

GEOGRAPHY

Analysis the biophysical interactions that contribute to the unique characteristics of an ecosystem at risk.

The four components of the biophysical environment, which are the atmosphere, lithosphere, hydrosphere and biosphere, play a vital role in determining the shape and nature of the Australian alpine ecosystem at Kosciuszko and coastal dune ecosystems. How these four spheres interact with one another and the ecosystem contribute to the unique characteristics of an ecosystem.

An alpine ecosystem is the area that lies above the treeline. In Australia, this is considered to be approximately 1850 m above sea level. The cool climate, high altitude, land formations and flora and fauna are factors that characterize alpine ecosystems.

Coastal dunes, like the ones found at Narrabeen and Collaroy, are very fragile ecosystems, consisting of massive accumulations of sand that are created by the actions of the wind and water. Coastal dunes are location behind the active zone of the beach, an area that is prone to destruction.

The Atmosphere

The atmosphere is the main source of the climatic factors characterizing an ecosystem. Temperature and the amount of rainfall determine the nature of all the elements within the ecosystem. Climate in the alpine area is widely determined by its latitude and altitude. This is because for every 1000 m rise in altitude there is a 6.5°C drop in air temperature. This is called the environmental lapse rate and occurs because the atmosphere is not warmed directly by the sun. Temperature falls as altitude increases because there is:

- A decrease in water vapor.
- A decrease in land area.
- A decrease in density and pressure of air.

Kosciuszko is located at a latitude and longitude of 36°S and 148°E and at an altitude of 1800-2227 m above sea level. This location results in the area experiencing a mid-latitude mountain climate with no dry seasons and a mild summer. An extreme level of high precipitation often falls in winter, and usually comes in the form of snow due to the cool temperature of around -25°C, which covers the higher altitudes for many months at a time. The Kosciuszko alpine area experiences rain, hail, snow, sleet, frost, strong westerly winds, low temperatures and frequent blizzards during the winter and spring months. During summer the temperature fluctuates from 9°C to above 30°C on a sunny day. This cool climate is a unique characteristic of the Kosciuszko alpine area.

In coastal dune ecosystems the atmosphere plays a role in the formation of the dunes. The three components of wind, temperature and precipitation have a significant impact on the development of the coastal dune ecosystem. The climate of the area is also very important.

The movement of sand by the wind is referred to as Aeolian transport. The volume of the sand transported is dependent on the size of the sand particles, the velocity of the wind, the local topography and the nature of the vegetation cover. The potential of the wind to transport sand is also affected by the local conditions, especially the degree of protection the sand has from the prevailing wind. The dunes at Narrabeen and Collaroy are protected and stabilized by the coastal vegetation, such as spinifex and pig face, from the prevailing winds. In the summer the prevailing winds are North Easterly and in the winter they are Southerly.

Temperature also plays an important role in determining the rate at which the beach sand dries up and the type of vegetation that grows there. The levels of precipitation are also important in determining the nature and type of the vegetation binding the sand together. The areas that have low or irregular rainfall are most likely to remain unstable and support little vegetation. Collaroy/Narrabeen has a fairly constant average precipitation, with higher levels occurring in winter. This consistently, allows the dunes to hold a variety of vegetation that supports the dune system. This development of the coastal dunes is a factor that makes it unique.

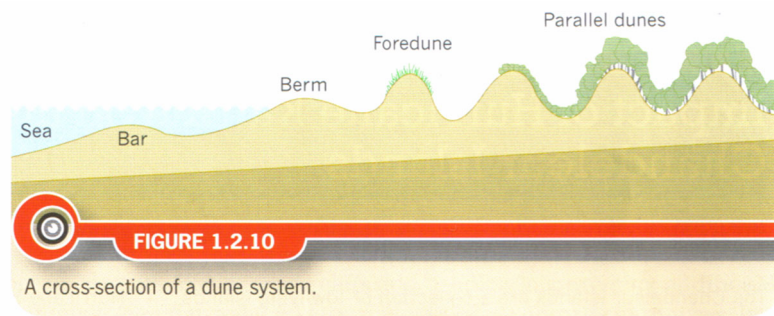
The Lithosphere

The lithosphere determines the nature of soils landscapes and provides habitats for many organisms. The Australian Alps (alpine region) are constantly changing landscape, with climate and geological processes continually at work, reshaping the land and impacting the soils. Over the year's harsh erosion and weathering, such as geomorphic processes, and glaciation have continued to shape the alpine landscape, adding to its uniqueness. Over time the weathering away of soils and vegetation have created a change in the ecosystem. The rocks that were once under the soils are now emerged and exposed, providing protection for the flora and fauna. Due to the long periods of erosion these boulders of granite have become rounded. Under the remaining soils plateaus have been created. Glaciation is also evident in the alpine ecosystem. Glaciation is the force of the snow and ice in the form of glaciers that act to erode the lithosphere, creating what is known as a periglacial landscape, which includes cirques and moraines. Blue Lake and Glacial Lake are two examples of cirque lakes formed within the alpine area.

A distinct feature in the Australian Alps is the presence of soils over the landscape. The soils here are very diverse and shallow. The main soil types that characterize the alpine area are alpine humus soils (the dominate soil type), lithosols and bog soils. As the altitude increases and the temperature starts to fall (atmosphere) the lithosphere is affected in the way that the soils have to adapt. This in turn affects the biosphere as animals start to find it more difficult to survive at the high altitudes.

The mineral and chemical composition of sands vary place to place, affecting the types of dune systems that develop there. Dunes are formed when sediment is brought to the coast, which accumulates around objects, and is then stabilized by the growing vegetation. Coastal dunes are also widely affected by the lithosphere due to coastal erosion. The erosion of dunes reshapes and destroys the dune system. In recent years there has been particular focus on the Collaroy/Narrabeen beachfront, as it is one of the most vulnerable areas in Australia to coastal erosion. Collaroy and Narrabeen have experienced a long history of coastal erosion. This factor that puts the ecosystem at risk contributes to its fragile characteristics. Dune soils are very important for the dune ecosystem. The development of soil enables the dune ecosystem to characterize large plant species to colonise. The main soil type at Collaroy/Narrabeen is sand. There are many different types of dunes, which are a unique characteristic to the ecosystem. The different types of dunes include:

- Foredunes: the first permanent dunes constructed, which act as an important barrier between the sea and inland areas.
- Incipient dunes: initial dunes that develop in front of the foredunes, providing them with sand and protecting them from storms.
- Parallel dunes: form when a new ridge of sand is constructed in front of and parallel to an old foredune.
- Parabolic dunes: long dunes that are shaped like a horseshow and formed by blowouts of the dune system.



The Hydrosphere

The hydrosphere is closely linked to the atmosphere and has to do with the water. One characteristic of the alpine region is that it is an important water storage system. All year round water is stored in either a liquid or frozen state. The ability to hold water and regulate its discharge to rivers flowing out of the alpine area and the environments downslope makes the Australian Alps an important water storage for the eastern coastal catchments and the Murray-Darling Basin. During the winter most of the water is held as snow or ice and held back from the rivers until the warmer seasons come round and melts it. During the summer, stream flows are boosted, ensuring that water is available for most of the year. One of the most common processes characterizing the landscape is due to the erosion of soils caused by water traveling down the mountains. The enormous runoff carries sediment down the mountains with it. This constant erosion can cause small streams to form along the mountain and also creates stony pavements.

Along the coasts, water is a critical factor determining the nature of coastlines. The hydrological processes transport sediment to the coast and move it up and down the coast, via ocean currents and the processes of longshore drift. Longshore drift acts as a transporter of sediment, shaping the coast. In times of heavy rainfall, surface runoff accumulates to form a swale. A swale is a shallow depression between the crests of the dunes, where dune lakes occur. Another feature of dunes is ponding. Ponding occurs when the dunes act like dams, resisting the flow of water to the river, which in turn can cause a major change to the local environment.

The Biosphere

The biosphere is the domain on or near the Earth's surface where the environmental conditions enable solar energy to produce the chemical changes needed for life. The unique endemic flora and fauna characterize the Australian Alps. The alpine area has a wide diversity of vegetation that also provides habitats for the wide range of animals. All the major animal groups are represented in the Australian Alps. There are more than forty native mammals, two hundred bird species, thirty reptiles and many more other animals. Travelling up the mountain there are a wide variety of zones and vegetation communities within them. There are four distinct zones that go up the mountain:

- Lower slopes
- Montane
- Subalpine
- Alpine

Above the tree line, where the alpine area is, there are no trees and vegetation is primarily dwarfed shrubs and ground-hugging herbs. Many of the flora and fauna constantly have to adapt to survive the dynamic conditions. The ground-hugging plants are close to the ground allowing them to stay out of the wind and retain warmth. The fauna also lives entirely under a snow cover during the winter, during this time many hibernate.

The biosphere interacts with the coastal dunes to characterize its unique variety of vegetation. The dune vegetation can be categorized into three zones:

1. Primary colonizing species: those found in the pioneer zone, which are very sand and salt tolerant, such as sand spinifex, marram grass, and pigface.
2. Secondary shrubs – semipermanent heath-like shrubs and small trees that stabilise the foredune, such as coastal banksia, wattle and saltbush.
3. Tertiary species – found beyond the coastal heath, where trees tend to dominate. They are characterised by large amounts of organic matter. Some species include melaleuca, woodlands and lowland rainforests.

In conclusion the four components of the biophysical environment, interact with each other and various ecosystems. The interaction of the biophysical environment contributes widely to the unique characteristics of the Australian alpine area and the coastal dune ecosystems at Collaroy and Narrabeen beach.