



ARCTIC ECOSYSTEM

The Arctic ecosystem is a unique and fragile environment characterized by extreme cold temperatures, long periods of darkness and light, low precipitation, and the presence of permafrost. Some of the main characteristics of the Arctic ecosystem are:

- 1 – Tundra vegetation:** The Arctic ecosystem is dominated by tundra vegetation, which is characterized by low-growing plants, such as mosses, lichens, and dwarf shrubs. The vegetation is adapted to the harsh climate and low nutrient availability.
- 2 – Permafrost:** The Arctic ecosystem has a layer of permanently frozen ground, known as permafrost. The permafrost is an important characteristic of the Arctic ecosystem, as it affects the soil moisture, vegetation, and water availability.
- 3 – Ice and snow:** The Arctic ecosystem is covered by snow and ice for most of the year. The ice and snow play a crucial role in reflecting sunlight and maintaining the cold temperatures in the Arctic.
- 4 – Cold and dark:** The Arctic ecosystem is characterized by long periods of darkness and light, extreme cold temperatures, and low precipitation. The cold temperatures limit the growth of vegetation and the amount of available water.
- 5 – Biodiversity:** Despite the harsh conditions, the Arctic ecosystem is home to a diverse range of species, including polar bears, Arctic foxes, reindeer, muskoxen, and various bird species. The biodiversity of the Arctic ecosystem is threatened by climate change and human activity.

Overall, the Arctic ecosystem is a unique and fragile environment that is adapted to extreme cold temperatures and low nutrient availability. The ecosystem is home to a diverse range of species and plays a crucial role in regulating the Earth's climate.





SAHARA DESERT ECOSYSTEM

The Sahara desert ecosystem is a harsh and arid environment that is home to a variety of species that have adapted to survive in the extreme conditions. Some of the main characteristics of the Sahara desert ecosystem include

- 1 – Extreme temperatures:** The Sahara desert is known for its high temperatures, with daytime temperatures often exceeding 49 degrees Celsius and nighttime temperatures dropping to below freezing. These extreme temperatures make it difficult for most living organisms to survive.
- 2 – Low precipitation:** The Sahara desert is one of the driest places on Earth, receiving less than 10 cm of rain per year. This means that water is scarce and most plants and animals have to be adapted to survive in a desert environment.
- 3 – Sand dunes:** The Sahara desert is dominated by vast sand dunes that can reach heights of over 182 meters. The sand dunes are constantly shifting due to the wind, making it difficult for plants and animals to establish themselves.
- 4 – Sparse vegetation:** The Sahara desert is home to a variety of plants, but they are generally sparse and adapted to survive in the arid environment. Examples of vegetation found in the Sahara include acacia trees, date palms, and desert grasses.
- 5 – Adapted species:** Many species in the Sahara desert have adapted to survive in the extreme conditions. Examples include camels, which can go long periods without water and store fat in their humps, and fennec foxes, which have large ears to help dissipate heat.

Overall, the Sahara desert ecosystem is a harsh and challenging environment, with extreme temperatures, low precipitation, and sparse vegetation. However, a variety of species have adapted to survive in the desert, making it a unique and important ecosystem



CLIMATE CHANGE IN THE ARCTIC

1- Increased Temperatures and Rainfall: The Arctic is warming at a rate approximately three times faster than the global average. In Svalbard, annual temperatures and annual precipitation are expected to increase, with rain storms becoming more frequent and more intense. This will lead to shorter snow seasons, increased flooding, landslides and avalanches.

2- Sea Ice Loss: The continued warming of the Arctic has led to the loss of sea ice, with both extent and thickness decreasing over time. This loss of sea ice has profound implications for Arctic ecosystems, wildlife habitats, and indigenous communities reliant on ice-dependent species.

3- Glacier Retreat: Arctic glaciers are rapidly retreating due to rising temperatures, leading to the loss of freshwater reserves and contributing to global sea-level rise. Glacier meltwater also impacts local ecosystems and freshwater availability.

4- Permafrost Thaw: Permafrost, or permanently frozen ground, is thawing in many areas of the Arctic due to rising temperatures. Thawing permafrost releases stored greenhouse gasses such as methane and carbon dioxide, further exacerbating global warming.

5- Ecosystem Changes: Climate change is altering Arctic ecosystems, affecting the abundance, distribution, and behavior of species adapted to cold environments. Changes in sea ice dynamics, temperature, and precipitation patterns can disrupt food webs and ecosystem functions.

6- Human Impacts: Indigenous communities in the Arctic are particularly vulnerable to the impacts of climate change, as their traditional ways of life are closely tied to the environment. Rising temperatures, melting ice, and changes in wildlife distribution and abundance can affect food security, cultural practices, and overall well-being.

7- Global Feedback Effects: Changes in the Arctic have far-reaching implications for the global climate system. The loss of reflective sea ice and snow cover reduces the Earth's albedo, leading to increased absorption of solar radiation and further warming. This feedback loop contributes to the acceleration of climate change worldwide.

Climate change is transforming the Arctic at an unprecedented rate, with profound consequences for the region's ecosystems, communities, and the Earth's climate system as a whole. Adaptation and mitigation efforts are essential to address the impacts of climate change and build resilience in the Arctic and beyond.





CLIMATE CHANGE IN THE SAHARA

1- Increased Temperatures: Rising global temperatures are likely to exacerbate the already extreme heat in the Sahara Desert. This can lead to more frequent and intense heat waves, further stressing both human populations and ecosystems.

2- Changes in Precipitation Patterns: Climate models suggest that precipitation patterns in the Sahara may shift, leading to changes in the timing, intensity, and distribution of rainfall. Some areas may experience increased rainfall, while others may become even drier.

3- Desertification: The combination of rising temperatures and altered precipitation patterns could accelerate desertification in the Sahara. This process involves the expansion of desert landscapes at the expense of more fertile areas, leading to soil degradation, vegetation loss, and increased desert-like conditions.

4- Water Scarcity: Changes in precipitation patterns and increased temperatures may exacerbate water scarcity in the region. This can have significant implications for human populations and ecosystems reliant on limited water resources for survival.

5- Ecosystem Changes: Climate change is likely to disrupt fragile desert ecosystems in the Sahara. Shifts in temperature and precipitation patterns may alter the distribution of plant and animal species, leading to changes in biodiversity and ecosystem dynamics.

6- Impacts on Human Communities: Climate change poses challenges for human communities living in the Sahara Desert. Water scarcity, food insecurity, and increased frequency of extreme weather events can threaten livelihoods and exacerbate socio-economic vulnerabilities.

Climate change is expected to have far-reaching impacts on the Sahara Desert, affecting both natural ecosystems and human societies in the region. Adaptation strategies will be crucial for mitigating these impacts and building resilience to a changing climate.



GLACIERS

A glacier is a persistent body of dense ice that is constantly moving under its own weight. A glacier forms where the accumulation of snow exceeds its ablation over many years, often centuries. Glaciers are important components of the global cryosphere.

- 1 – Made of ice:** Glaciers are massive bodies of ice that form over many years as snow accumulates and compacts into ice.
- 2 – Movement:** Glaciers flow and move due to the force of gravity, and can move at speeds ranging from a few centimeters to several meters per day. They can cause erosion and create unique landforms, such as moraines and U-shaped valleys.
- 3 – Shape:** Glaciers can take on a variety of shapes, including bowl-shaped cirques, valley glaciers, and ice sheets.
- 4 – Blue ice:** Glaciers can take on a blue hue, particularly in areas where the ice is compressed and dense. This occurs because the ice absorbs all colors of the visible spectrum except blue, which is scattered back to the surface.
- 5 – Importance to ecosystems:** Glaciers provide important ecosystem services, such as freshwater resources and habitat for a range of plant and animal species. They also play a critical role in regulating global climate by reflecting sunlight and cooling the planet.
- 6 – Importance to humankind:** Glaciers serve as freshwater reservoirs for millions of people around the world, providing a reliable source of water for drinking, irrigation, and a source of electricity production.

Glaciers play a critical role in regulating global climate by reflecting sunlight back into space, thereby cooling the planet. They serve as natural indicators of climate change, with their melting patterns and retreat providing scientists with valuable data about the state of the Earth's climate. Glaciers are also important tourist destinations, attracting visitors from around the world who come to marvel at their stunning beauty and unique ecosystems.





DUNES

A dune is a landform composed of wind- or water-driven sand. It typically takes the form of a mound, ridge, or hill.

- 1 – Made of sand:** Sand dunes are landforms made of sand that have been transported by wind.
- 2 – Shape:** Sand dunes can take on a variety of shapes, including crescent, linear, and star-shaped. They can be small or very large, with some dunes reaching heights of over 600 feet (182 meters).
- 3 – Movement:** Sand dunes are constantly shifting and moving due to the wind, which can create unique patterns and landforms.
- 4 – Location:** Sand dunes are typically found in desert environments, where there is little vegetation to stabilize the sand.
- 5 – Importance to ecosystems:** Sand dunes provide important ecosystem services, such as habitat for a range of plant and animal species. They can also play a role in regulating local climate by reflecting sunlight and reducing temperatures in the surrounding area

The dunes, ergs and hamada (rocky plateaus) make up the Moroccan desert. The desert is an ecosystem of crucial importance for the planet. We still have much to learn from the remarkable adaptive capabilities of its flora and fauna. These capabilities may uncover many answers to the questions about food and healthcare for the future.

<https://www.conservation-nature.fr/ecosysteme/>



ARCTIC PLANTS

VS

DESERT PLANTS

RUBUS CHAMAEMORUS

APPLE OF SODOM – CALOTROPIS PROCERA

ARCTIC PLANTS

Arctic plants have evolved a number of adaptations that allow them to survive and thrive in the harsh conditions of the Arctic. Here are some ways in which arctic plants are adapted to their environment:

- 1 – Short growing season:** Arctic plants have a short growing season, so they must be able to grow and reproduce quickly. Many arctic plants are able to flower and set seed within a few weeks of the snow melting.
- 2 – Shallow root systems:** Arctic soils are often shallow and nutrient-poor, so many arctic plants have shallow root systems that allow them to access nutrients close to the surface.
- 3 – Low-growing habit:** Many arctic plants grow close to the ground in order to avoid the wind and conserve heat. This low-growing habit also helps to protect the plants from herbivores.
- 4 – Photosynthesis adaptations:** Some arctic plants have adapted to the low light levels of the Arctic by developing larger chloroplasts or more chlorophyll in their leaves, which allows them to photosynthesize more efficiently.
- 5 – Drought tolerance:** Arctic plants must be able to survive long periods of drought and cold temperatures. Some Arctic plants have adapted by developing succulent leaves or stems that can store water, while others have waxy or hairy leaves that help to reduce water loss through transpiration.
- 6 – Reproductive adaptations:** Many Arctic plants possess the dual capability of sexual and asexual reproduction. They depend on wind or insects for pollination and are also capable of self-pollination. Some arctic plants are also able to reproduce asexually, which allows them to quickly colonize new areas without the need for pollination.

These adaptations allow Arctic plants to survive in one of the most extreme environments on Earth, where temperatures can drop to below freezing and the growing season is short. By adapting to these harsh conditions, Arctic plants are able to provide important habitat and food sources for a wide range of animals that are also adapted to life in the Arctic.





ZYGOPHYLLUM

SVALBARD'S POPPY – PALENDERBUKTA

DESERT PLANTS

Desert plants have evolved a variety of adaptations that allow them to survive and thrive in the hot, dry, and often harsh conditions of desert environments. Here are some ways in which desert plants are adapted to their environment:

- 1 – Drought tolerance:** Desert plants have adapted to the arid conditions of the desert by developing drought-tolerant structures and mechanisms that allow them to conserve water. Many desert plants have small leaves or no leaves at all, reducing water loss through transpiration. Others have thick, fleshy stems and leaves that can store water for long periods of time.
- 2 – Root adaptations:** Desert plants have extensive root systems that can reach deep underground in search of water. Some desert plants also have shallow, spreading roots that allow them to absorb as much water as possible when it does rain.
- 3 – Photosynthesis adaptations:** Some desert plants have adapted to the intense sunlight of the desert by developing specialized pigments and structures that allow them to photosynthesize efficiently. For example, some cacti have modified their leaves into spines that protect them from the intense sunlight, while allowing them to carry out photosynthesis.
- 4 – Reproductive adaptations:** Many desert plants have adapted to the harsh environment by developing reproductive strategies that allow them to take advantage of rare rain events. Some plants produce seeds that can lie dormant for years, waiting for the right conditions to germinate. Others have evolved to reproduce asexually, allowing them to quickly spread and colonize new areas.
- 5 – Mutualistic relationships:** Some desert plants have developed mutualistic relationships with animals such as insects, birds, and bats. These animals pollinate the plants and help to spread their seeds, while the plants provide food and shelter for the animals.
- 6 – Heat tolerance:** Desert plants must also be able to tolerate high temperatures during the day and low temperatures at night. Some desert plants have adapted by closing their stomata during the day to reduce water loss and opening them at night to take in carbon dioxide.

These adaptations allow desert plants to survive in one of the harshest environments on Earth, where temperatures can soar to over 40 degrees Celsius during the day and drop to near freezing at night. By adapting to these harsh conditions, desert plants are able to provide important habitat and food sources for a wide range of animals that are also adapted to life in the desert.



RANGIFER TARANDUS PLATYRHYNCUS

SVALBARD REINDEER

The Svalbard reindeer (*Rangifer tarandus platyrhynchus*) is a subspecies of reindeer that inhabits the Arctic archipelago of Svalbard, located between Norway and the North Pole. Here are some ways in which the Svalbard reindeer is adapted to its environment:

- 1 - Thick fur coat:** Svalbard reindeer have a thick fur coat that provides insulation from the cold temperatures and wind of the Arctic. Their fur is also white in winter, which provides camouflage in the snow.
- 2 - Adapted diet:** The Svalbard reindeer is herbivorous and has adapted to survive in a harsh, Arctic environment by feeding on lichens, mosses, and other low-growing plants that can survive in the harsh conditions.
- 3 - Large hooves:** Svalbard reindeer have large, concave hooves that provide traction on the icy and snowy terrain, allowing them to move around more easily in their environment.
- 4 - Energy conservation:** During the long, dark Arctic winters, the Svalbard reindeer conserves energy by reducing its activity levels and lowering its metabolism. In addition, during periods of low food availability, they can live off of their fat stores for extended periods of time.
- 5 - Reduced predator risk:** The Svalbard reindeer evolved with no natural predators allowing it to develop a relatively low level of fear and an absence of defensive behaviors. However, it has been documented that polar bears hunt adults to supplement their diets in summer due to low sea ice, and the Arctic fox can prey on small calves.

These adaptations have allowed the Svalbard reindeer to survive and thrive in the extreme conditions of the Arctic, where few other species are able to exist.





CAMELUS DROMEDARIUS

CAMEL

The camel is a large, long-legged, and even-toed ungulate that is well adapted to life in arid regions of the world, such as deserts. Here are some ways in which camels are adapted to their environment:

- 1 - **Water conservation:** Camels can survive for long periods without drinking water, thanks to their ability to store water in their body tissues. Camels can drink up to 100 liters of water at once and can survive for up to several weeks without drinking again.
- 2 - **Adapted diet:** Camels have a specialized diet that is well suited to their environment. They can eat thorny, dry, and prickly plants, as well as foliage that is unpalatable or toxic to other herbivores. Camels can also extract more nutrients from their food than other animals, which allows them to survive in harsh desert environments.
- 3 - **Thick fur coat:** Camels have a thick, shaggy coat that protects them from the heat of the day and the cold of the night. The coat also provides insulation, helping them to retain moisture and regulate their body temperature.
- 4 - **Large, padded feet:** Camels have large, padded feet that spread out when they walk, which helps them to walk on sand without sinking. Their feet are also covered with tough skin, which protects them from the hot desert sand.
- 5 - **Efficient respiration:** Camels have adapted to the harsh desert environment by developing a respiratory system that is highly efficient at conserving water. They exhale warm, moist air, which condenses in their nasal passages and is then reabsorbed back into their body, reducing water loss.
- 6 - **Behavioral adaptations:** Camels have evolved a number of behavioral adaptations to survive in their environment, including their ability to travel long distances in search of food and water, their social organization, and their ability to protect themselves from predators.

These adaptations allow camels to thrive in some of the harshest and most inhospitable environments on Earth, making them invaluable to the people who rely on them for transportation and sustenance.



Vulpes lagopus

ARCTIC FOX

The Arctic fox (*Vulpes lagopus*) is a species of fox that is well-adapted to survive in the harsh, cold climate of the Arctic regions. Here are some of the ways in which they are adapted to their environment:

- 1 - Thick fur coat:** Arctic foxes have a thick, dense fur coat that keeps them warm in temperatures as low as -50°C . The fur coat also changes color seasonally to blend in with the snow and tundra, providing excellent camouflage.
- 2 - Small size:** The Arctic fox is relatively small, with a body length of about 50–60 cm and a weight of 2.5–9 kg. This small size helps to reduce heat loss and conserve energy in the cold environment.
- 3 - Thick fur on their paws:** Arctic foxes have thick fur on their paws that act as insulation, helping to keep their feet warm on the ice and snow.
- 4 - Excellent hearing:** Arctic foxes have excellent hearing, which helps them to locate prey that is hiding under the snow. They can also detect the sound of lemmings running under the snow, which is one of their main food sources.
- 5 - Adapted diet:** Arctic foxes are omnivores and their diet varies depending on the season. In summer, they eat small mammals, birds, and eggs, while in winter, they rely mostly on lemmings. They are also able to survive on carrion and plant material when food is scarce.
- 6 - Ability to conserve energy:** In winter, when food is scarce, Arctic foxes are able to reduce their metabolic rate by up to 30% in order to conserve energy. They can also store food in their dens to sustain them during periods of low food availability.

These adaptations allow the Arctic fox to thrive in one of the harshest environments on Earth, and they have successfully adapted to life in the Arctic for thousands of years.





Vulpes zerda

FENNEC FOX

The fennec fox (*Vulpes zerda*) is a small fox species that inhabits the Sahara desert of North Africa. Here are some ways in which the fennec fox is adapted to its environment:

- 1 - Large ears:** Fennec foxes have large ears, which help them dissipate heat and regulate their body temperature. The ears also have a large surface area, which helps them to hear the movements of prey and predators, locate underground prey, and communicate with other foxes.
- 2 - Adapted diet:** Fennec foxes are omnivorous and opportunistic feeders, which means they eat a wide variety of foods, including insects, small mammals, birds, reptiles, and fruit. They are able to go long periods without water by obtaining most of their moisture from their food.
- 3 - Insulated fur:** Fennec foxes have a thick coat of fur, which insulates them from the heat of the desert during the day and the cold at night. Their fur also helps them to blend in with the desert sand.
- 4 - Digging behavior:** Fennec foxes have long, sharp claws that help them dig burrows in the sand. These burrows provide protection from predators and the extreme temperatures of the desert.
- 5 - Nocturnal behavior:** Fennec foxes are primarily nocturnal, which means they are active mainly at night when temperatures are cooler. This helps them to avoid the hottest parts of

The fennec fox is the smallest species of fox and is well-adapted to its hot and arid desert environment.



POLAR BEAR

The polar bear (*Ursus maritimus*) is highly adapted to its harsh Arctic environment. Here are some of the ways in which the polar bear is adapted.

- 1 – Two Layers of Fur:** Polar bears have 2 layers of fur that prevent almost all heat loss. In fact, the fur keeps them so warm that adult males can quickly overheat when they run.
- 2 – Large body size:** Polar bears are the largest land predators in the world, with males weighing up to 680 kgs. Their large size helps them conserve body heat and provides them with the strength needed to hunt and capture prey.
- 3 – Webbed paws:** The polar bear has partially webbed paws that help it swim efficiently through the icy Arctic waters.
- 4 – Thick layer of blubber:** The polar bear has a thick layer of blubber beneath its skin that provides insulation and serves as an energy reserve during times of food scarcity.
- 5 – Excellent sense of smell:** The polar bear has an excellent sense of smell, which helps it locate prey, such as seals, under the ice.
- 6 – Adapted diet:** The polar bear is adapted to a diet of primarily fat-rich marine mammals, such as seals, which provide the high-energy food needed to survive in the Arctic.
- 7 – Seasonal adaptations:** During the summer months, when sea ice melts and hunting is more difficult, polar bears live off their body's fat reserves during the summer and may eat berries, eggs, kelp and reindeer.

Overall, the polar bear's adaptations have allowed it to survive and thrive in one of the harshest environments on Earth. However, climate change and other human activities are threatening the polar bear's habitat and food sources, making their future uncertain.





The last photograph taken of a wild Atlas lion from flight from Casablanca-Dakar in 1925.

ATLAS LION

There are no longer any big carnivores in Morocco today. The Atlas lion (*Panthera leo leo*), also known as the Barbary lion, was a subspecies of lion that is now extinct in the wild. It used to be found throughout North Africa.

The last wild specimens disappeared around the mid-20th century. Less than a hundred Atlas lions remain in captivity. The Atlas bear and Barbary leopard, the two other main predators in North Africa, are now respectively extinct and near extinction.

This reminds us that an animal or plant species disappears every 20 minutes, which means 26,280 species disappear each year.

Nearly a quarter of animal and plant species could disappear by the middle of the century due to human activities

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Special thanks to Florian Ledoux for authorizing us to use some of his amazing photos.

Educating through emotion, through discovery and experience, and creating empathy with nature are the best ways to awaken young people to the seriousness of climate change. We believe that learning to explore differently, to understand in order to better preserve, and simply to act while having a good time are important.

WE BELIEVE THE OUTDOORS CHANGES LIVES

THANK YOU ! / TAKK / شكراً

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