

Forces on the Surface of Fraser Island Dune Lakes

All might look tranquil and serene when most visitors look at the outstanding variety of Fraser Island's dune lakes, but there are dynamic forces at work within them. Temperature difference below the surface drive one internal circulation system but on the surface the wind and rain are very significant forces at work determining the shape and character of the lakes and its longevity in this easily eroded environment of sand. This FIDO Backgrounder No 60 (March 2013) attempts to explain how the wind ruffling the surface impacts on the lakes.

Impact of wind and waves

Apart from disturbing the water of the lakes creating anything from ripples to waves, the influence of wind has the significant impact on the physical attributes in other ways:

- 1. Beaches:** Waves lapping or breaking on sandy shores creates the beaches. The bigger the waves the more significant and wider the beach will be. This is apparent on Fig.1. On Fraser Island where the lakes are set entirely in sand the beaches are sandy and the impact of the water has leached all colour from the sand and the grains of pure silica appears white. Because the prevailing wind on Fraser Island for eons have been from the south-east wherever beaches have been formed they are invariably on the north-west side of the lake. The beaches will also tend to have increasing width towards the centre of the beach which is proportionate to the strength of the wind and waves the section of the beach has been exposed to.
- 2. Littoral currents:** Wave action creates littoral currents. If this weren't so, the water levels would be higher on one side of the lake than the other. Thus water is forced to circulate within the lake. The strength of this is dependent on the height of the waves but the currents flow in two different directions both away from the centre of the beach the waves have broken on. The littoral currents within the lake can and do carry some of the sand from the shore with them as they move away from the impacted beach.

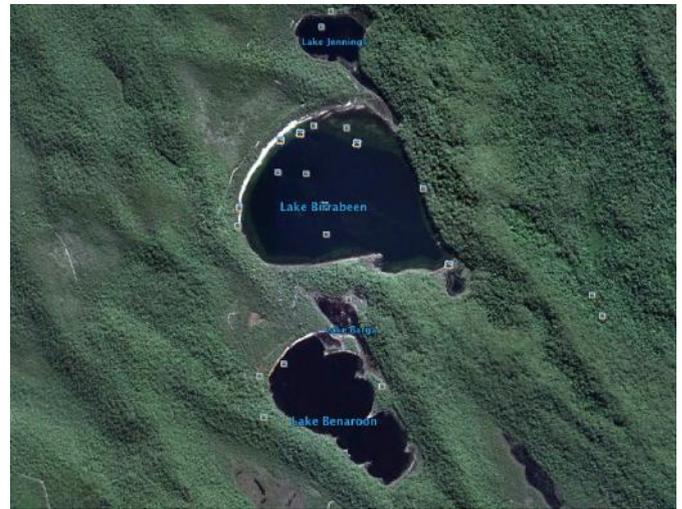


Fig. 2. This photo from Google Earth illustrates three of Fraser Island's dune lakes, Jennings, (top) Birrabeen (centre) and Benaroon (lower)

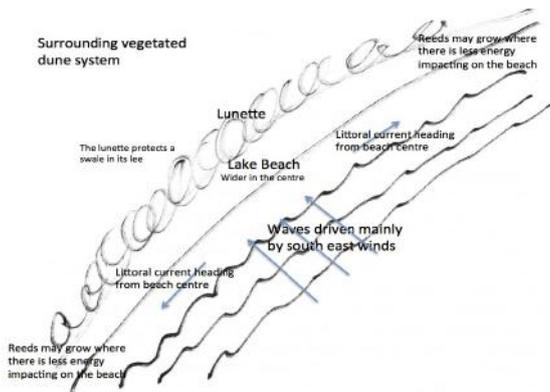


Fig 1. How wind energy creates littoral currents in lakes

- 3. Sand spits:** As the littoral currents get further from the main beach they lose energy. With this loss of energy they drop sand. Eventually over long periods, the sand deposited accumulates to form spits. Because these spits take hundreds, indeed thousands of years to create, they are evidence of the age of the lake. In the case of Lake Benaroon the spits are very pronounced and reach out to each other from opposite sides of the lake indicating a great age of this lake that is less exposed to wind than the adjacent Lake Birrabeen. Figure 2 shows that Lake Benaroon has several spits that are creating segments in the lake and the beaches on the sand spits provide further sand to create other spits upwind. Lake McKenzie (Boorangoora) has a very significant spit.

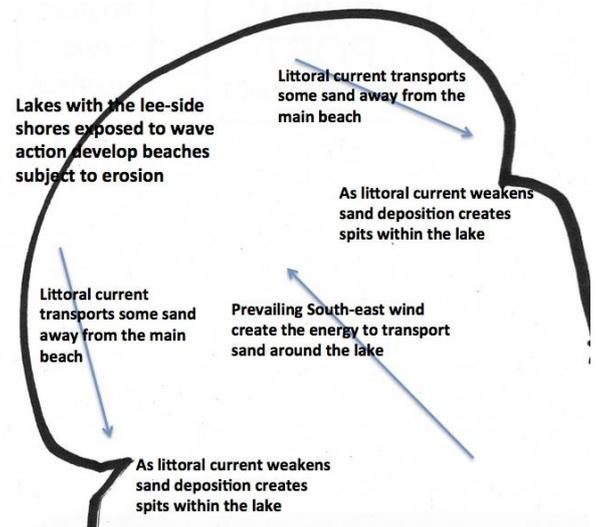


Fig 3. How Littoral currents create sand spits in lakes

- 4. Lunettes:** Depending on the degree of exposure the prevailing wind will sweep sand from the beaches. This sand is trapped in the vegetation behind the beach. These depositions accumulate over time to create a foredune behind the beach. This foredune is usually higher and wider behind the central part of the beach and because it is the nature of dune lakes to have a curved beach, these foredunes have the three-dimensional shape of a crescent moon. Thus the dunes in the lee of dune lakes are called lunettes because of their crescent shape. There is usually a correlation between the height of the lunette and the amount of exposure to the wind.

In very well developed lakes such as Lake Boomanjin and Lake Birrabeen and to a lesser extent Lake McKenzie (Boorangoora) even these lunettes are subject to further erosion and reworking by the prevalent wind. Thus sandblows form and are a feature of these lakes exposed to higher energy winds. They are natural processes and should not be interfered with.

Determinants of wind impact on the lakes

Wind and the wind-driven waves create the geomorphic features of beaches, sand spits and lunette and other associated lake features such as the swales that form behind the lunettes. The presence or absence of beach vegetation such as reeds also owes much to the power of the prevailing wind. While the wind on Fraser Island has a relatively uniform strength micro-geographical features such as the area of the lake surface, topographical of vegetation protection determine the extent of the impact of wind on the dune lakes.

Size of the lakes: There is a correlation between the size of lakes and the size of the beach. The largest lake on Fraser Island, Lake Boomanjin has the widest beach and the next two largest lakes, Lake McKenzie (Boorangoora) and Lake Birrabeen have normally conspicuously wide beaches. On the other hand as can be seen in Fig 2, although Lake Birrabeen has a clearly defined beach the smaller Lake Benaroon has much less of a beach and adjoining and even smaller Lake Jennings has no beach at all.

Orientation: If lakes are aligned from south-east to north-west, the same direction as the prevailing wind, there is much more opportunity for the wind to gain greater velocity and create more high waves and deliver more energy.

Size. Lakes that are so small there isn't much surface to raise more than a ripple on are little affected by the forces of the wind. This is even less so if they are sheltered from the wind. However it is inevitable that the wind when strong enough will have impacts on the larger lakes such as Boomanjin. The heaviest impacts are on the exposed beaches and lunettes formed behind them by sand blown from the beach.

Topography: Where lakes are in deep depressions and shielded from the wind by surrounding tall vegetation the impact of the wind at the lake surface is negligible. Thus Basin Lake (Tahwan) and Lake Allom have no beaches.

Vegetation: In areas of the beach where there is less wave action reed beds may become established but where there is high wave energy such as in the centre of an exposed beach reeds have difficulty in becoming naturally established

Depth: Shallow lakes are more conducive to the growth of reeds and thus the wind is less able to stir up the water surface and create waves. Thus while Lake Coomboo is a

relatively large and exposed lake, it has no beach because it is shallow and the reeds soften the impact of waves on the shore enough to prevent a beach forming there.

Other features: There are many micro-features associated with dune lakes that warrant closer examination.

These range from shape and ripples along the shoreline as seen on the shores where the streams flow into the lake as seen at Lake Boomanjin.

Surface sand surrounding the lakes is so leached of nutrients that the main plants to grow there are carnivorous plants able to extract all of their requisite nutrients from the bacteria and small insects they ingest. Sundews don't

even have chlorophyll to help them photo-synthesize. Bladderworts (*Utricularia*) devour nematodes and mosquito larvae and present stunning patterns when their long red filaments are teased out on the white sands of beaches such as at Lake Boomanjin.



Above: Lake McKenzie (Boorangoora)

Below: Lake Boomanjin

