Coral Reef Ecosystem (C. C.)

Coral reefs are one of the most diverse ecosystems on the planet. Corals are colonial organisms made up of individual polyps, each 1–3 mm in diameter, that are connected to one another via a thin layer of tissue. The connection between polyps allows for the sharing of nutrients. Beneath the soft bodies of scleractinian, or stony corals, polyps secrete a calcium carbonate skeleton, and it is this skeleton that becomes the foundation of coral reef ecosystems. Coral colonies can be either dieocious or hermaphroditic and can also reproduce asexually through fragmentation and reattachment.

Abiotic Factors and Coral Reefs

The abiotic factors influencing coral reef community include-

1. Calcium and carbonate ions from the environment. Depositing calcium carbonate skeleton set the physical boundaries that limit the distribution of corals.
2. Both temperature and salinity affect calcification, restricting tropical coral reefs to waters between 23°C –29°C and in a salinity range of 32–40‰ .

3. Increasing carbon dioxide concentrations in the atmosphere and subsequently the ocean lowers the pH — a process referred to as ocean acidification. While the net impact of lower pH on coral reefs continues to be examined, decreases in pH can reduce the calcification rates of corals and other calcifying organisms (Ries *et al*. 2009).

4. The reliance of corals on photosynthetic zooxanthallae to grow fast enough to produce reefs further limits coral reef distribution. Photosynthesis requires light.

5. Dependence of corals on zooxanthallae limits corals to shallow depths. Most reef building corals occur in less than 25 m of seawater.

6. Turbidity reduces light penetration, which restricts coral growth. High sedimentation rates can also bury or smother these sessile animals.

7. Corals are heterotrophic because they capture zooplankton from the water column with their tentacles. As a sessile organism, corals rely on currents to bring food as well as aid in gas exchange; however, high flow can reduce the ability of corals to capture food and waves can fracture and damage corals.

Zonation of Coral Reefs

Coral reefs can be separated into three distinct zones: the back reef, reef crest, and fore-reef. The back reef includes the shallow lagoon between the shore and coral reef. This habitat includes small patches of corals, sea grass beds, and sand plains. The back reef is often warmer because of the shallow depth, reduced water flow, and protection from waves. Salinity can also fluctuate due to fresh water inputs. In addition, sediment and runoff from shore can increase turbidity in this zone.

The reef crest is the pinnacle of the reef and can be exposed to the air during extreme low tides. The reef crest is a harsh environment, with the potential for desiccation and UV stress associated with a shallow environment. In addition, breaking waves limit coral diversity to only a few species that can persist in this high-energy zone. The staghorn coral, *Acropora cervicornis*, can form dense monotypic stands along the reef crest. The thin branches of *A. cervicornis* aid the coral in asexual reproduction, with branches

breaking off and moving during large storm events. These forked or branched fragments can then become wedged into other coral rubble and reattach to the reef substrate (Tunnicliffe 1981).

The ocean side of the reef begins the fore-reef, which continues down in depth to a sand plain. Abiotic factors on the fore-reef are less stressful compared to other zones and ideal for coral growth. The highest diversity of corals is found in the fore-reef due to light accessibility. Coral diversity is greatest around 15–20 m depth and dramatically decreases with increasing depth and the resulting lower light availability. In addition, internal waves carry nutrients from deeper water to the fore-reef, providing additional food resources for coral reef communities.

Communities

Coral reefs are some of the most diverse ecosystems in the world. Coral polyps, the animals primarily responsible for building reefs, can take many forms: large reef building colonies, graceful flowing fans, and even small, solitary organisms. Thousands of species of corals have been discovered; some live in warm, shallow, tropical seas and others in the cold, dark depths of the ocean.

Almost every phylum of living creature can be found living on coral reefs, with over 800 species of corals. Corals provide the substrate for sessile organisms to attach, including algae, sponges, and non-reef building corals. In addition to corals, encrusting bryozoans, sponges, and calcareous red algae act as biological-cement, keeping the reef framework intact. The diverse benthic flora and fauna along with the calcium carbonate understructure increases habitat heterogeneity, which provides a refuge from predation for invertebrates such as crabs, lobsters, sea urchins, brittlestars, and molluscs. The diversity of pelagic species is equally vast. In the waters above coral reefs, one can find nearly 25% of all marine fishes. Coral reefs, therefore, are one of the most diverse ecosystems on the planet, rivaling their terrestrial counterpart, tropical rain forests.