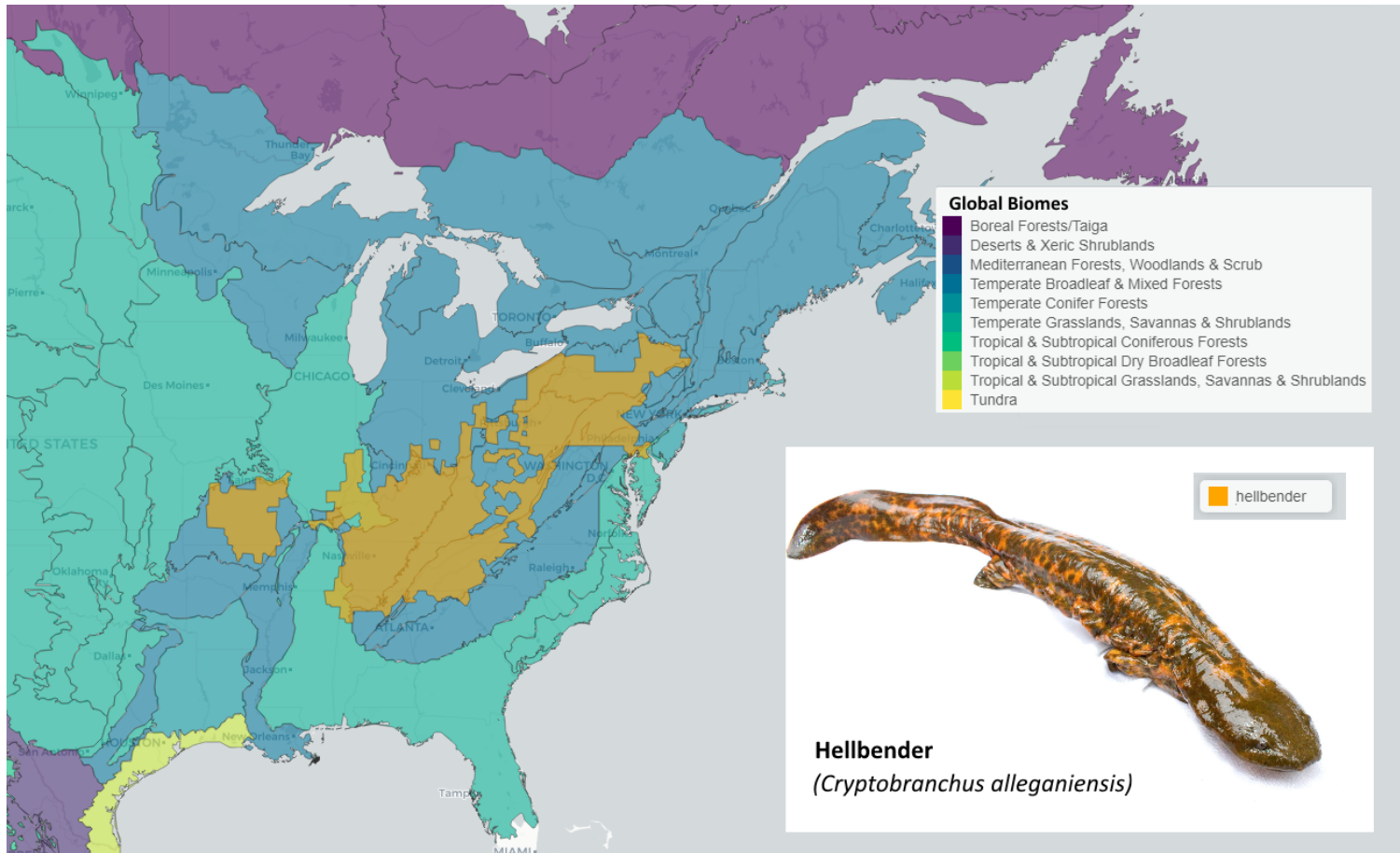
Why does *Puma concolor* have so many common names?

What does it really *need*?



Consider the **Eastern Hellbender**

Near threatened in New York State. Range restricted, mainly, to **"temperate broadleaf and mixed forest"** biome.



Other salamanders?

Let's compare other salamanders present in New York State.

My Naive Prediction: They will mainly be limited to the principle biome of New York State ("**temperate broadleaf and mixed forest**").

Because generally: **small ranges** and **confined to streams**.

**CHECKLIST OF
AMPHIBIANS, REPTILES, BIRDS AND MAMMALS
OF NEW YORK STATE**

Including Their Legal Status

New York State
Department of Environmental Conservation
Division of Fish and Wildlife
February 2019



Blue-spotted Salamander

Artwork by Jean Gawalt



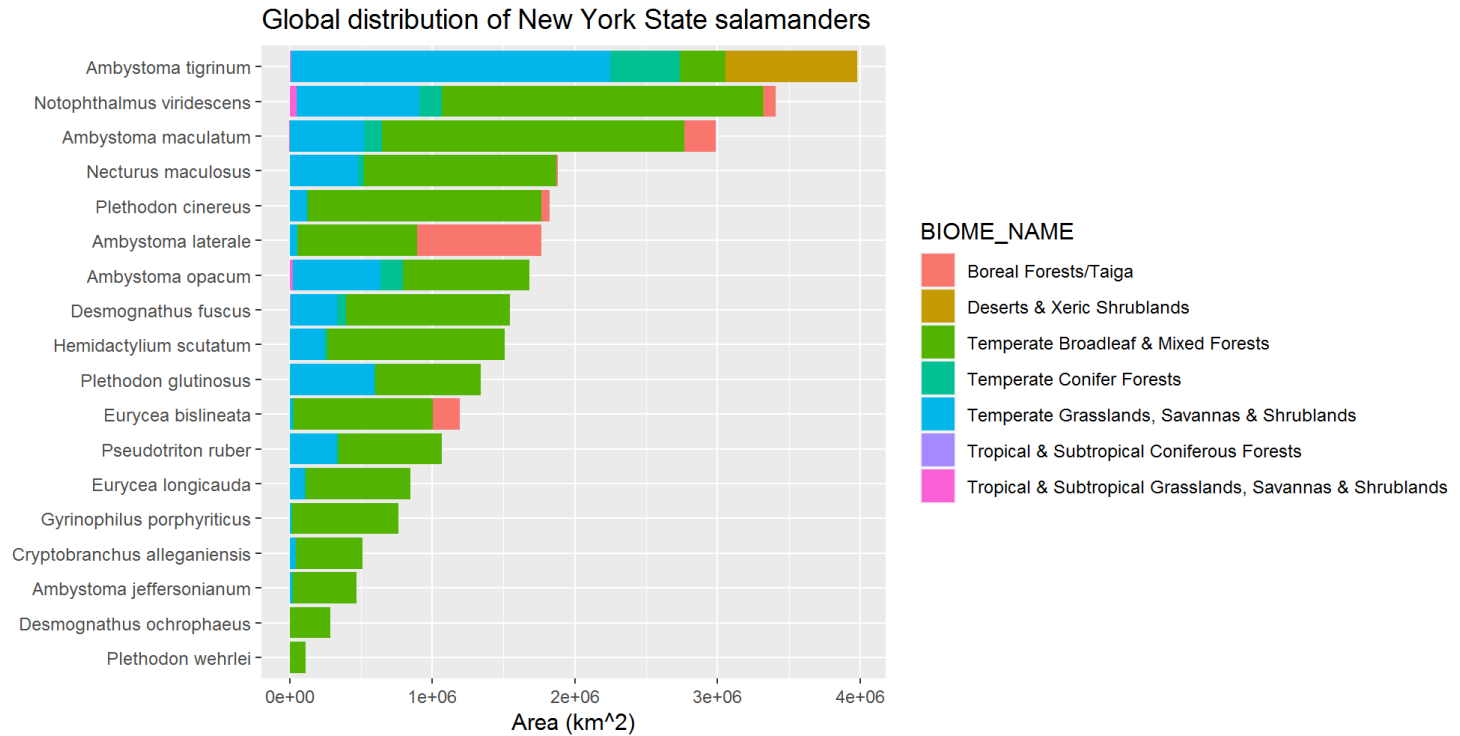
AMPHIBIANS

| COMMON NAME | SCIENTIFIC NAME | LEGAL STATUS | |
|---|-------------------------------------|--------------|-------|
| | | FEDERAL | STATE |
| Hellbender, Mudpuppy and Salamanders | | | |
| Hellbender | <i>Cryptobranchus alleganiensis</i> | Un | GN-SC |
| Common Mudpuppy | <i>Necturus maculosus</i> | Un | GN |
| Marbled Salamander | <i>Ambystoma opacum</i> | Un | GN-SC |
| Jefferson Salamander ^C | <i>Ambystoma jeffersonianum</i> | Un | GN-SC |
| Blue-spotted Salamander ^C | <i>Ambystoma laterale</i> | Un | GN-SC |
| Spotted Salamander | <i>Ambystoma maculatum</i> | Un | GN |
| Eastern Tiger Salamander | <i>Ambystoma tigrinum</i> | Un | GN-E |
| Eastern Red-spotted Newt | <i>Notophthalmus viridescens</i> | Un | GN |
| Northern Dusky Salamander | <i>Desmognathus fuscus</i> | Un | GN |
| Allegheny Mountain Dusky Salamander | <i>Desmognathus ochrophaeus</i> | Un | GN |
| Eastern Red-backed Salamander | <i>Plethodon cinereus</i> | Un | GN |
| Northern Slimy Salamander | <i>Plethodon glutinosus</i> | Un | GN |
| Wehrle's Salamander | <i>Plethodon wehrlei</i> | Un | GN |
| Four-toed Salamander | <i>Hemidactylium scutatum</i> | Un | GN |
| Northern Spring Salamander | <i>Gyrinophilus porphyriticus</i> | Un | GN |
| Northern Red Salamander | <i>Pseudotriton ruber</i> | Un | GN |
| Northern Two-lined Salamander | <i>Eurycea bislineata</i> | Un | GN |
| Long-tailed Salamander | <i>Eurycea longicauda</i> | Un | GN-SC |

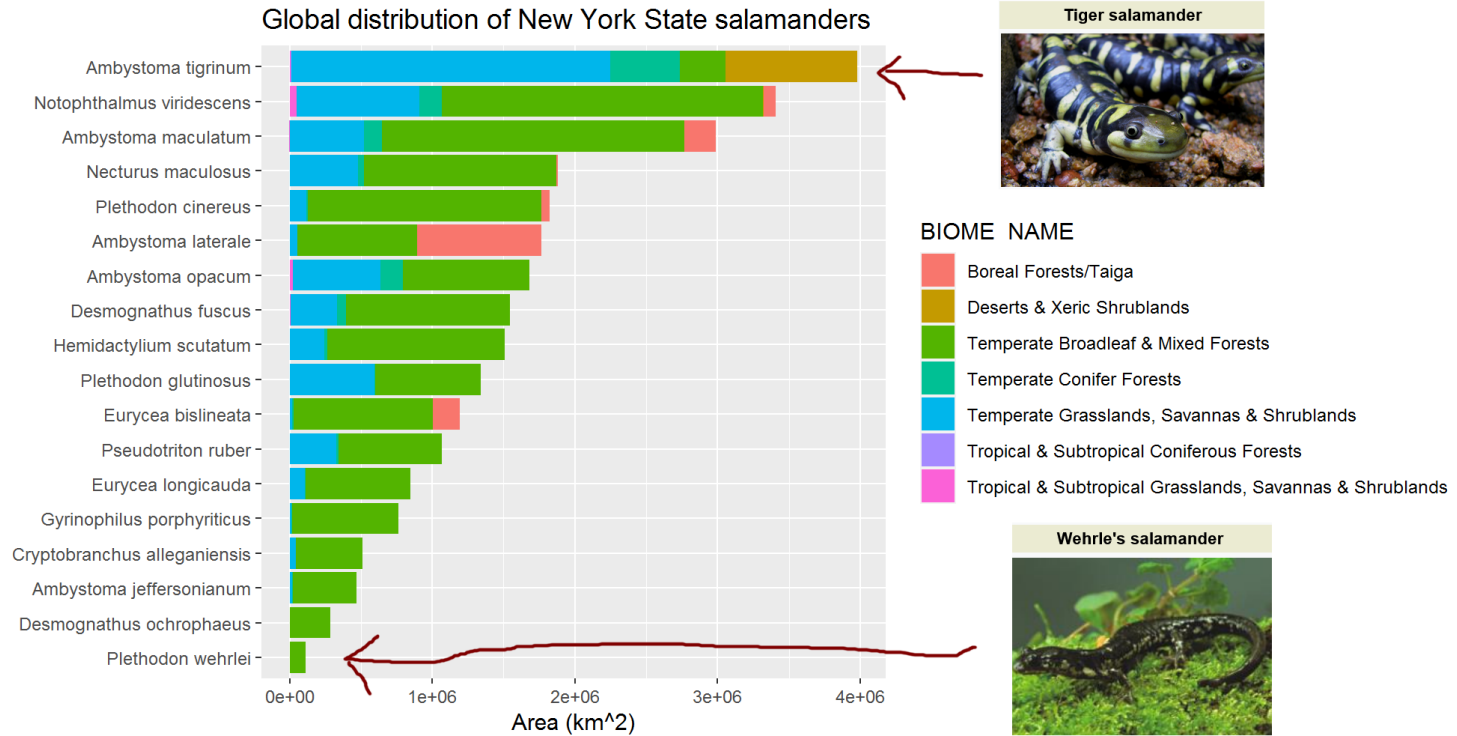
Quick analysis:

- Download Ecoregions (e.g. from [here](#))
- Get species ranges of all amphibians from [IUCN](#)

In fact ... quite a few "biome generalist!"



Let's look at a couple more species more closely



Predictably, the smaller the range, the more specialized.

But **why?**

Ask the question: **What do they really need?**

Wehrle's Salamander



"... found in upland forests and woodlands (e.g., red spruce-yellow birch, mixed deciduous). Found in rock crevices, under rocks, logs, and leaves, and in twilight zone of caves (at lower elevations). Eggs are laid in damp logs, moss, cave crevices, and other protected sites."

IUCN - Wehrle's Salamander

Tiger Salamander



*"Can be found in virtually **any habitat**, providing there is a terrestrial substrate suitable for burrowing and a body of water ... for breeding. Terrestrial adults usually are underground, in self-made burrows or in those made by rodents, shrews, or other animals ... This species seems tolerant of habitat disturbance."*

IUCN - Eastern Tiger Salamander

What do they really need = **Habitat**

lots of possible definitions ... from very limiting ones:

"the place where an organism lives; where one would go to find it"
(Odum, 1971)

*But isn't that just **range**!?*

To somewhat vague ones:

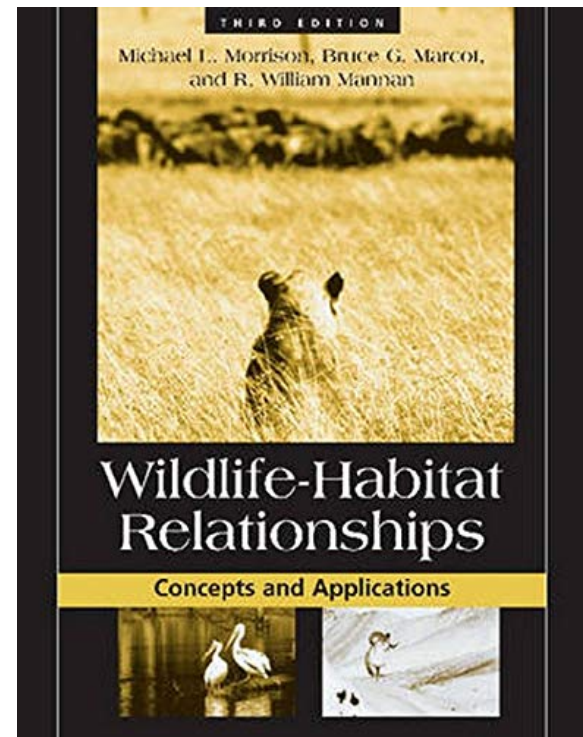
"the place where a plant or animal *normally* (!?) lives, often characterized by a dominant plant form or physical characteristic." (Ricklefs, 1973)

What does **normally** mean?

Decent working definition:

"An **area** with the combination of **resources** (like food, cover, water) and the **environmental conditions** (temperature, precipitation, presence or absence of predators and competitors) that **promotes occupancy** by individuals of a given species (or population) and allows those individuals to **survive and reproduce.**"

Morrison 2012



Components of Wildlife Habitat

Habitat: Biotic and abiotic factors

Typically, enumerated as:

| component | description |
|------------------|--|
| food | Very important (obviously)! |
| water | Also important |
| shelter | Dens / burrows / nesting sites / predator avoidance |
| space | Important, especially, for territorial animals. But ultimately linked with food & shelter. |

These interact in complex ways, but are often used as a "checklist" for direct habitat restoration efforts.

Components of Wildlife Habitat

I would definitely add ...

| component | description |
|---------------------|----------------------------------|
| food / water | ... |
| shelter | ... |
| space | ... |
| reproduction | Minimal presence of conspecifics |
| survival | Ability to avoid predation |

Coming back to definition:

"An area with the combination of resources (like food, cover, water) and the environmental conditions (temperature, precipitation, **presence or absence of predators and competitors**) that promotes occupancy by individuals of a given species (or population) and **allows those individuals to survive and reproduce.**"

Definition: **Habitat type**

Description of an *ecological community* (much finer than **biome**), often used synonymously with *vegetation type*.

- **Habitat** is species specific
- **Habitat type** describes an area that includes many species

How many are there?



habitat types



People also ask :

What are the 5 types of habitats? ▾

What are the 7 types of habitats? ▾

What are the 3 types of habitat? ▾

What are the 2 types of habitat? ▾

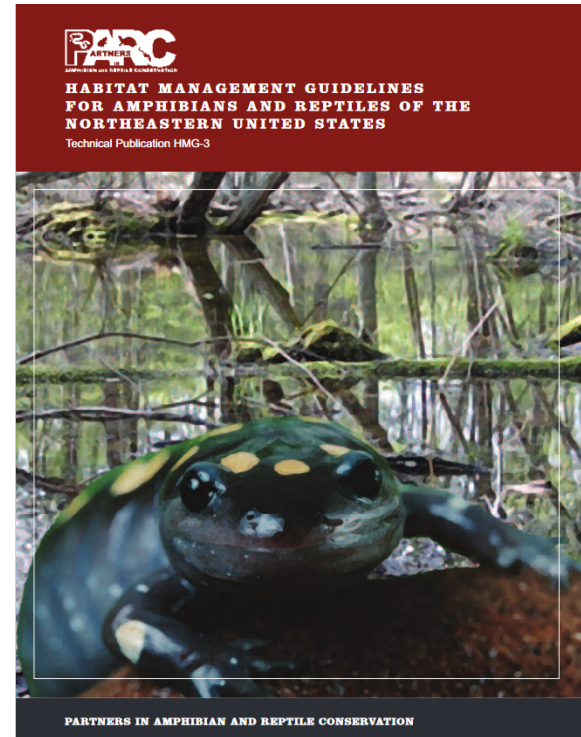
Feedback

How many **habitat types** are there?

Totally depends on context and group of interest!

Habitat types for herps in NE. USA:

- Seasonal Isolated Wetlands
- Wet Meadows, Bogs, and Fens
- Permanent Wetlands
- Small Streams, Springs, and Seepages
- Rivers
- Estuarine and Coastal
- Hardwood Forests
- Spruce and Fir Forests
- Xeric Upland and Pine Forests
- Grasslands and Old Fields
- Rock Outcrops and Talus
- Caves and Karst
- Agricultural Lands
- Urban and Residential Systems



(Mitchell et al. 2010)

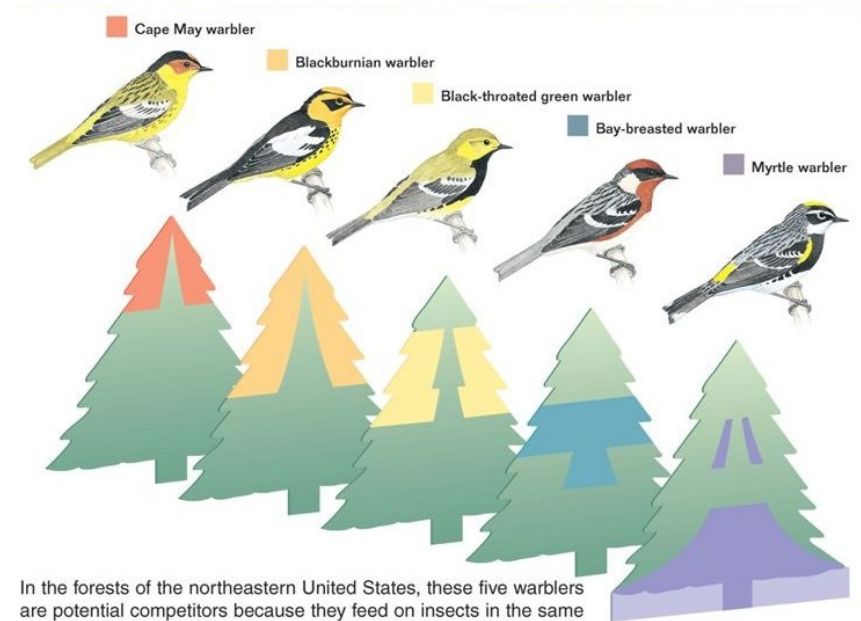
Habitat can be VERY specific

How do 5 species of warbler co-exist in one tree?



(MacArthur 1958)

By sharing very specific portions of the tree!



In the forests of the northeastern United States, these five warblers are potential competitors because they feed on insects in the same trees. However, each species hunts only in a portion of the tree. Ecologist Robert MacArthur proposed that this feeding strategy reduced competition among these species of warblers.

Habitat depends on life cycle

Reproduction / early rearing habitat

- Can be extremely specific
- Tends to prioritize *shelter/protection*

Dispersal/migration habitat

- Tends to be ... just about *anything*

Foraging habitat

- Good food to get fat!

Breeding habitat

- Mainly requires presence of conspecifics!
- (often but not always same as "reproduction" habitat)



Spotted owl (*Strix occidentalis*) - very picky about nesting habitat

What is Pacific salmon (*Oncorhynchus spp.*) habitat?

Habitat Specialists vs. Generalists

Raccoon (*Procyon lotor*)



- very **catholic** diet (omnivorous)
- very **behaviorally adaptable**
- deciduous / mixed forests, mountains, urban/suburban environments, coastal marshes

Koala (*Phascolarctos cinereu*)



- Strict eucalyptus diet
- Strict arboreal lifestyle
- Pretty small range

Generalist species make very good invaders (see racoons in Europe).
Specialist species are (generally) more vulnerable to environmental change /

Very closely related species can be quite different

Brown bear (*Ursus arctos*)



- Highly adaptable diet
- Found in forest / mountain / savannah / tundra

Polar bear (*Ursus maritimus*)



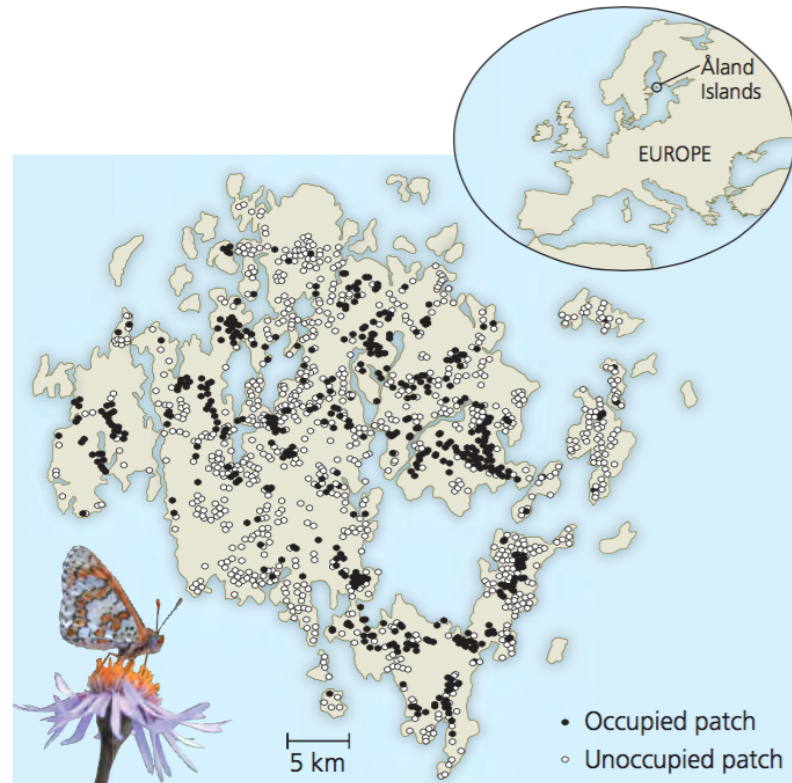
- Reliant almost entirely on seal meat on floating sea ice.

VERY RECENT divergence (~100,000 ya) ... shift in diet completely transformed their "habitat". Polar bears are (in consequence) more vulnerable to climate change / sea-ice loss.

Habitat Connectivity is very important for specialists

Habitat Fragmentation is decrease in connectivity.

For **specialists**, patchily distributed resources **HAVE** to be accessible.



▲ **Figure 53.21 The Glanville fritillary: a metapopulation.**

On the Åland Islands, local populations of this butterfly (filled circles) are found in only a fraction of the suitable habitat patches (open circles) at any given time. Individuals can move between local populations and colonize unoccupied patches.

Specialists vs. Fragmentation

French breeding birds: **More fragmented** environments leads to **less specialized communities**

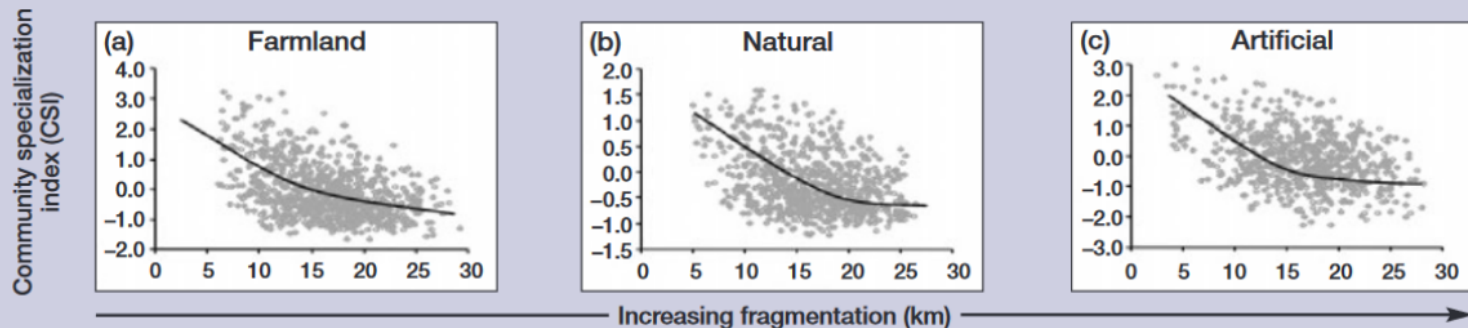
Panel 1. Community specialization index: an indicator of functional homogenization

Julliard *et al.* (2006) have quantified the specialization of species as the coefficient of variation (standard deviation/average) of their densities among habitat classes. The species specialization index (SSI) may be useful in building a sensitive (yet simple) index of biotic homogenization at the community level. The community specialization index (CSI) could, in turn, be used to test the role played by human-induced disturbances, such as habitat fragmentation, in functional biotic homogenization.

We used data from the French Breeding Bird Survey and considered 100 common species. We investigated the response of the CSI to habitat fragmentation and quantified these pressures using a land-cover survey (CORINE Land Cover database; Figure 3). The CSI was then calculated as the weighted average of the SSI in the site j (weighted by the number of individuals at the j site).

$$CSI_j = \frac{\sum_{i=1}^N a_{ij}(SSI_i)}{\sum_{i=1}^N a_{ij}}$$

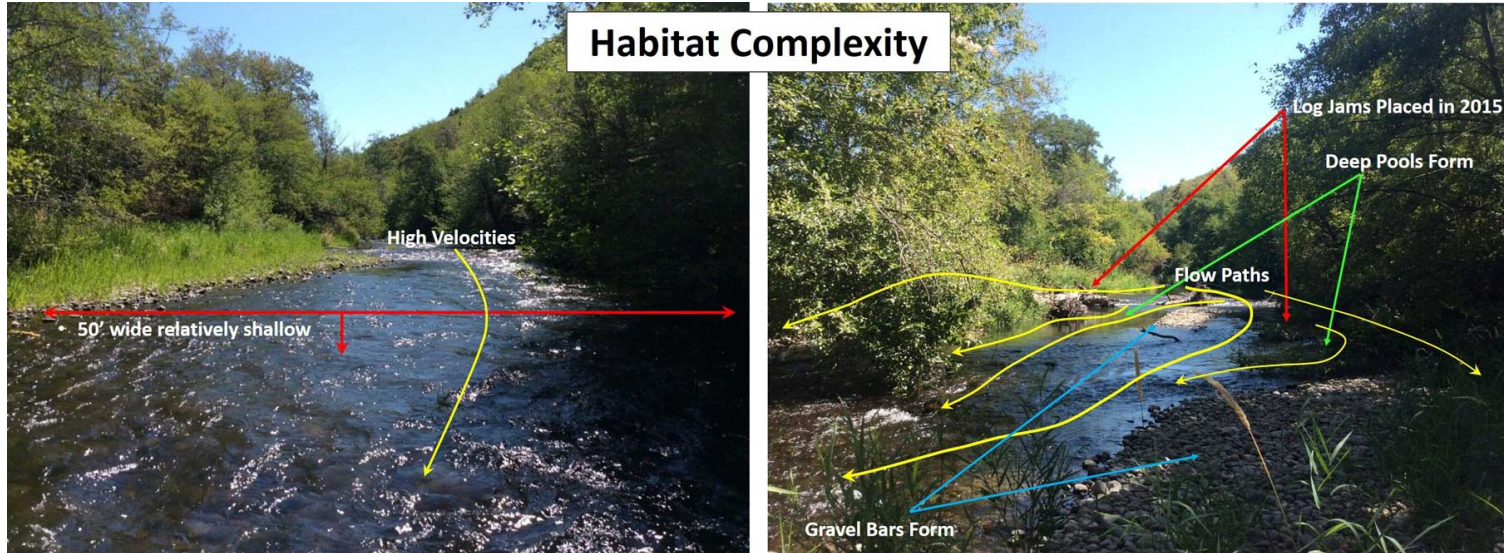
Where N was the total number of species recorded, a_{ij} the abundance of individuals of species i in plot j , and SSI_i its specialization index.



(Clavel *et al.* 2011)

Habitat complexity is good

Even when considering a single species (e.g. Chinook salmon *Oncorhynchus tshawytscha*) in a single river ... the more **complexity** the better, because of different needs for *food, shelter, rearing, life stages*.



A very, very common goal in habitat restoration is enhancing **complexity**.

Habitat depends on scale

Hierarchy of scale:

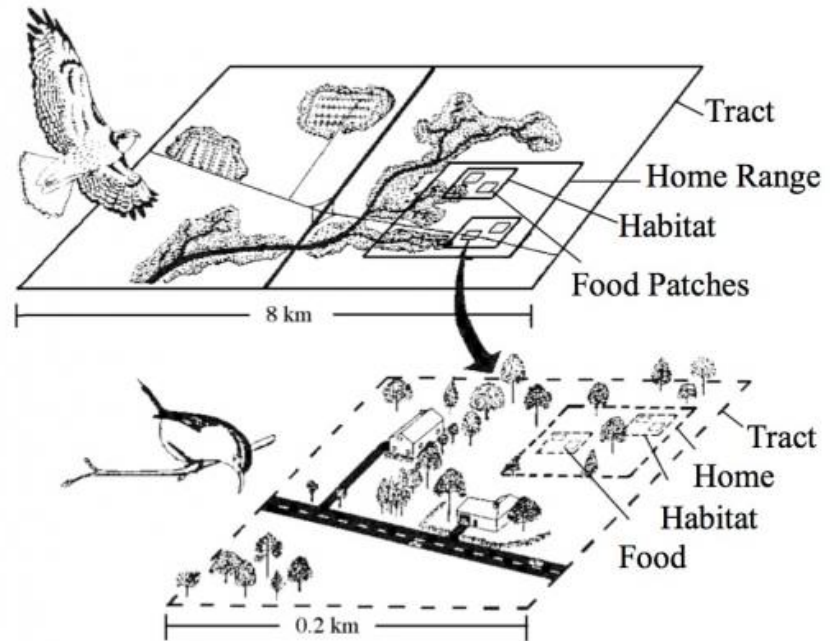
1st order: Geographical range

2nd order: Selection of home range

3rd order: Patches within home range

4th order: Resource patch

(Johnson 1980)



Habitat alteration ...

is **OVERWHELMINGLY** the single greatest threat (& impact) to wildlife and ecosystems

Habitat alteration types

Habitat destruction/conversion:

- physical loss of one habitat (by necessity replaced by another)

Habitat fragmentation:

- breaking large continuous blocks of habitat into smaller patches
- increasing barriers to movement

Habitat degradation:

- changing composition, structure, or function of an ecosystem

Habitat enhancement: habitat restoration

Some takeaways

- Animals are not distributed uniformly in space
- There is wide variability in the **geographic ranges** of species
- Largely - animal communities vary with global **biomes**

The **habitat** concept ...

- is extremely **fundamental** but **very complex**
- depends on **scale**
- depends on ecological interactions
- depends on **life cycle** and **behavior** and **subpopulation** and **season**
- generally: **connectivity** and **complexity** are very important

humans

- Have mainly altered habitats **destructively**
- But are also capable of enhancing habitats
 - by emphasizing **complexity** and **connectivity** and **interactions** and **awareness of scale**

An aerial photograph of a savanna landscape. A winding river flows through the center of the image, surrounded by dense green vegetation. The surrounding areas are a mix of green grass and scattered trees, typical of a savanna environment. The sky is not visible, and the overall scene is a lush, natural setting.

Next time ...

We will demystify the **quantification** and **estimation** and **assessment** of habitat with **modeling**...

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