Pukehina Beach Coastal Change

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- Pukehina Beach is expected to have sediment accretion due to the regional rivers' sediment output (Dickson et al., 2024). However, Pukehina Beach has been eroding in recent years, especially after extreme storm events (EcoNomosLtd, 2003).
- Climate change is contributing to increased tropical cyclone frequency, intensity and rising sea levels, thus increasing dune erosion (Knutson et al., 2019; Michener et al., 1997; van Wiechen et al., 2023). Wave-driven erosion is removing sediments at a rate faster than they can be replenished.
- A comparison of 2015 and 2024 LiDAR data revealed up to 10m of dune retreat, but only 3m of accretion in some areas (Figure 4). This is consistent with the Bay of Plenty Regional Council's (BOPRC) report from 2002, showing that this is an ongoing issue (EcoNomosLtd, 2003; Land Information New Zealand et al., 2015; Te Whenua Land Information New Zealand et al., 2024).
- Shoreline changes in the BOPRC report were attributed to storm cuts and subsequent recovery.
    - Estimates of the maximum 50 and 100-year return of the main foredune at Pukehina are around 25m.
    - These values depend on the current dune stability factor. Changing the stability will likely change the predicted return rates.
- Comparison of NDVI (Normalised Difference Vegetation Index) false-colour satellite imagery taken after winter shows that the most consistent vegetation recovery occurred in 2021 and 2022 (Union & ESA, 2025). This aligns with New Zealand's COVID-19 lockdowns (Figure 3). Suggests that anthropogenic activity is linked to the degradation of the dunes.
- A study looking at how storms impact dune stability revealed that dune erosion is driven by sediment transport, particularly due to avalanching (van Wiechen et al., 2023). Initiated by dune instabilities, it's likely that anthropogenic activity, such as using vehicles and having children near the base of the dune, could increase the dune's susceptibility to erosion.
- A recommendation is not to allow anthropogenic activity near the base or on the dunes to allow them to revegetate. There is also a need to replant vegetation to stabilise the dunes. The dunes need to be stabilised to protect residential properties on the dune; otherwise, relocation might be a more appropriate solution.
- Vegetation gain in 2023 was lower than usual, predicted to be a result of Cyclone Gabriel.
- The significant loss of vegetation in 2024 is likely due to the East Coast floods in June. The false-colour satellite image was taken in July, so the direct influence is evident.
- According to S-maps, the soils behind the dunes are poorly drained soils, so their resilience to repeated storm events is low (LINZ, 2025). This is likely to exacerbate the impact of repeated storm events, resulting in a significant loss of vegetation in 2024.