GEOGRAPHY

With reference to 2 ecosystems at risk, compare the biophysical interactions that lead to the unique characteristics of ecosystems.

An ecosystem is defined as a set of identifiable interrelationships between organisms and their living environment. Ecosystems are dynamic and exist in a state of equilibrium. They are defined according to their dominant feature – for example the Great Barrier Reef (GBR) ecosystem or the Homebush Bay Intertidal Wetlands ecosystem (ITW). The unique character of ecosystems is determined by the interactions between atmosphere, hydrosphere, lithosphere and biosphere. These factors determine the degree of specialisation in an ecosystem and are, in turn, determined by an ecosystem's location. Often, ecosystems with extreme characteristics, such as the high salinity of the ITW, are the most highly specialised.

The GBR is located off Queensland's east coast, stretching 2300km from Papua New Guinea to Fraser Island. It is composed of an area of 348 500km2, and includes features below the seabed and above the high tide level, 950m into the sky. Its unique atmospheric, lithospheric, hydrospheric and biospheric features make it a highly dynamic and nutrient-rich ecosystem, with a fairly high degree of specialisation. The GBR itself is made of coral polyps, growing on the limestone remains of dead coral.

The Homebush Bay ITW are located 12km outside of Sydney's CBD, on the south bank of the Parramatta River. They are located at 33°15'S, 115°33'E and take up approximately 58ha. The boundaries of this ecosystem are determined by human modifications, for example the heavy traffic roadway in the west and the bund walls in the north. Extreme saline conditions mean this ecosystem in extremely specialised.

Atmospheric conditions are very important in determining the character of an ecosystem. The GBR lies in Qld's cyclonic zone, meaning it is exposed to many extreme weather events. High wind activity causes high wave action, which can chip hard corals and rip apart soft corals. This activity also causes further sediment runoff into the GBR, leading to high turbidity and potentially smothering the coral. However, the effects of cyclones can benefit the GBR, for example Cyclone Larry, which brought cooler waters to the GBD (thus re-establishing optimum temperature conditions) and cleared sediment from the coral.

The Homebush Bay ITW experience a cooler temperature than the surrounding areas and higher humidity than its surrounds. Nutrient-recycling organisms in the soil of the ITW assist in the production of hydrogen sulphide gases, an important part of the ecosystem. The ITW do not experience regular extreme weather events as the GBR does. The hydrospheric conditions of the ITW contribute to high humidity.

The lithospheric interactions in an ecosystem also determine its characteristics. On the GBR, coral polyps secrete calcium carbonate to form limestone beds, which assist in protection from high wave action. Erosion of these limestone beds can lead to the formation of new landforms, such as coral cays. Sediment runoff on the GBR from Qld's land area (around 25% of this area drains into the GBR through 26 major rivers) brings nutrients to the coral reef ecosystem. However, excess sediment runoff can lead to coral being smothered.

The Homebush Bay ITW has a unique soil composition. The soil here is made up of fine particles and is poorly drained, leading to water logging. Soil is composed entirely of organic matter, due to the high rate of nutrient cycling by organisms such as snails. Mangroves in the ITW trap sediment, increasing soil volume. The soil is made of a small aerobic layer and a large anaerobic layer.

These features help to create the high degree of specialisation present in the ITW. Unlike the GBR, where excess sediment has negative effects, sediment is highly valued in the ITW.

Hydrospheric conditions on the GBR operate within a narrow range. Water temperatures are at their optimum for coral growth are between 25 - 35°C. Water depth, for coral survival, should be kept between 2 – 30m. Increases or decreases in these two features have highly adverse effects on the ecosystem. Wave action is important for the dynamic nature of the GBR ecosystem. A reversal of currents in the northern part of the reef in summer brings cooler waters and replenishes nutrients, stabilising conditions on the GBR.

ITW are extremely specialised, due to the highly saline conditions in the hydrosphere. However, the salinity I slow at high tide, when fresh water flushes out the ITW. At low tide, conditions are highly saline. In between, the water is brackish. The temperature of the water, while not as vital for ecosystem health as it is on the GBR, is around 5°C lower than the surrounding water bodies. Saline conditions lead to low flora diversity, as many plants are unable to survive in the extreme conditions. For example, the beaded glasswort actively absorbs fresh water to ensure a balanced salinity.

While the biosphere is largely determined by interactions between the other three spheres, it is also able to alter the characteristics of an ecosystem; High flora and fauna diversity on the GBR contributes to its dynamic nature and leads to high rates of nutrient recycling. The GBR is home to over 4000 fish species, 500 types of coral, 6 turtle species (many endangered) and over 225 species of birds. This means that every type of relationship between organisms (including symbiosis, parasitism, competition etc.) is present on the GBR.

The ITW has very low flora diversity due to its extreme conditions, but high fauna diversity. For example, the ITW is a breeding ground for many migratory birds from Japan. The high diversity of fauna leads to high nutrient recycling.

In conclusion, interactions between the four spheres lead to the unique character of ecosystems. This is because the interactions determine conditions in an ecosystem and subsequently the dynamic nature of the ecosystem. The GBR and ITW, while experiencing very different forms of interactions, have both evolved as highly specialised ecosystems.