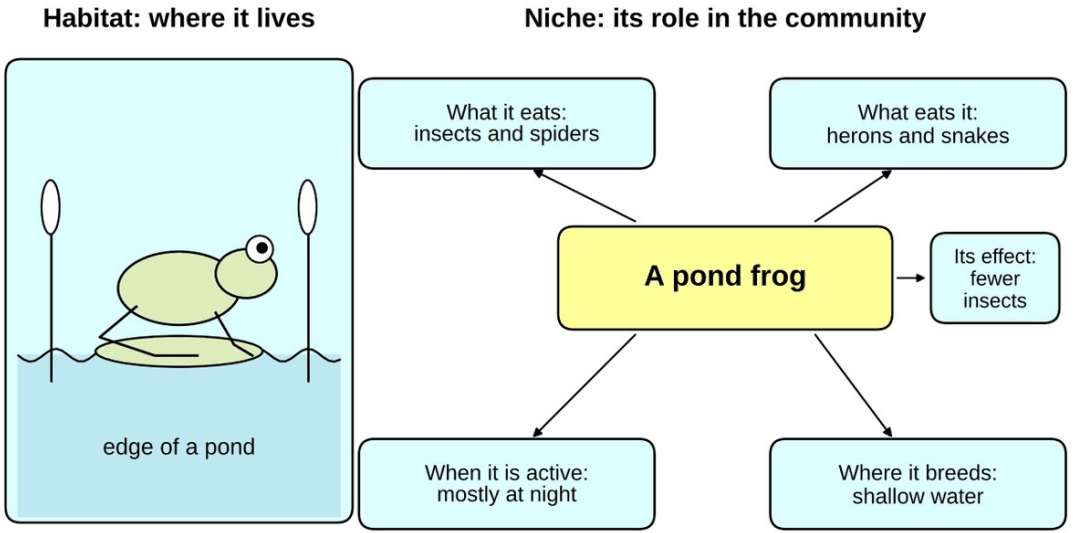
Essential Question

What decides where a species can survive?

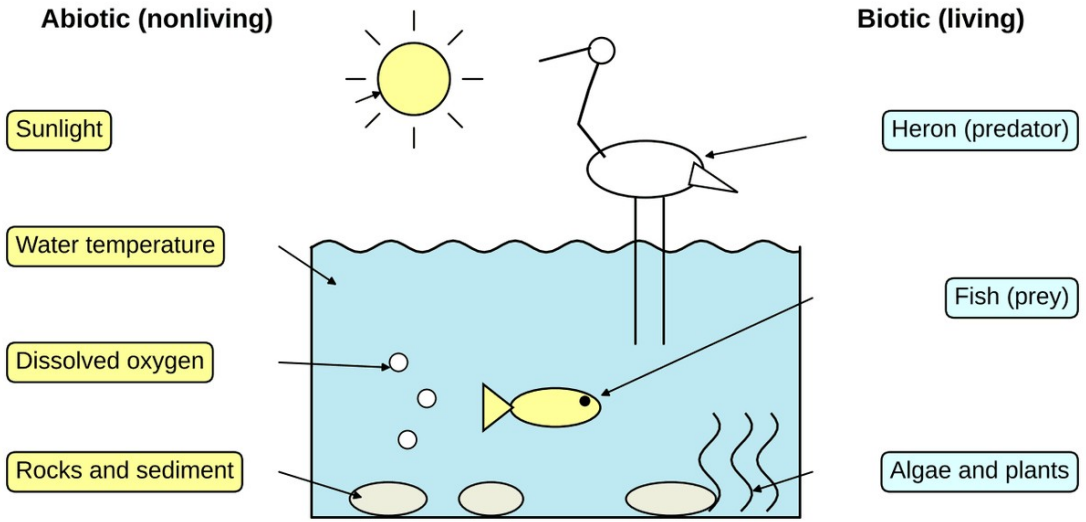
Habitat and Niche

- Habitat: the place where an organism lives
- Niche: the role an organism plays there
- A niche includes what it eats, what eats it, when it is active, and where it breeds
- Each species has its own niche



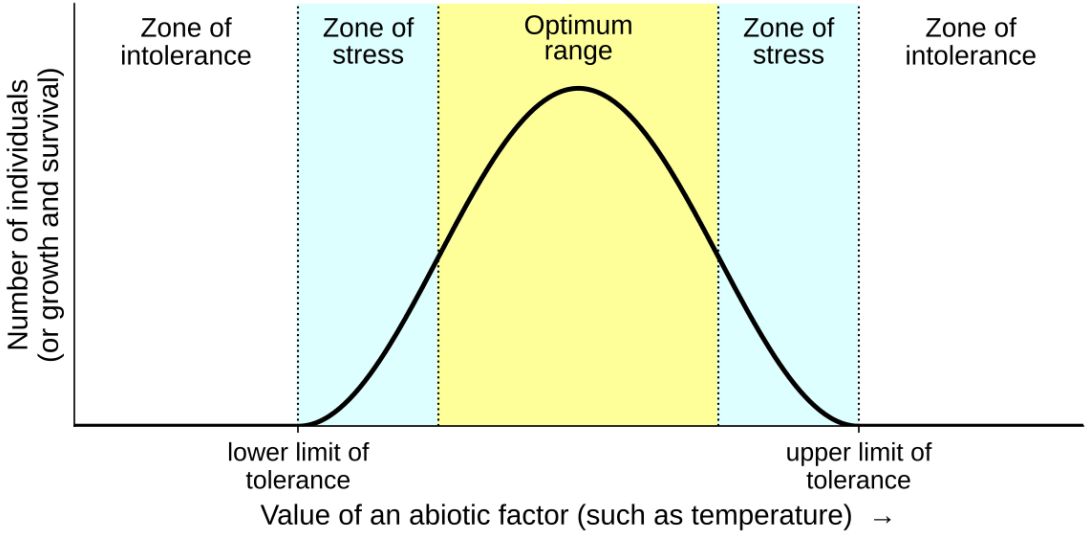
Abiotic and Biotic Factors

- Abiotic factors are the nonliving parts of the environment
- Examples: sunlight, temperature, water, oxygen, pH, soil
- Biotic factors are the living parts: other organisms and their effects
- Examples: predators, prey, competitors, parasites, decomposers



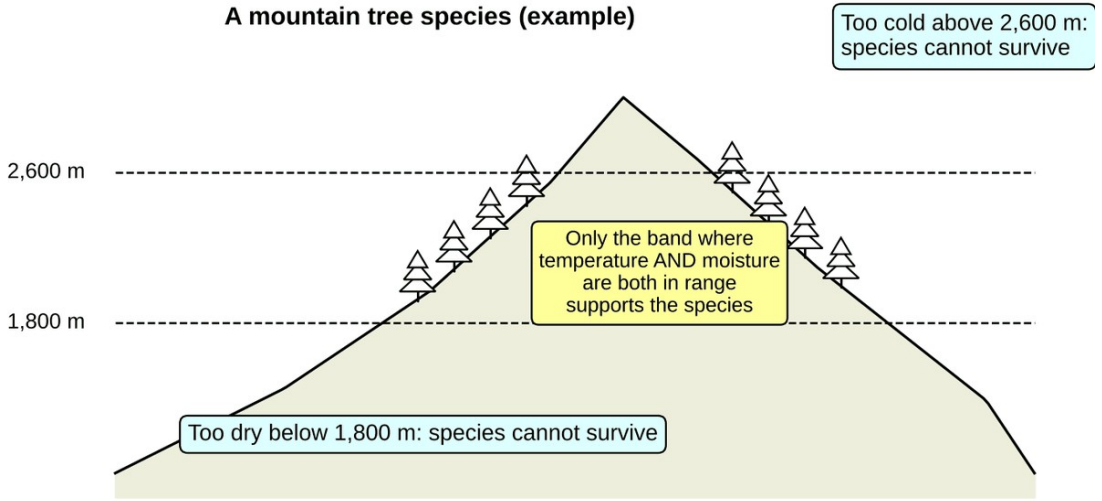
Tolerance Ranges

- Tolerance range: the span of a factor an organism can survive in
- Optimum range: best growth, survival, and reproduction
- Zones of stress: survival is possible, but growth and reproduction fall
- Beyond the limits of tolerance, individuals cannot survive



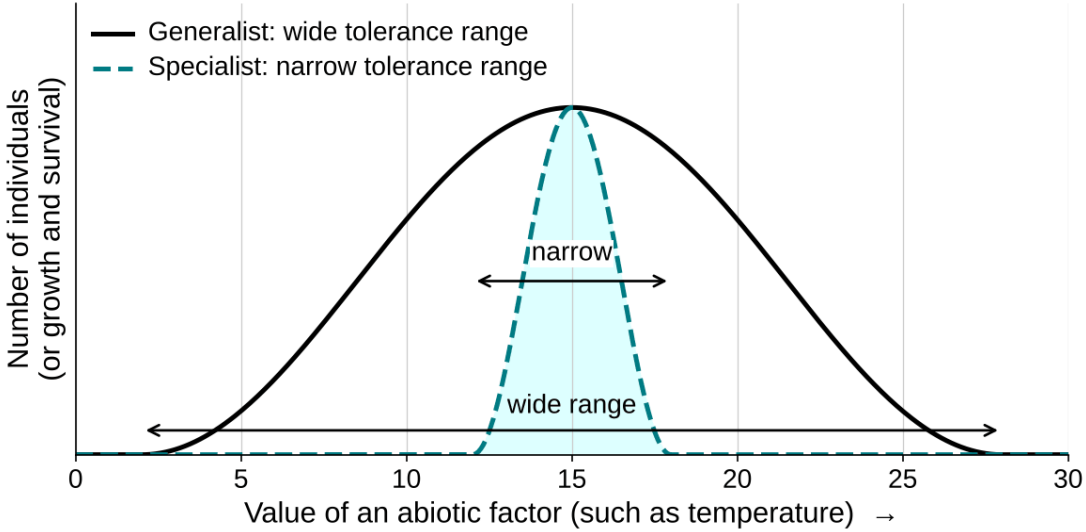
Where a Species Can Live

- The abiotic factors must be inside the species' tolerance ranges
- One factor outside its range can keep a species out
- Two limits together can make a band, as on a mountain slope
- If a factor changes, the places a species can live change too



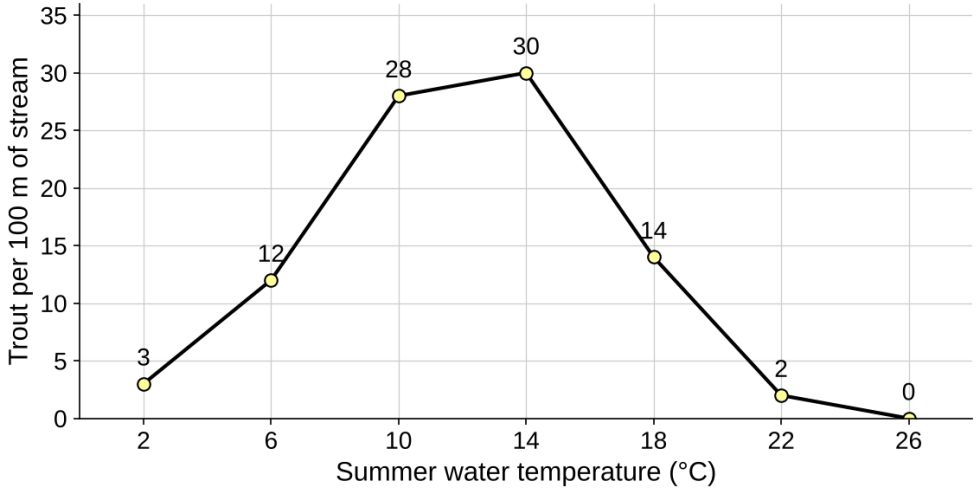
Generalists and Specialists

- Generalist: wide tolerance range or many resources used
- Specialist: narrow tolerance range or few resources used
- Raccoons eat fruit, nuts, insects, and crayfish
- Koalas feed almost entirely on eucalyptus leaves



Example: Trout and Stream Temperature

Trout were counted per 100 m of stream at different summer temperatures (sample data). Describe the optimum range and the upper limit. Predict the effect of warming a stream from 14 °C to 22 °C.

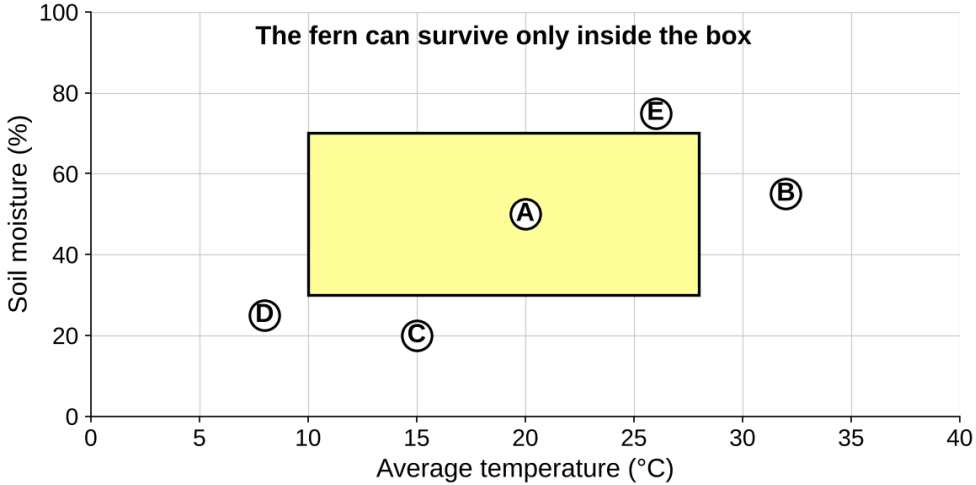


Solution: Trout and Stream Temperature

- Optimum range: the highest counts, 28 and 30 trout per 100 m, are at 10 °C and 14 °C. The optimum range is about 10 to 14 °C.
- Upper limit: the count falls to 14 at 18 °C and 2 at 22 °C, and there are no trout at 26 °C. The upper limit of tolerance is between 22 °C and 26 °C.
- Calculate the change: (30 − 2) trout per 100 m ÷ 30 trout per 100 m × 100 = 93% decrease
- Claim: the trout population would decline sharply.
- Evidence: streams at 14 °C had 30 trout per 100 m, but streams at 22 °C had only 2, which is a decrease of about 93%.
- Reasoning: temperature is an abiotic factor with a tolerance range. 22 °C is in the upper zone of stress, close to the upper limit, so the trout that survive grow and reproduce less. Warmer water also holds less dissolved oxygen.

Example: A Fern and Two Factors

A fern survives at 10 to 28 °C and 30 to 70% soil moisture (sample values). (a) Which sites work? Name the factor that fails at the others. (b) Which sites work if every site warms by 4 °C?

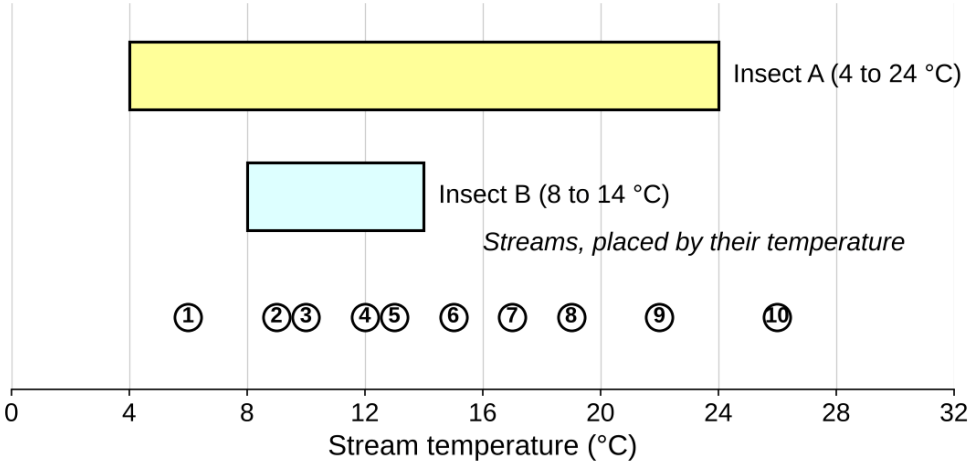


Solution: A Fern and Two Factors

- Test each factor: a site works only if the temperature is from 10 to 28 °C and the moisture is from 30 to 70%.
- (a) Site A: 20 °C and 50% are both in range. Site B: 32 °C is too hot. Site C: 20% is too dry. Site D: 8 °C is too cold and 25% is too dry. Site E: 75% is too wet.
- (b) Add 4 °C: A is 24 °C, still in range. B is 36 °C, too hot. C is 19 °C, but the soil is still too dry. D is 12 °C, now in range, but the soil is still too dry. E is 30 °C, too hot, and still too wet.
- Reasoning: the fern needs both factors inside their ranges at the same time, which is the box on the graph. Fixing one factor does not help when another is still outside its range.

Example: Comparing Two Insects

Insect A tolerates 4 to 24 °C. Insect B tolerates 8 to 14 °C. Find each range's width and the percent of the 10 streams where each could survive. Which is the generalist?



Solution: Comparing Two Insects

- Width of each range: insect A: 24 °C − 4 °C = 20 °C. Insect B: 14 °C − 8 °C = 6 °C. Insect A's range is 20 ÷ 6 ≈ 3.3 times as wide.
- Insect A: streams 1 to 9 are between 4 and 24 °C, and stream 10 (26 °C) is too warm. 9 streams ÷ 10 streams × 100 = 90%.
- Insect B: only streams 2, 3, 4, and 5 (9 to 13 °C) are between 8 and 14 °C. 4 streams ÷ 10 streams × 100 = 40%.
- Claim and reasoning: insect A is the generalist for temperature. Its wider range means more streams meet its needs. Other factors, such as oxygen and food, could still limit where each insect lives.

2.1 Niches and Tolerance Ranges

Big Ideas

- A habitat is where an organism lives; its niche is its role
- Abiotic factors are nonliving; biotic factors are living
- A tolerance range has an optimum, zones of stress, and limits
- A species lives only where its abiotic factors are in its tolerance ranges
- Specialists have narrow ranges and are often more at risk