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Habitat
Ecological Factors and Adaptation

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INTRODUCTION

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- The presence of vagueness and ambiguity in natural language concepts present an enormous challenge to computational representation and geographic information.

- However, in the contemporary studies on applications of formal theories of semantic and ontology minimize these vagueness and ambiguity.

- Environment/Habitat/Biome are words which are more ambiguous in the normal language concepts.

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FOR THE NEXT SLIDES:
What is the habitat? Microhabitat?
Community? Niches? Biotic factors?
Abiotic Factors? Limiting factors?

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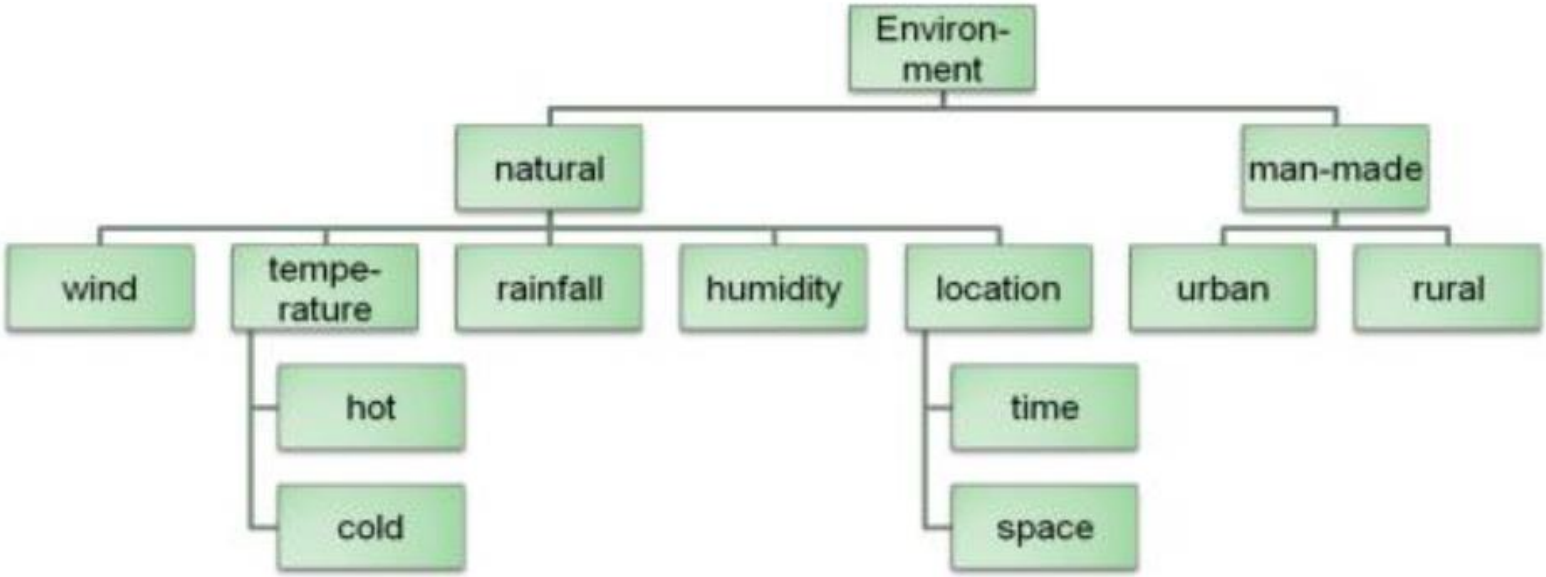
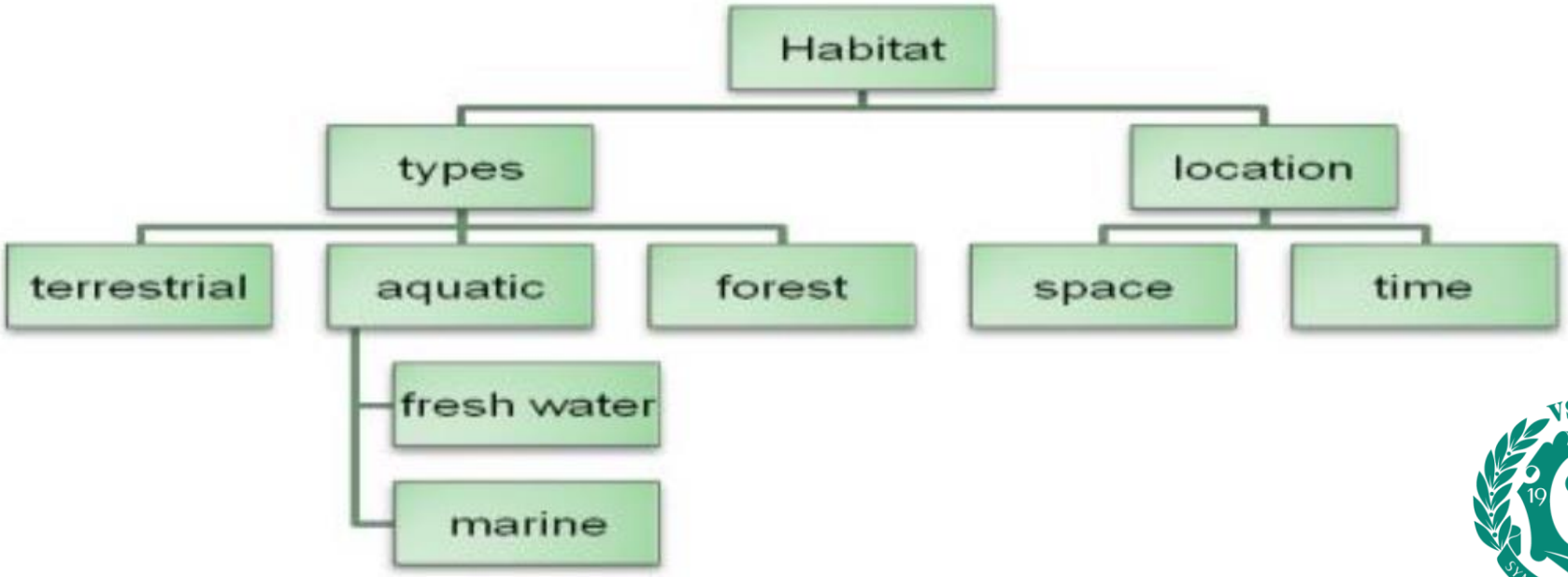
AMBIGUOUS DEFINITION

- **Environment:**
  - the totality of surrounding conditions.
  - is our surrounding.
  - range of conditions where an organism thrives.
- **Habitat:**
  - area where a plant or animal naturally live or makes a living.
  - type of environment in which an organism or group normally lives or occurs.
  - is the place where a population lives.
- **Biome:**
  - are the major regional groupings of plants and animals discernible at a global scale.
  - is a group of ecosystems that have similar climates and communities.

AMBIGUITIES IN MODES OF CLASSIFICATION





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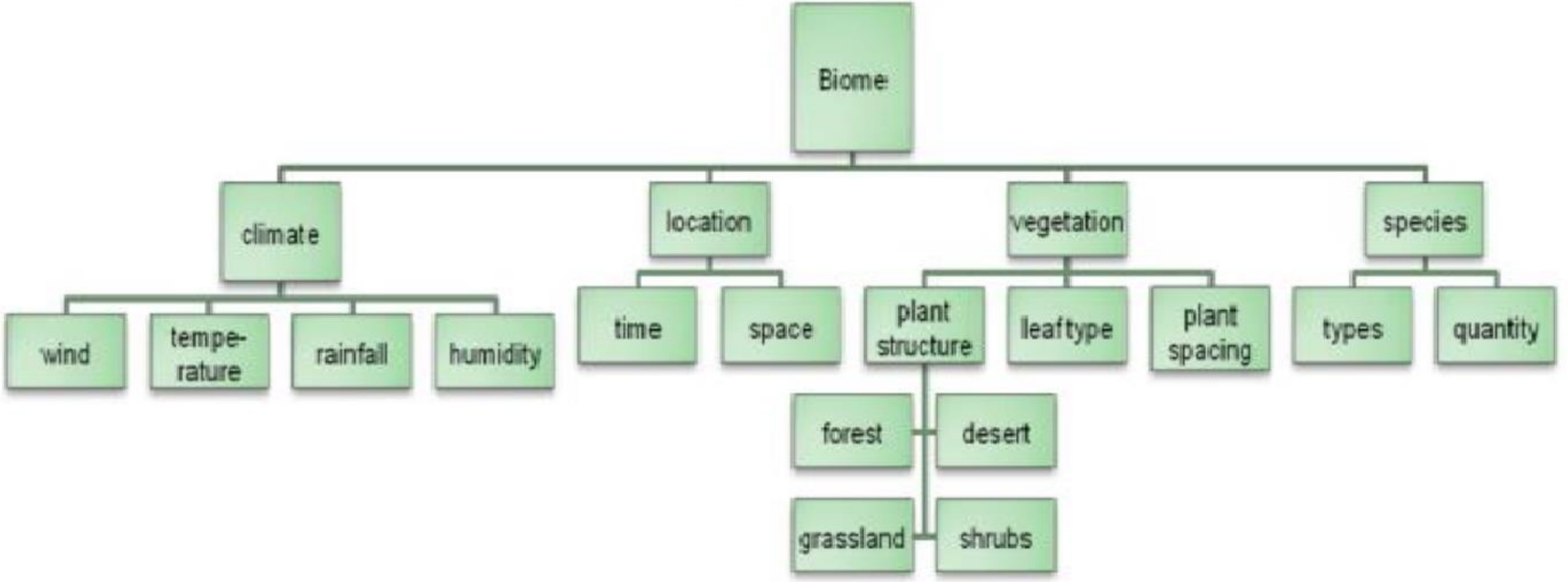

AMBIGUITIES IN MODES OF CLASSIFICATION

Environmentt/Habitat/Biome:

Global Environment:
(where in the globe?)

Affective Environment: a potential **habitat**
where an organism can survive

Water, forest, soil…?

Local Environment: Proximity threshold?

Immediate Env't - (water, rock, forest…) impact on a particular animal.

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Microhabitats

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A microhabitat is a more localised or specialised part of a general habitat.

- For example, in a freshwater pond, some organisms may occupy the soft sediment at the bottom, while others may live among the aquatic plants. These are two different of many microhabitats

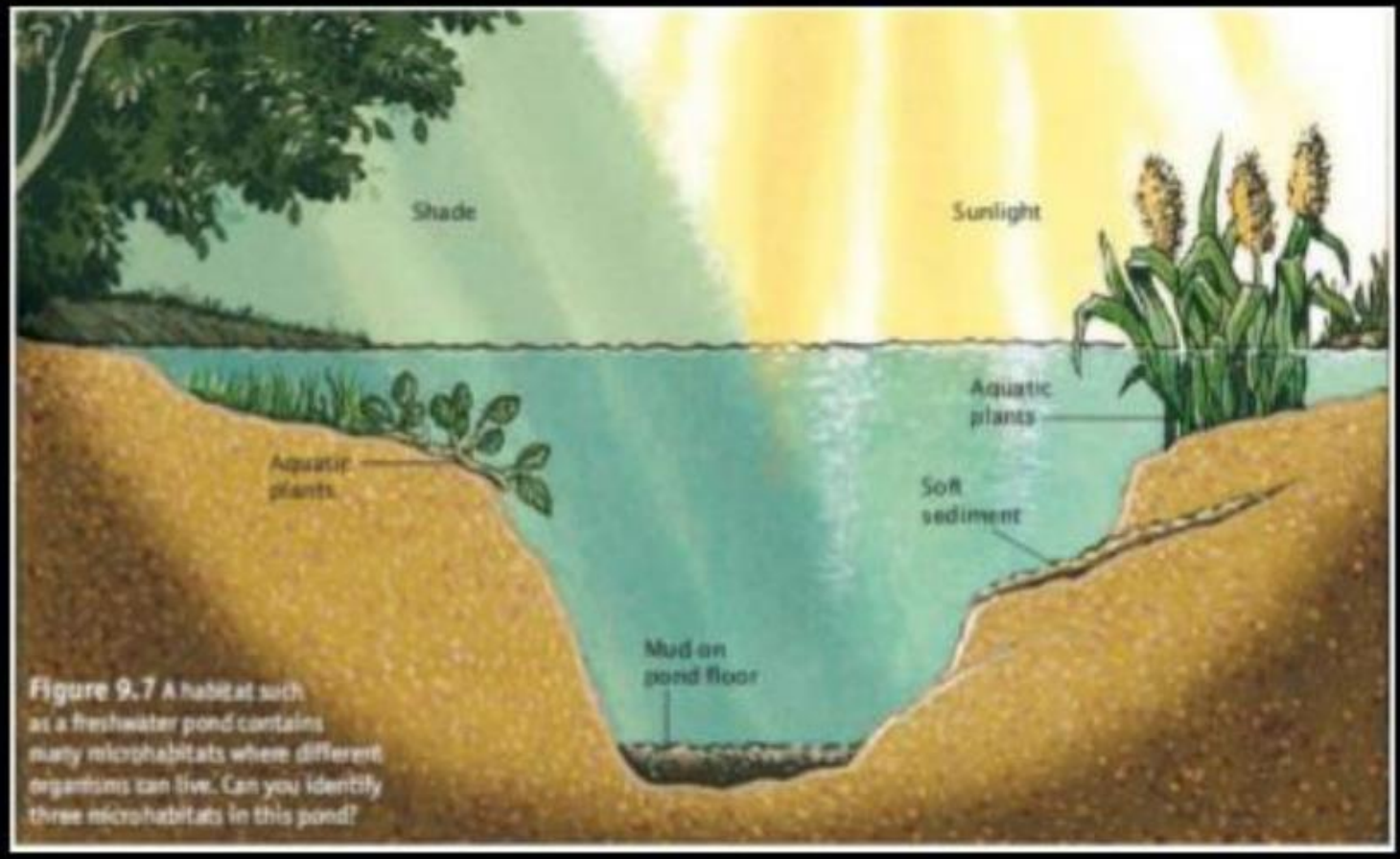

Figure 9.7 A habitat such as a freshwater pond contains many microhabitats where different organisms can live. Can you identify three microhabitats in this pond?

Niche

- NICHE refers to the 'way of life of a species'

OR the role of a species in a community

OR the status or role of an organism in its habitat

- A niche can be explained using the example of a human population within a city.

  - groups of people are identified by their way of life, e.g. educator, surgeon, security guard, etc

  - each group can then be subdivided, e.g. the educator role includes: pre-school teachers, biology teachers, etc

- A niche can be identified in terms of the degree of use of resources e.g. where it lives, what it eats, when it feeds

Environmental Factors

- The various factors that produce the particular conditions in a habitat are called environmental factors.

- BIOTIC or living factors relate to other living organisms in the environment and include factors such as the presence of predators, parasites and competition between members of one species.
- ABIOTIC are non living factors relating to aspects of soil, water, light, shelter, temperature etc.

Biotic & Abiotic Factors Affecting A Crocodile

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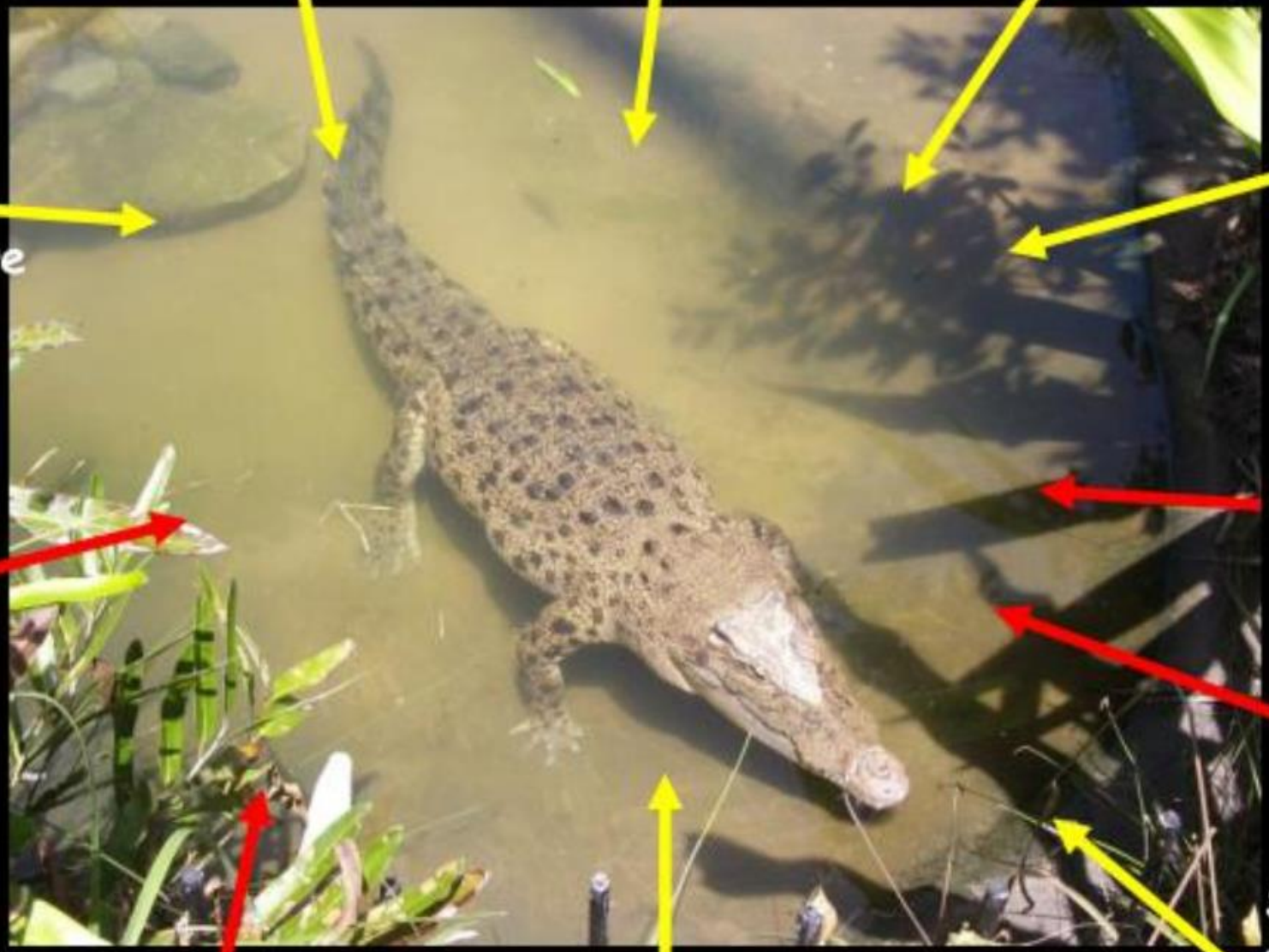

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Environmental factors in water

Some water-related environmental factors in different habitats

Terrestrial habitat, such as open forest	*Aquatic (marine) habitat, such as coastal sea*	*Aquatic (freshwater) habitat, such as river*
• annual rainfall	• salinity of water	• rate of current flow
• seasonal pattern of rainfall	• water temperature	• pH of water
• relative humidity	• dissolved oxygen levels	• water temperature
• rate of run-off	• dissolved nutrients	• dissolved oxygen levels
• soil water	• tidal movements	• dissolved nutrients
• rate of drainage	• wave action	• frequency of flooding
	• clarity of water	• input of waste water

Comparison of the environment and limiting factors for three different organisms.

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	House sparrow	Weddell seal
		
Environment and distribution	terrestrial, aerial, cities	aquatic, marine, Antarctic
Abiotic factors in common	oxygen, water	oxygen, water
Other abiotic factors needed or experienced by the organism	shelter, nest sites, temperatures above freezing	cold water, solid ice near the coast, males need territories under the ice during the breeding season, females prefer solid ice near land
Biotic factors in common	a mate for sexual reproduction, disease-causing organisms	a mate for sexual reproduction, disease-causing organisms
Other biotic factors	seed for food, predators such as cats, humans who provide food	the predatory leopard seal and the killer whale, availability of prey (fish and crabs) for food

Micro-environments

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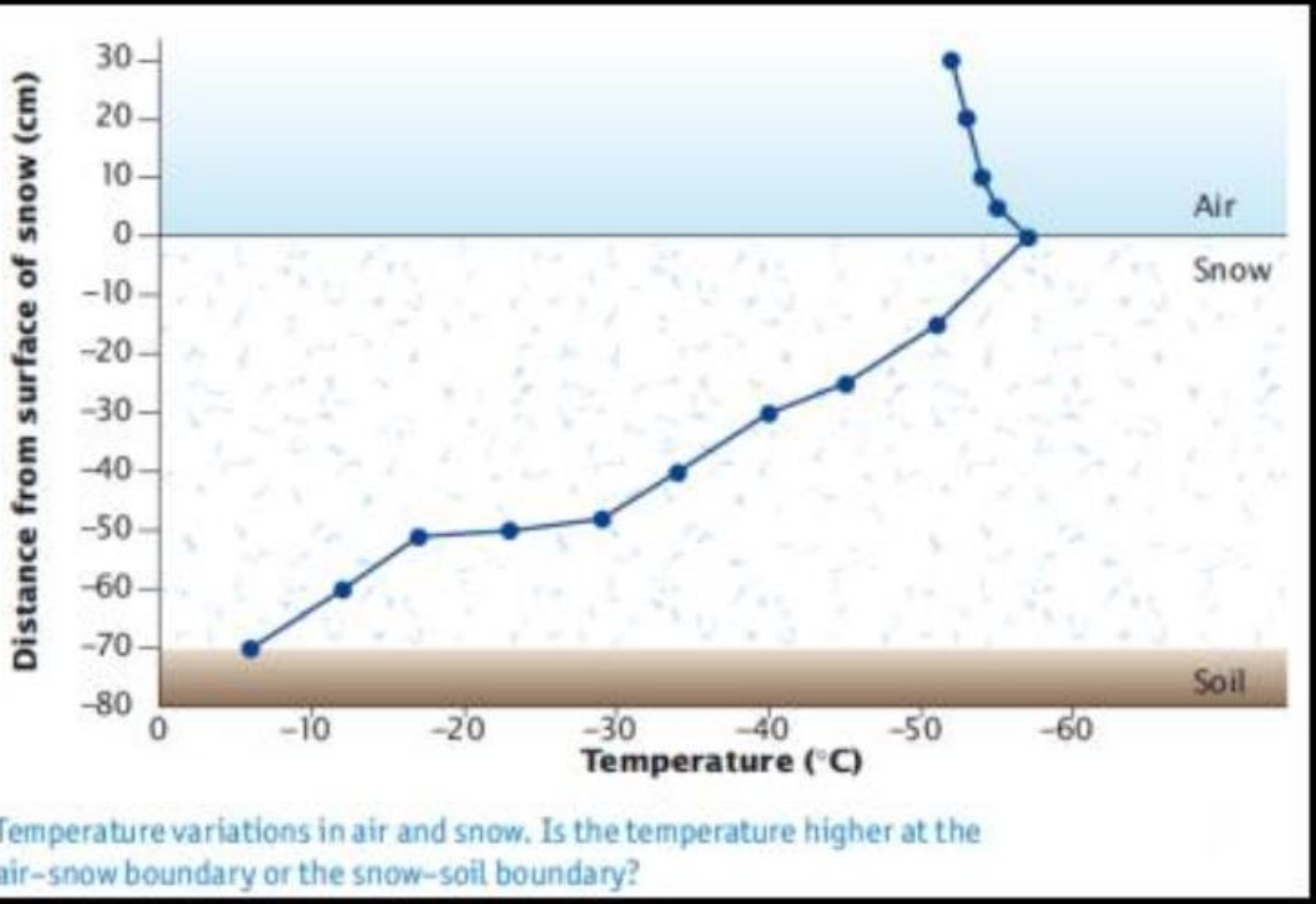
- Conditions in a small region of habitat
- Many of these can be found within an environment

For example
In Arctic winter
air temp above
snow-covered
may be colder
than the temp
within the snow
layer...
forming different
micro-environments



Temperature variations in air and snow. Is the temperature higher at the air–snow boundary or the snow–soil boundary?

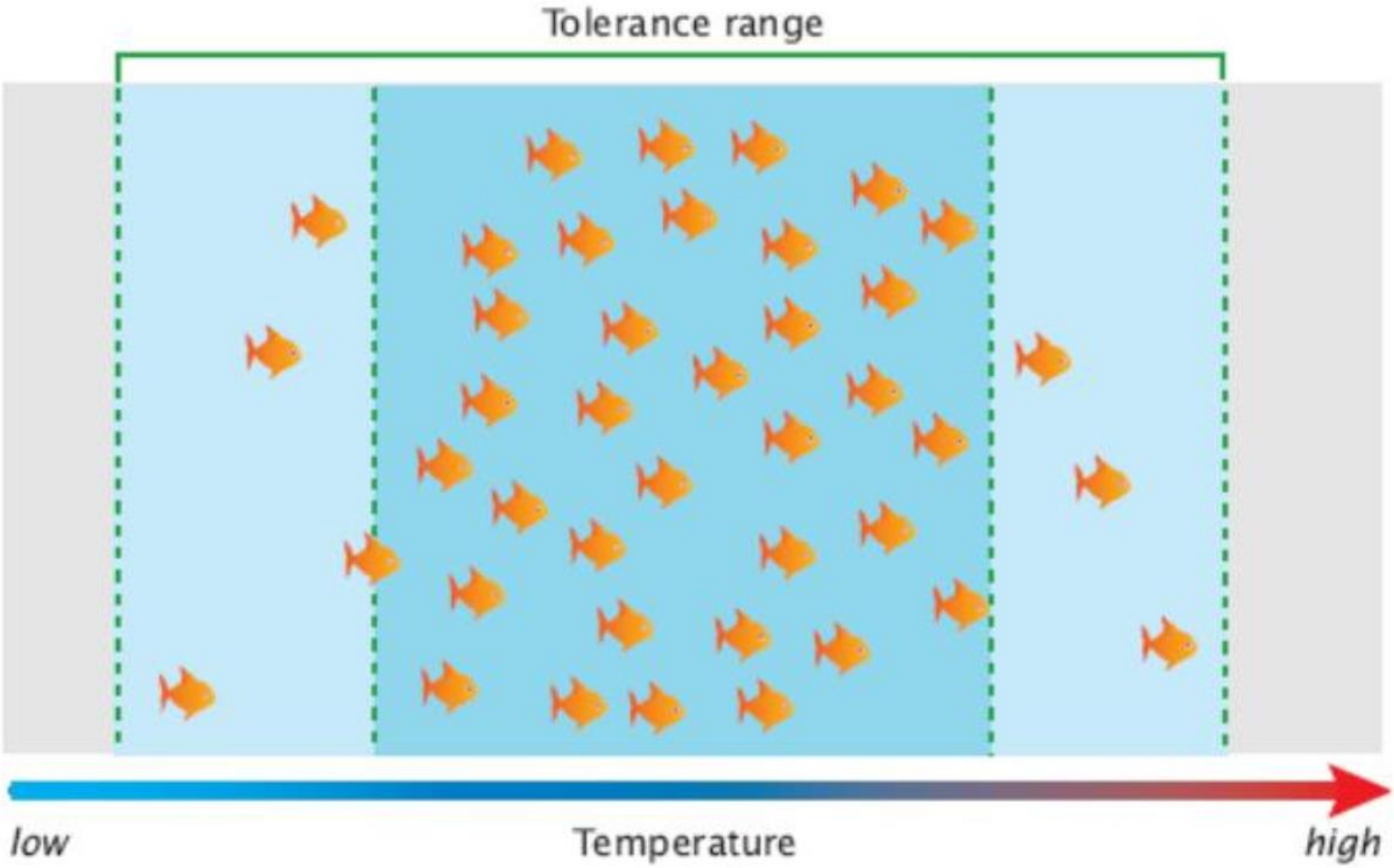
Range

- The geographic area that encloses all the habitats where the species lives denotes the range or distribution map of the species.

Present range of the Numbat (*Myrmecobius fasciatus*). Their range is shrinking because of feral predators.

Tolerance Range

- Conditions in which an organism can survive. Beyond these conditions are detrimental.
- The tolerance range of organism affects an organisms distribution.



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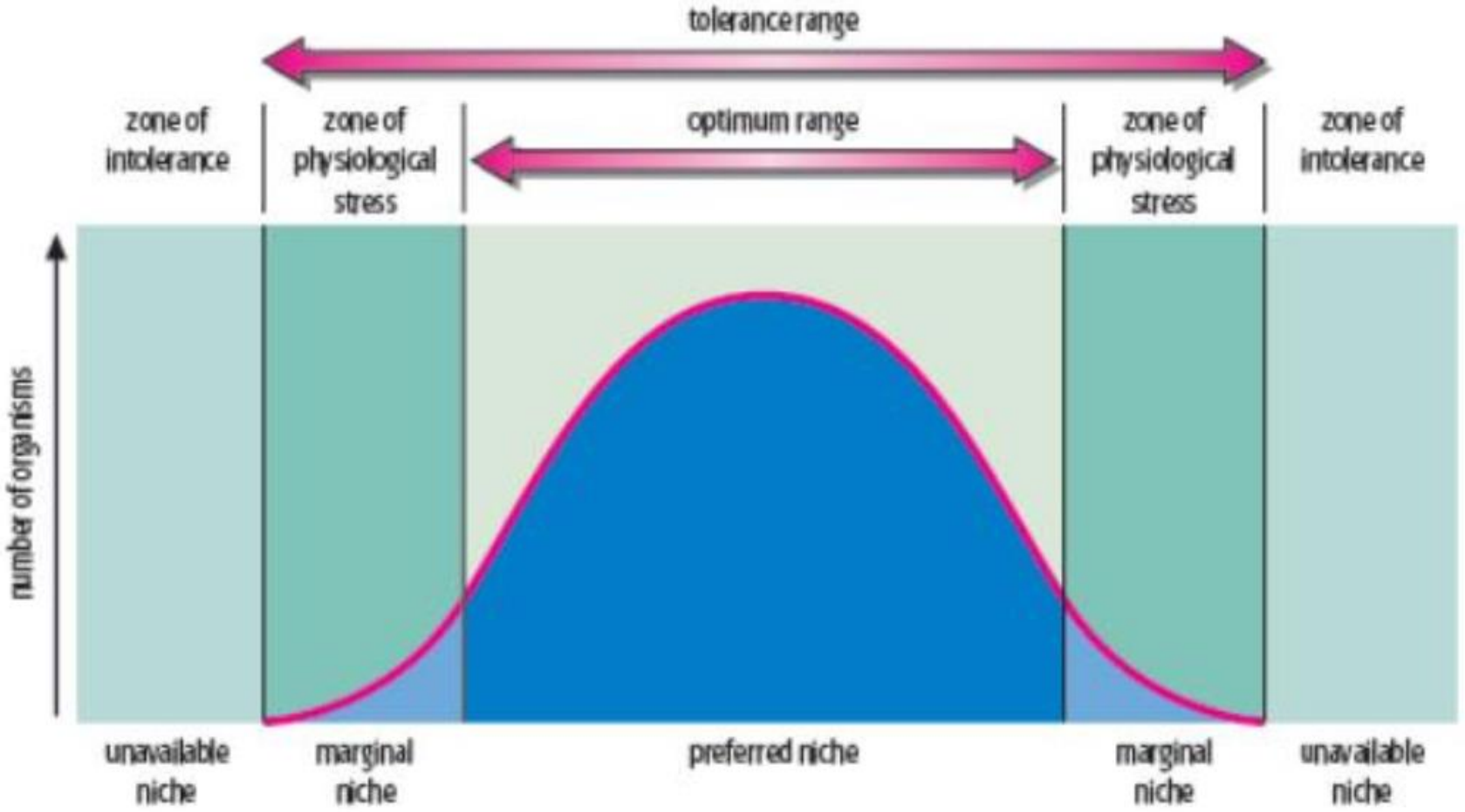
Tolerance Range



Limiting Factors

- A requirement that is in short supply can affect the organisms survival and reproduction of an organism.
  - E.g. Light, water, oxygen, carbon dioxide

Describing environmental conditions

- An environment can be described in qualitative terms, such as 'warm and humid' where 'warm' refers to the air temperature and 'humid' refers to the water vapour content of the air.
- An environment may also be described in quantitative terms where a numeric value is stated, such as, 'the air temperature is 23°c'.
- When scientists measure environmental factors in a habitat, they usually express their findings in quantitative term. Some of the devices are shown on the next slide.

Monitoring Physical Factors

Devices for measuring the physical factors in the field include the following meters:

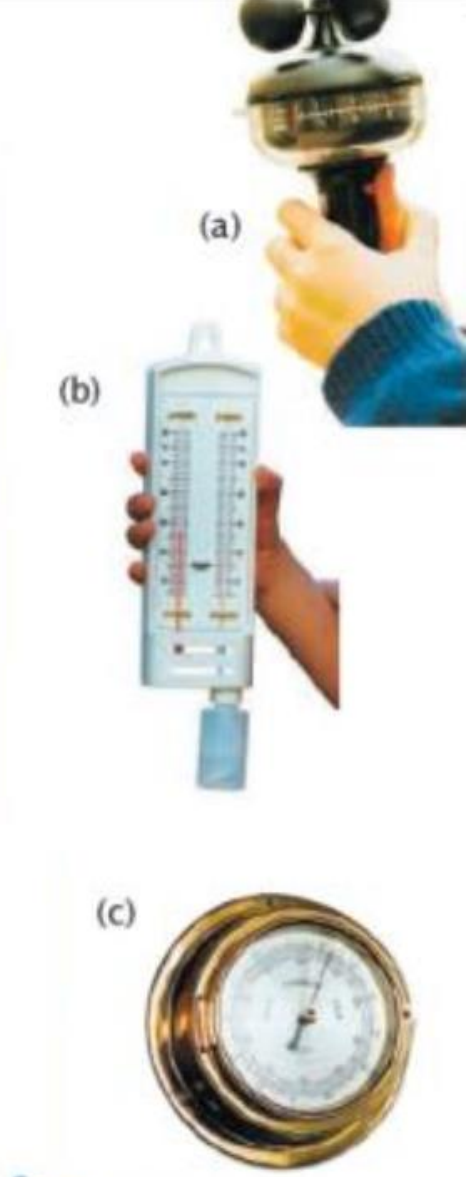
- Quantum light meter
- Dissolved oxygen
- Oxygen meter
- pH meter
- Total dissolved solids (TDS) meter
- Current meter
- Multi-purpose meter
- Hygrometer
- Wind meter
- Other equipment includes:
  - Secchi discs
  - Nansen bottles

Pasco datalogger with attached sensor

Some instruments used in measuring some environmental factors. Several of these instruments can be combined into a single device.

Environmental factor	*Value units*	*Instrument*
Temperature	degrees Celsius	thermometer
Air velocity	metres per second	anemometer
Wet	percentage humidity*	hygrometer
Atmosphere pressure	hectopascals	barometer
Light	lumen per square metre	light meter
Humidity	gram water per gram dry soil	moisture meter
Hardness of water	gram per litre	conductivity meter

* The amount of water in air at a particular temperature compared with what it can hold.



Some instruments that are used in measuring environmental factors in a habitat: (a) an anemometer measures wind speed (b) a hygrometer measures relative humidity (c) a barometer measures air pressure.

Testing Water

- Why is water important?
- Why test water?
- Research the following water qualities and why we need to test them:
  - Turbidity
  - Sulfates
  - Nitrates
  - Temperature
  - pH

Types of adaptations

- Adaptations enable organisms to survive in the conditions in which they normally live
- An adaptation can be anatomical, physiological or behavioural
- **Anatomical adaptations**
  - Structural or physical features
  - Example: The white fur of a polar bear provides camouflage in the snow so it has less chance of being detected by prey
- **Physiological adaptations**
  - Biological processes within the organism
  - Example: Mosquitos produce chemicals that stop the animal's blood clotting when they bite, so that they can feed more easily
- **Behavioural adaptations**
  - The way an organism behaves
  - Example: Cold-blooded reptiles bask in the sun to absorb heat

Types of Adaptations Table

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Organism	Vulpes zerda (Fennec fox)	Sulfolobus acidocaldarius (Prokaryote)
Description	A species of fox that lives in the deserts of North Africa.	A thermophilic archaean that lives in volcanic springs with temperatures around 80°C.
Anatomical adaptations	Large ears and eyes for good hearing and vision when hunting at night. Large ears help to lose heat during the day. Thick fur retains heat when hunting during cold nights.	Contains an enzyme that supercoils DNA, making it very compact and able to withstand extreme heat. Proteins have many polar amino acids that form many hydrogen bonds and ionic bonds, stabilising the tertiary protein structure to reduce the chance of denaturation.
Physiological adaptations	Kidneys reabsorb a lot of water, making urine very concentrated and helping to avoid dehydration. This enables them to survive solely from the water in their food if necessary.	Produces heat shock proteins that protect the cell against damage in response to high temperatures. Produces a heat-resistant DNA polymerase enzyme so replication can still occur even at extreme temperatures.
Behavioural adaptations	Nocturnal, staying in aburrow underground during the day. Avoids the heat of the day and falling prey to eagles.	Forms a matrix that sticks individual cells together to form biofilms that are better able to withstand high temperatures.

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Plant Adaptations In Different Habitats.

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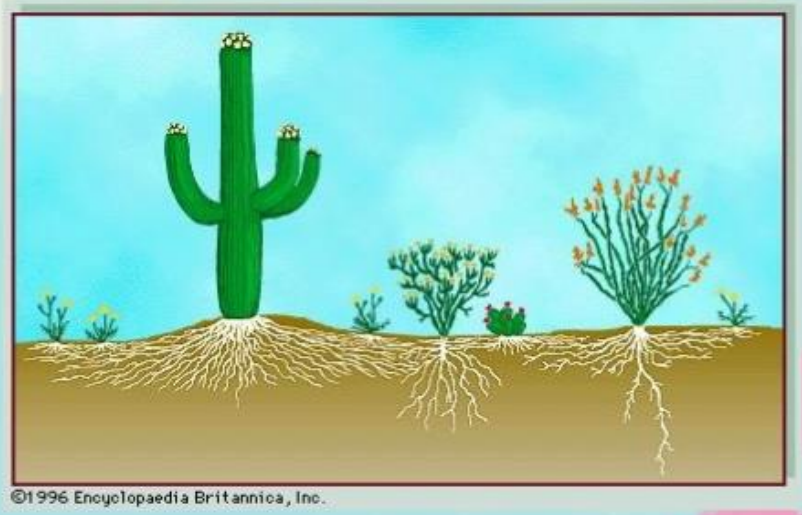
The Desert

- Plants called succulents store water in their stems or leaves.
- Long root systems spread out wide or go deep into the ground to absorb water.



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Grassland

- Some prairie trees have thick bark to resist fire.
- Soft stems allow praire grasses to bend in the wind
- Long and large root system prevents grazing animals from pulling roots out of the ground.

Tropical Rainforest

- Some plants climb on others to reach sunlight.
- Plants have shallow roots to help capture nutrients from the top level of soil.

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Temperate Rain Forest

- Trees can grow very tall due to amount of precipatation.
- Mosses/Ferns grow on top of other plants to reach light.

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The Tundra

- Plants are dark in color, this helps them absorb solar heat.
- Some plants grow in clumps to protect one another from the cold.

Examples

Marram Grass

-Very long roots to search for water deep down in sand dunes.

Prickly Pear Cactus

- Fleshy stem to store water
- Leaves reduce to spines that acts as a defense from herbavores.

Pine tree

-Leaves are needle shaped to resist wind damage.

pine tree

Marram grass

prickly pear cactus

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Different Types of Leaves

Leaves high in the tree canopy tend to be smaller in size. Leaves in the lower tree canopy are larger in size.

Needle shaped leaves have a very low light absorb surface area. Each needle is not able to capture very much light.

"Trees with needle leaves are suited to sites that have drier soil. They can also photosynthesize in the middle of winter creating more energy."

CONCLUSION

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- There's no threshold for the spatial extend of environment/habitat/biome in terms of square meters
- Parameters of variability depend on particular type of environment/habitat/biome, e.g. the camels' habitat has a high temperature, the polar bears' habitat has a low temperature
  - ⇨ impossible to make general statements about "habitats"
- Environments/ habitats/ biomes contain other geographic features described by other concepts

CONCLUSION

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THANK YOU FOR ATTENTION!