ZONATION OF VEGETATION IN THE SEASONAL PANS

INTAKA ISLAND

In some ecosystems it is clear that species of plants and animals do not occur evenly or randomly in space. Instead we see that they occur in particular patches, and these patches are arranged in a regular pattern. Such regular spatial patterning in an ecosystem is referred to as zonation. The zones have a typical appearance and species composition, and the zones always occur in the same spatial relationship to each other.

A well-known ecosystem with clear zonation is the inter-tidal zone at the seashore. That part of the shore which is regularly inundated and exposed, as the tides rise and fall, is known as the inter-tidal zone, and it is divided into definite sub-zones, each characterized by particular plants and animals. The reason for the zones is that inter-tidal organisms have different tolerances to exposure to air. Organisms with greater tolerance occur in higher zones which are exposed for longer, and those with less tolerance occur in lower zones which are exposed for shorter periods

At Intaka Island we can observe a pattern of zonation in the seasonal pans. The reasons for zonation are not the same as in the inter-tidal zone, but there are some striking similarities.

When one looks out over the pans, even in summer when the pans are dry, it is immediately obvious that the different types of plants are not evenly distributed over the area. The first thing one notices is that the higher ground has taller plants as well as a greater variety of plant species, while the lowest areas, the floors of the pans themselves, have only very low vegetation, and only a handful of different types of plants

In winter, the rainy season, the pans are full of water. Not surprisingly, at this time of year there is a clear difference between the aquatic environment of the pans and their surrounding terrestrial habitats. One would not expect the same plants and animals to live both in the water and on the dry land. Why not? The reason, of course, is that the adaptations an organism needs for living in water and on dry land are not the same and, generally speaking, most organisms are adapted to one type of environment and not the other

But this does not explain why clear differences in plant growth persist when both the higher and lower ground are dry in summer. Why don't we see similar plants in the pans and on the banks in summer? There are several good reasons. The most obvious is that any terrestrial plant that grows from seed in the pans will drown when the pan next fills with water. For this reason, even if many terrestrial species try to establish themselves in the pans, they will not survive through the wet season. On the other hand, plants that grow and set seed quickly, can complete their lifecycle before the pans are flooded again. Such plants are not long-lived trees, shrubs and bulbs, but rather small annual grasses and herbs

When we look out on the dry pan floor, we notice that it is indeed only a few grasses and small herbs - as opposed to woody plants and bulbs - that appear to thrive in this habitat. For these plants it does not matter that they will die when the pans are flooded, because they produce their seeds before the end of summer and re-grow from seed when the pans dry out again.

In summer, the dominant herbaceous plant on the pan floors is a curious-looking little succulent with jointed stems and no obvious leaves. It usually has a reddish colour which is a pigment that protects the chlorophyll (the green, food-producing pigment) from excessive exposure to sunlight in this very open, exposed habitat. Break off a small piece of this plant and chew it. What do you notice? It has a strong salty taste, indicating that salt has accumulated in its tissues. This is a clue to another factor that is responsible for zonation in the pans

This little succulent plant goes by the name Sarcocornia perennis or Saltwort. (There is another similar plant which is bright purple in colour Salicornia meyeriana, but it is much less common at Intaka.) This is a plant typical of salt marshes. You may be surprised that the seasonal pans are salt marshes, but when you consider that water flows only into the pans, not out, and water is lost only by evaporation, it is to be expected that, over the years, salt accumulates in these pans. Plants have a limited tolerance for salt, and only a few species can tolerate high concentrations. Such plants are known as halophilic (salt-loving), and the Saltwort is a good example. Also, as you can taste, it accumulates salt in its tissues.

The clue the Saltwort provides is that salt concentration, not just inundation with water, is a determining factor in the zonation of the seasonal pans. Salt concentration peaks when the water in the pans evaporates in summer. The high salt concentration prevents most plants from growing on the pan floor, but a the Saltwort thrives in the salty soil.

In this picture you can see that even the floors of the pans are not uniform. Large areas are covered with Saltwort, but towards the edges, where the ground slopes up, other plants, such as grasses and reeds, take over

But if you look carefully you can see that this applies not only to the edges of the pans, but to any area within the pan that is raised, even areas that are only slightly raised above the lowest level of the floor. Why should a few centimetres of height make such a difference? One reason may be that the raised areas are better drained and are therefore relatively dry. However, if you consider how very slightly raised some of these areas are, it seems unlikely that this is the sole reason. Salt concentration must also play a role.

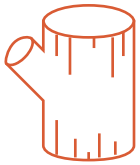
The fact that the halophilic Saltwort dominates only at the lowest levels suggests that salt concentrations are highest at those levels, and areas that are even slightly raised have a significantly lower concentration of salt and can therefore be colonized by less halophilic plants, such as certain grasses. Furthermore, the fact that the grasses themselves are unevenly distributed suggests that the different species of grass have different tolerances for salt: notice the distribution of the grey/green (Brakgras Sporobolus virginicus) and bright green grass (Couch Grass Paspalum vaginatum) in the foreground in the picture. The pale grey growth in the middle distance is a mixture of annual species which appears to flourish on slightly raised areas of the pan floor.

The bare area in the distance is a part of the pan that contains water for longest. The prolonged inundation prevents even the Saltwort from flourishing there.

Along the edges of the pans we see more zones. Above the zone of annual grasses, we get a zone of perennial taller grasses (Couch Grass Paspalum vaginatum in the picture) and larger, reedy plants. Unlike the annual grasses and the Saltwort, these are long-lived plants, but they don't mind some inundation. They can tolerate short periods of inundation with water that is not too salty, so they occur only around the edges of the pans where the ground is significantly raised above the level of the pan floor

Above this reedy zone one can see the true terrestrial zone, dominated by relatively tall shrubs.

Two species of reedy plant can be seen around the edges of the pans at Intaka: Juncus kraussii (a rush of the family Juncaceae), and Dekriet Chondropetalum tectorum (a restio reed of the family Restionaceae). Of the two, Juncus is more tolerant of inundation and salt, hence it is found lower down, and the Dekriet higher up. Juncus grows only in wetland areas, whereas Dekriet also grows in completely terrestrial habitats. In the picture you can see Juncus in the foreground and Dekriet (darker green) in the background.



In summary then, we can identify four distinct zones:

- Zone 1: salt marsh, dominated by Saltwort;
- Zone 2: a zone dominated by annual grasses and herbs;
- Zone 3: a reedy/grassy zone, dominated by perennials: Juncus, Dekriet and Couch Grass;
- Zone 4: a terrestrial zone dominated by tall shrubs and other fully terrestrial species.

Within the seasonal pan area of Intaka Island (the eastern half), there is a portion where the natural zonation of the pans has broken down and is being replaced by a different, more irregular pattern. In the picture you can see that the salt marsh, dominated by Saltwort (foreground), is being invaded and taken over by Brakgras Sporobolus virginicus. Why is this happening? The reason is quite simple: freshwater is leaking from Pond 1 of the constructed wetlands and seeping into the northwestern pan. This seepage does three significant things: (1) it creates a perennially moist environment, as opposed to a seasonally moist environment, (2) it reduces the salt concentration in the wet part of the pan, and (3) it brings in a relatively high concentration of dissolved nutrients. These conditions are favourable to grasses and unfavourable to Saltwort, so the one replaces the other.

This is an example of the difficulties one faces when trying to conserve natural systems. If these systems are disturbed, sometimes even quite slightly, there can be far-reaching and dramatic ecological consequences.