How Fraser's Famous Fens Formed

K'gari and Cooloola are noted for the occurrence of a special type of patterned fens that aren't replicated anywhere else in the world. The factors that make them so special are:

(1) They occur in a subtropical environment;

(2) They are at a very low elevation almost down to sea-level

All previously known fens occur in high latitudes or high altitudes. The one thing K'gari and Cooloola fens have in common with the high altitude or high latitude fens is that they only occur on peatlands that are also known as *mires* or bogs.

This FIDO Backgrounder (No 88) by John Sinclair (April 2018) explains how these fens, so different to other known fens, are formed in such a vastly different environment on K'gari and Cooloola.

Understanding Peat

Peat: Peat forms when plant material does not fully decay in acidic and anaerobic conditions. It is composed mainly of wetland vegetation, principally bog plants including mosses, sedges, and shrubs. As it accumulates, the peat holds water. This slowly creates wetter conditions that allow the area of wetland to expand. Peat (also sometimes called *turf*) results from an accumulation of partially decayed vegetation or organic matter that is unique to natural areas called peatlands, bogs, mires, moors, or muskeg.

Peat usually accumulates slowly at the rate of about a millimetre per year. Peat is porous allowing water to slowly filter through it. Because the peat is acidic the water passing through it has low pH and where it is seen emerging, it is strongly tea coloured

Mires/ bogs / peatlands: Peat has been used by so many civilizations as fuel and for building material. It isn't surprizing that there are many terms to describe both peatlands and some of their features.

Carbon sinks: Peatland ecosystems are the most efficient carbon sinks on the planet because peatland plants capture CO_2 naturally released from the peat, maintaining an equilibrium. In natural peatlands, the annual rate of biomass production is greater than the rate of decomposition. It takes thousands of years for peatlands to develop the thickest known deposits.

Fens: Fens form in some mires. One element that patterned fens have in common is that they occur as an elaborate series of peat ridges (**strings**) and pools (**flarks**). The patterns in the fens seen from above are due to the occurrence of these water-holding pools or flarks

Flarks: Flarks are thought to form when the peat becomes so thick that it slides downslope due to its own weight. If a thick heavy woollen blanket it placed on a very slight slope and water poured over it, it will crumble and stretch over time under the weight of the constantly flowing water and its own weight. On K'gari and Cooloola, flarks form near the base of high dunes, where there is a constant seepage of freshwater through a reasonable distance of peat substrate. The flarks are depressions or hollows within a bog separated by ridges known as strings.

Forming Fraser's Fens

Fens are dependent in a continuous flow of water filtering through the peat. On K'gari and Cooloola the source of the water comes from adjacent high dunes.

Put a saturated wet sponge on a table or any other impervious surface and gravitational pressure will cause the water to slowly seep out. Because it has to move laterally, the seepage will be slow and progressively become slower at the gravitational pressure weakens.

While this process occurs on both the eastern and western side of K'gari, the fens can only form where there is an accumulation of peat. Tidal action prevents peat forming on the eastern side and so the freshwater exuding from the dunes is seen seeping across the beach, sometime accumulating in small surface streams. On the western side, the peat is able to accumulate and it is on the western side of K'gari and Cooloola that most of the fens are found.

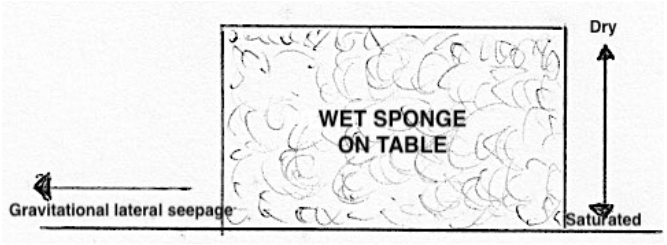


Diagram A

A saturated sponge on a table will release water slowly to seep over the table surface.

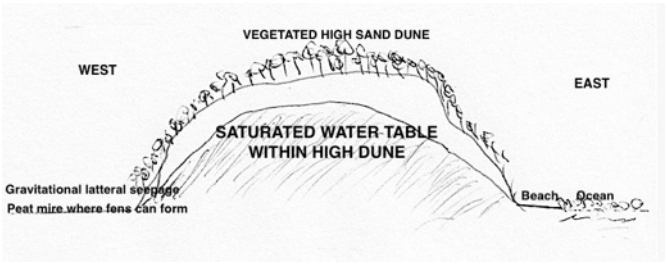


Diagram B

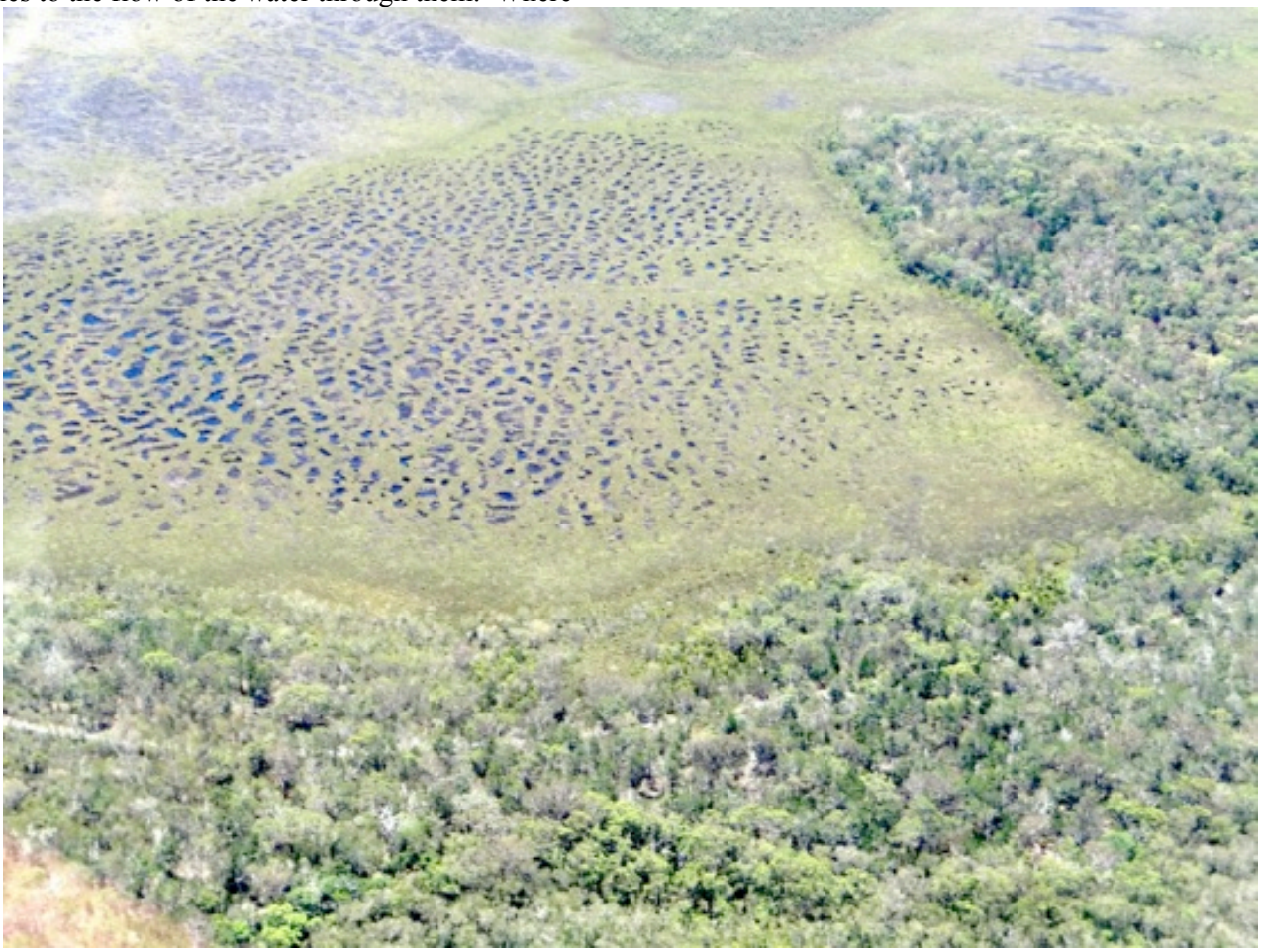
Water held in high dunes seeps slowly laterally across the water table. Where this seeps into peat bodies, fens may form.

The two situations of the saturated sponge and the saturated dunes are similar and the same principles apply causing water to seep out. The critical difference occurs when the water passes through peat mires.

Flow Rates Create and Shape Flarks

The flow rate of water through the peat mires is significant because the rate of flow determines the size and shape of the small ponds or flarks that form. Where the water percolates faster through the peat (closer to the base of the dunes or subterranean streams), flarks will be normally be absent or very small as the velocity slows the size that the flarks tend to grow. Flarks also tend to be elongated and at right angles to the flow of the water through them. Where the peat mires occur along some streams, the flow from the dunes isn't enough to form flarks

Flarks tend to be larger further away from the water source that is seeping out of the high nearby dunes where the flow of water through the porous peat isn't fast. Flarks tend to be absent from the mire where the water is flowing faster. That explains their absence in some fingers where the water is flowing faster through the fen. Flarks are generally elongated across the direction of the water flow.



The Puthoo fens north-east of Moon Point.

This aerial photo of the Puthoo Fens Complex taken during the International Mire Conservation Group field workshop shows the area studied. The photo has North at the top and south to the bottom.

There are few flarks around the base of the high dune but they get progressively larger the further from the dune base that they occur. Few flarks occur on the north western side of Puthoo Creek that flows through the mire because there are no high dunes there to supply the source of water.

A finger extending from the high dunes towards the centre of the fens also has no pools because there is a stronger flow of water in that alignment.

The alignment of the strings and flarks occur generally at more or less at right angles to the flow of water which emanates from the high dunes on the right hand side of the photo.

Fens Vegetation

Few species are adapted to be able to grow in such an acidic and waterlogged environment. *Melalueca quinqinerva* and other trees species are almost totally absent over what seems like a vast plain. Dr. Angéline Bedolla, vegetation ecologist, Swiss Research Institute for Forests noted that the fens were dominated by *Restionaceae*, mostly *Empodisma minus* and *Sporadanthus interruptus*. She also noted the peat forming vegetation such as *Empodisma* were adapted to bush fires. Many plants such as *Drossera* were adapted to low nutrient water-logged environments.