

# Kirra Beach Dune Regeneration Works: Large scale revegetation of artificially created coastal dunes

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## Abstract

Regen Australia partnered with Gold Coast City Council to undertake the revegetation of newly created dunes at Kirra Beach on the Gold Coast. The primary purpose of the project was to establish a vegetation community of native dune species to enhance dune functions; to improve amenity and conserve biodiversity using local-provenance coastal ground-cover species.

Sand from the intertidal zone was deposited along a 1.5km stretch of beach at Kirra to form the new dunes. Native ground-cover species were grown from cutting material sourced nearby. The plant species included *Spinifex sericeus*, *Ipomoea pes-caprae*, *Vigna marina* and *Canavalia rosea*.

Revegetation focused on the frontal dune area and strategically placed planting cells toward the hind dune. 18000 plants were installed in April 2011. Good rainfall during, and immediately following planting assisted the successful establishment of plants. Plant establishment rates (overall >80%) were varied across the site due to anthropological disturbance and sand mobility.

At twelve months following the planting *S. sericeus* had reached densities expected for a natural frontal dune and all four species had flowered and produced seed.

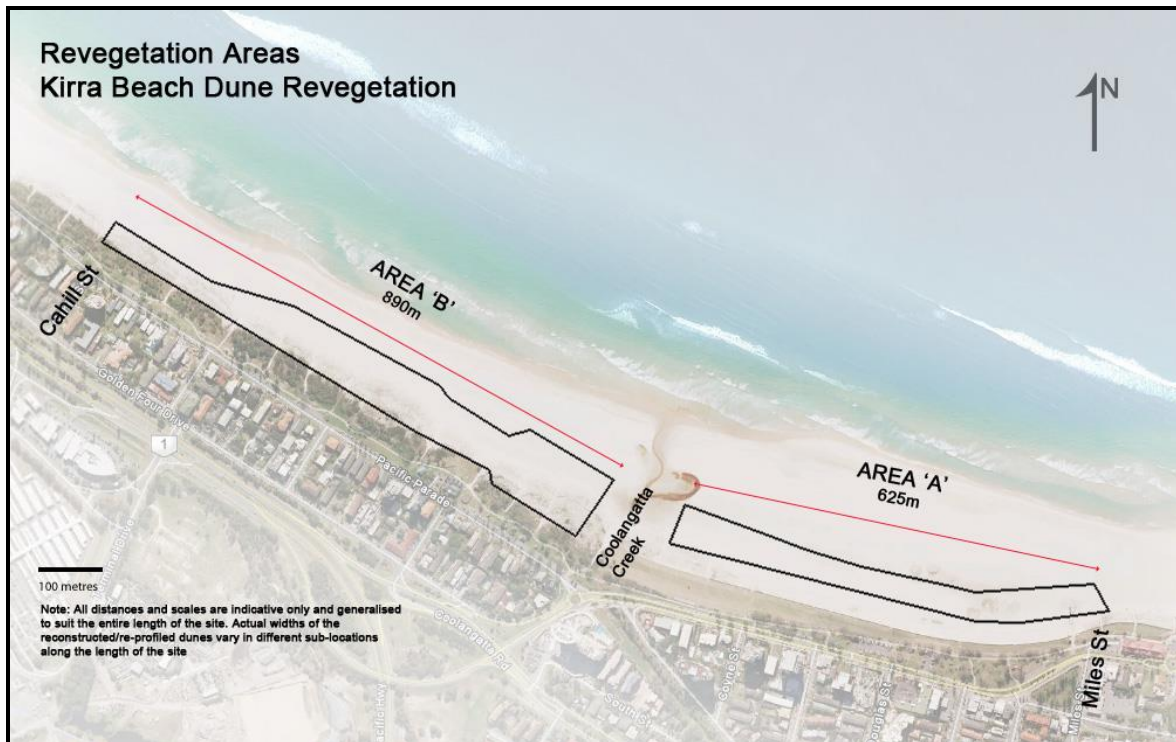
At twenty four months following the planting vegetative cover and plant abundance are good to very good. Combined with the species composition (richness) many areas of the frontal dune are indistinguishable from a naturally occurring frontal dune.

The main threats observed during the implementation and maintenance period were anthropogenic disturbance, allowing the dunes to be more susceptible to erosion; and sand-blow covering or undermining plants.

Overall, the aims and objectives of the project were successfully achieved.

## Introduction

A project was developed in 2009 to remove sand from the intertidal area at Kirra to form a new series of dunes along a 1.5km stretch of beach from Kirra to Bilinga, on the far south coast of Queensland (Figure 1). While the purpose was to maintain the beach amenity and reinforce a buffer to the shoreline, the reconstruction of the dunes also involved reinstating native plant communities along the dunes for stabilisation and the conservation of biodiversity.



**Figure 1 Project Area**

The project was funded and overseen by the Department of Environment and Heritage Protection (formerly DERM), with Gold Coast City Council (GCCC) as the key stakeholder responsible for managing the operational aspects of the project.

Regen Australia was employed to undertake and manage the revegetation aspects of the project. The main aims of the revegetation project were to enhance visual amenity; establish a vegetation community of local native dune species to enhance dune functions; and to increase stability and resilience of the dune system.

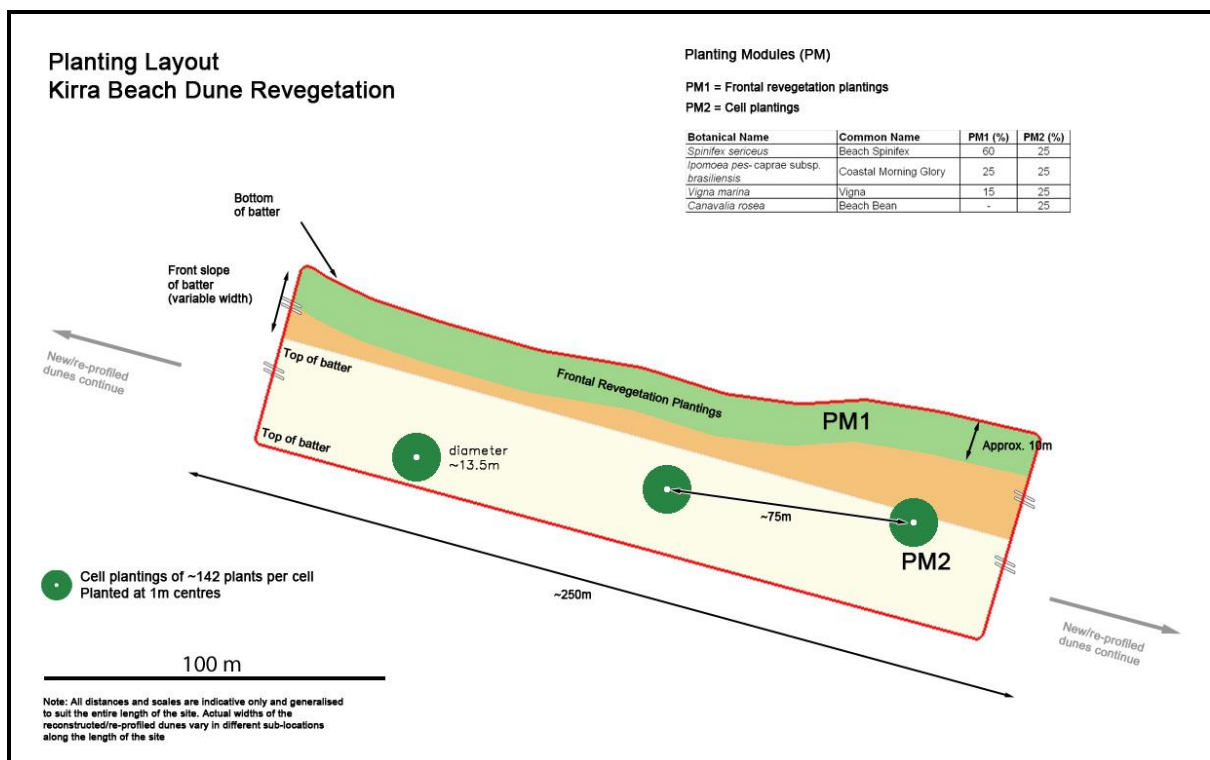
## Methods

### Dune Formation

Using excavators and tipper trucks, sand was scraped from the intertidal zone at Kirra Beach and deposited at the required areas (Figure 1). The new dunes were formed along a 1.5km stretch of beach between Kirra and Bilinga. The average height of the dunes was 4 metres and the width varied from 25m to 60m. Fencing was installed at all pedestrian walkways and on the frontal dune edge in Area A only (Figure 1). A section of the fencing in Area A was covered in shadecloth.

### Revegetation

Plants were installed in the frontal dune area of the project site and in strategically placed infill planting cells between the frontal dune and the existing vegetation landward edge of the project site (Figure 2).



**Figure 2 Planting Layout**

Four locally occurring dune species were selected: Spinifex (*Spinifex hirsutus*) \*65%; Beach Bean (*Canavalia rosea*) \*5%; Goats Foot Convolvulus (*Ipomoea pes-caprae*) \*15%; and Vigna (*Vigna marina*) \*15%. \*Denotes the amount of each species used as a percentage of the total plants used. (ie. 65% of the total plants were Spinifex)

The total length of planting area is 1515 metres and the width of the frontal dune planting averages 10 metres. The infill planting cells average ~142m<sup>2</sup> each and there are 20 of these cells. The total area of revegetation is 18000 square metres.

Approximately 18,000 tubestock were planted out over a six day period in April 2011 by a team of 6. The planting team installed up to 4500 plants daily. Slow release fertilizer

and water crystals were placed in each planting hole and plants were watered in immediately following installation.

All plants used in this project were grown by Regen Australia nursery in either tubestock or Hiko forestry containers.

### **Plant Production**

Regen Australia nursery staff propagated the required species from cuttings collected from the local area. The grow time for the cuttings was 2 months. Plants were grown on heated benches in climate controlled propagation tunnels before hardening off in full sunlight.

Plants underwent a twelve week establishment period that included watering and replacements as required. Watering of the plants was undertaken with an off-road water truck with 25,000L capacity. This was followed by a twelve month maintenance program that included weed control.

### **Results**

Planting survival rates varied across the site due mainly to mobile sand and anthropogenic disturbance. Good rainfall during the installation period and for four weeks following the planting helped with the successful establishment of the plants (Figure 3).



**Figure 3 Plant Establishment at 12 weeks Area B**

At 12 months after the planting on the foredune, Beach Spinifex (*Spinifex sericeus*) densities are approaching, or in some areas have reached, densities expected for a naturally established frontal dune (Fig 4).



**Figure 4 Plant Establishment at 52 weeks Area A**

Since planting, the nursery-sourced Beach Spinifex have flowered and seeded, however the bulk of the increase in biomass is due to extension of the runners. Beach Spinifex runners have travelled in all directions across the dune (i.e. including up inclines). Small swales of windswept sand can be seen captured in front of Beach Spinifex. Of the three species planted on the frontal dune, Beach Spinifex (overall) has shown the greatest increase in area covered.

The other two species *Vigna* (*Vigna marina*) and Goats Foot Convolvulus (*Ipomoea pes-caprae*) have also done well, although not increased their biomass as rapidly as the Spinifex. The plants, however, have had a good survival rate and throughout December to April 2012 have seen an increase in their rate of growth. Based on the slower (compared to the Spinifex) growth rates that both the *Vigna* and the Goats Foot Convolvulus exhibited throughout the establishment period either:

- (a) they naturally require more time to establish;
- (b) their growth rate throughout winter months is less than Spinifex;
- (c) they are more sensitive to wind-blown sand than the Spinifex; or
- (d) a combination of factors.

Growth rate, however, was not a specific metric that influenced the decision to include these species in the revegetation species selection; the primary reason for their inclusion

was to increase in situ species richness in the mid- to long term. Based on this, their inclusion has been successful. As mentioned previously they are now growing more rapidly and both species have flowered and produced seed.

Runners are beginning to connect the infill planting cells with the frontal dune row plantings. In addition to the three species used in the frontal dune plantings, Beach Bean (*Canavalia rosea*) was also included. The establishment, growth and survivorship of Beach Bean has been similar to that of Vigna — a period where growth appeared minimal and then more rapid growth throughout the summer and autumn months.

The overall survival rate is approximately 80%; however survival rate of individual plants is probably not the best measure of success for a project of this nature. Percentage cover or biomass is a more appropriate measure. Despite this, whichever measure of success is chosen the project has met and exceeded requirements.

## **Conclusion**

Plant abundance and vegetative cover are very good to excellent. Combined with the species composition (richness) many areas of the frontal dune are indistinguishable from a naturally occurring frontal dune. The plants are reproducing and increasing their abundance; at this point predominantly vegetatively (i.e. 'runners') however all species have produced seed and these could reasonably be expected to add to the plant population.

The plants are well established and (in the absence of any extreme natural events or destruction by intent) self-sustaining.

## **Lessons learned**

Beach Spinifex (*Spinifex sericeus*) is a rapid colonizer of frontal dunes and was the first of the four planted species to reinforce a buffer for the newly created dunes.

Successful plant establishment on dunes is more likely when rainfall occurs during and immediately following plant installation than without rainfall.

The largest threats against successful establishment are:

- Anthropogenic disturbance through the planting establishment area. This resulted in breaking the 'crust' that forms on the top of semi-stable sand, making the underlying sand more susceptible to erosion.
- Sandblow that covers or undermines plants in the first few months post planting.

Because the sand was "sterile" (due to it having been reclaimed from the intertidal zone and lacking a seed bank), weed invasion, up to this point, has been minimal. This may suggest that weeds predominantly recolonise natural dunes due to accumulated seeds and other propagules persistent in the sand.

Sand has accreted in areas where the dune plants installed in this project have become established.