ECOLOGICAL MONITORING FOR TE TUMU KAITUNA 7B2 ECOLOGICAL RESTORATION PROJECT, 2013

VOLUME 2 - PHOTOGRAPHS

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ECOLOGICAL MONITORING FOR TE TUMU KAITUNA 7B2 ECOLOGICAL RESTORATION PROJECT, 2013

VOLUME 2 - PHOTOGRAPHS

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1. INTRODUCTION

Coastal sand dunes that retain their natural character are a nationally rare habitat type and have been identified as a priority for the protection of biodiversity on private land (MfE and DOC 2007). At national, regional, and local scales coastal dunes have been greatly reduced in extent by development for agriculture, horticulture and urban purposes, and modified by impacts of introduced species of plants and animals.

In 2010, the Trustees and owners of Te Tumu Kaituna 7B2, the Bay of Plenty Regional Council, and Nga Whenua Rahui entered into an agreement to restore the biodiversity and protect the cultural and archaeological heritage of coastal sand dunes east of Papamoa. Several initiatives have been implemented, including erecting a fence to exclude cattle from the entire site, erecting a rabbit-proof fence around *c.*6.8 ha of the site, and eradicating rabbits from inside the fence.

In 2011 Wildland Consultants Ltd was engaged to prepare a plan to monitoring change in the ecological condition at Te Tumu based on the items listed in Section 2.2 of the Te Tumu Kaituna 7B2 Biodiversity Management Plan, and to implement monitoring. Volume 1 of this report describes the results of the 2013 remeasurement compared with baseline monitoring established in 2011. This document (Volume 2) comprises photographs and comparisons of the permanent vegetation plots (presented in Section 2) and the permanent photopoints (presented in Section 3) taken in July 2013 paired with the photographs taken in June 2011. The locations of permanent plots and photopoints are presented in Appendices 1 and 2, respectively.

A list of the scientific plant names and common names used in this text is presented in Appendix 9 of Volume 1.

2. PHOTOGRAPHS OF PERMANENT VEGETATION PLOTS

Plate 1: View of Plot 1 from corner ‘P’ to corner ‘D’, 2011.

Plate 2: View of Plot 1 from corner ‘P’ to corner ‘D’, 2013. Herbaceous species ground cover and lupin cover has increased; spinifex height and density has also increased.

Plate 3: Plot 1 viewed from E2808006 N6379838 at a compass bearing of 60°, 2011.

Plate 4: Plot 1 viewed from E2808006 N6379838 at a compass bearing of 60°, 2013. Lupin and harestail cover has increased since 2013.

Plate 5: Plot 2 viewed from corner ‘M’, 2011.

Plate 6: Plot 2 viewed from corner ‘M’, 2013. The height and density of wīwī has increased noticeably within the plot.

Plate 7: Plot 2 viewed from 140° and 10m from corner D, at a bearing of 320° back towards the plot and the bach, 2011.

Plate 8: Plot 2 viewed from 140° and 10m from corner D, at a bearing of 320° back towards the plot and the bach, 2013. Bracken appears to be more prevalent than in 2011 (foreground), and *Carex testacea* and pōhuehue have grown in height and extent (mid-ground, right). Wīwī density within the plot appears to be greater than in 2011.

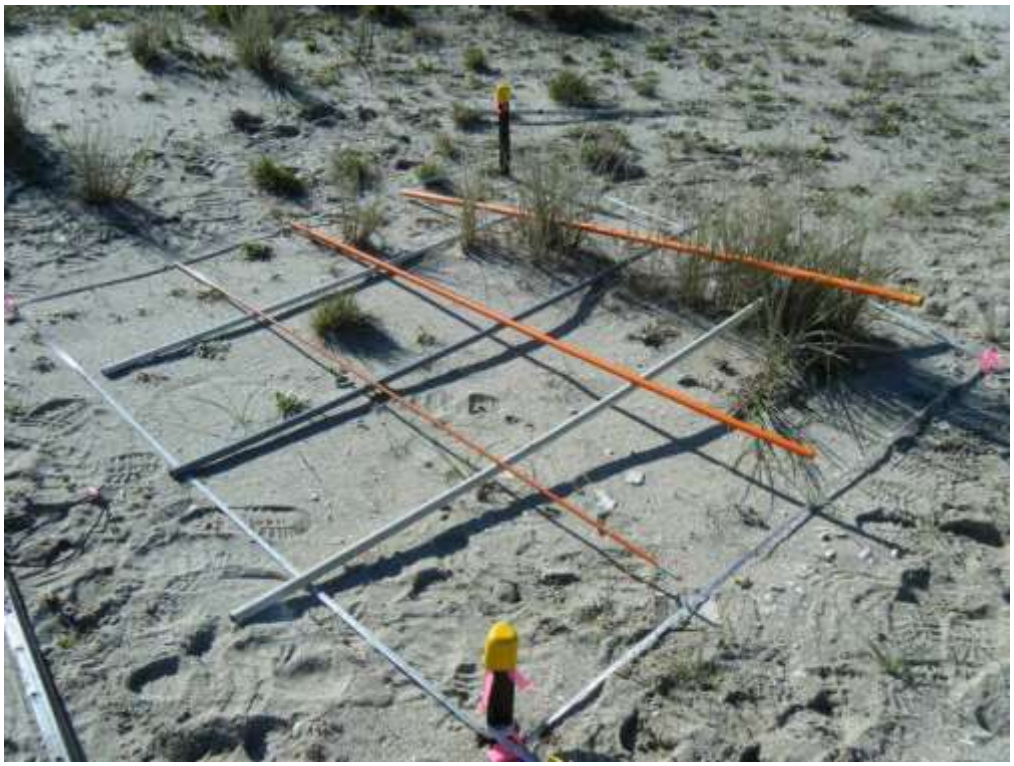

Plate 9: Plot 3 looking from corner ‘P’ to corner ‘D’, 2011.

Plate 10: Plot 3 looking from corner ‘P’ to corner ‘D’, 2013. No obvious change in vegetation cover or composition.

Plate 11: Plot 3 viewed from E2807599 N6380138 at a compass bearing of 235°, 2011.

Plate 12: Plot 3 viewed from E2807599 N6380138 at a compass bearing of 235°, 2013. Lupin and *Lachnagrostis billardierei* have increased in cover in the foreground.

Plate 13: Plot 4 looking from corner ‘P’ to corner ‘D’, 2011.

Plate 14: Plot 4 looking from corner ‘P’ to corner ‘D’, 2013. Little visible change to vegetation within the plot between 2011 and 2013.

Plate 15: View from Plot 4 towards the bach beyond the western boundary of the study site, 2011.

Plate 16: View from Plot 4 towards the bach beyond the western boundary of the study, site 2013. Lupin appears to have increased in cover in this area and spinifex density appears to have decreased. Pīngao has been planted alongside the rabbit-proof fence.

Plate 17: Plot 5 looking from corner ‘P’ to corner ‘D’, 2011.

Plate 18: Plot 5 looking from corner ‘P’ to corner ‘D’, 2013. *Carex testacea* cover has increased substantially. Pōhuehue has grown in height.

Plate 19: View from *c.*5 m east of Plot 5, looking west, 2011. No comparative photo was taken in 2013 due to problems with sun strike.

Plate 20: Plot 5 viewed from E2807562 N6380102 at a compass bearing of 210°, 2011.

Plate 21: Plot 5 viewed from E2807562 N6380102 at a compass bearing of 210°, 2013. The cover of *Carex testacea* has increased significantly in this area since 2011.

Plate 22: Plot 6 looking from corner ‘P’ to corner ‘D’, 2011.

Plate 23: Plot 6 looking from corner ‘D’ to corner ‘P’, 2013. No significant visible change is evident in this plot between years.

Plate 24: Plot 6 viewed from E2808190 N6379735 at a compass bearing of 260°. The person in the rearground is at Plot 25, 2011.

Plate 25: Plot 6 viewed from E2808190 N6379735 at a compass bearing of 260°, 2013. Lupin has increased in cover in the rearground since 2011.

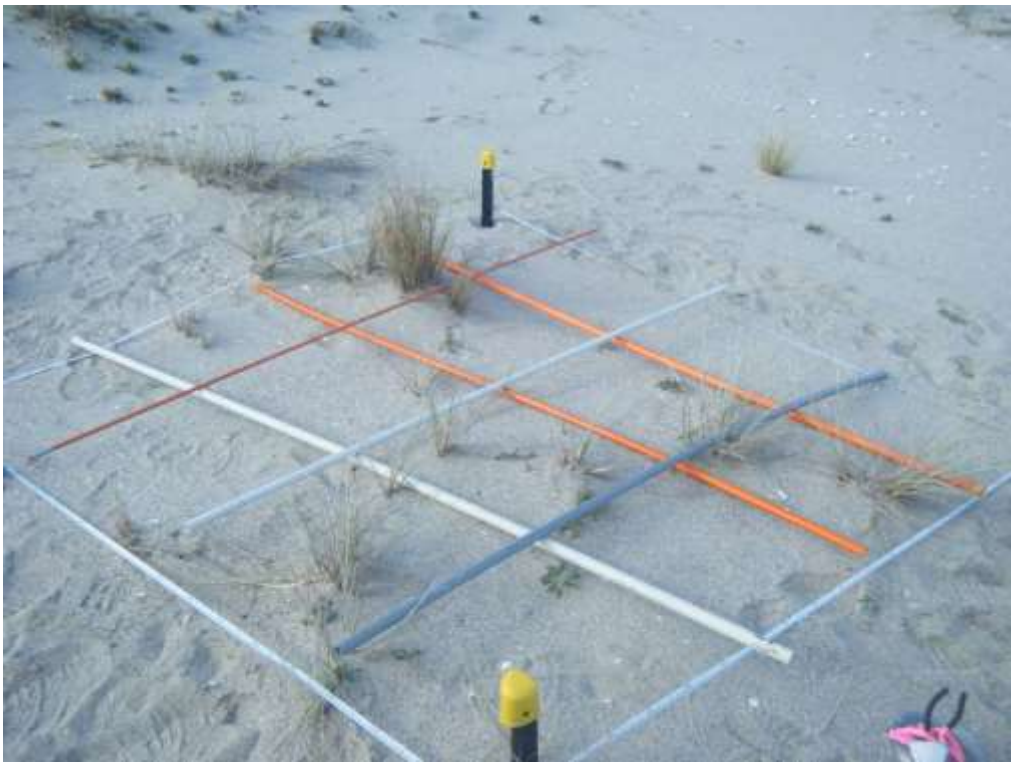

Plate 26: Plot 7 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 27: Plot 7 viewed from corner ‘P’ to corner ‘D’, 2013. No significant visible change is evident in this plot between years.

Plate 28: Plot 7 viewed from E2808170 N6379721 at a compass bearing of 280°, 2011. The person in the rearground is at Plot 25.

Plate 29: Plot 7 viewed from E2808170 N6379721 at a compass bearing of 280°, 2013. Lupin has increased in cover within this area, and there appears to be a slight decrease in spinifex cover.

Plate 30: Plot 8 viewed from corner ‘P’ to corner D’, 2011.

Plate 31: Plot 8 viewed from corner ‘P’ to corner D’, 2013. The proportion of bare ground has visibly decreased within this plot, lupin has colonised the site, and the wīwī within the plot appears to be in poor health.

Plate 32: Plot 8 viewed from E2808002 N6379749 at a compass bearing of 266° towards the old hay barn in the rearground, 2011.

Plate 32: Plot 8 viewed from E2808002 N6379749 at a compass bearing of 266° towards the old hay barn in the rearground, 2013. Bare ground present in 2011 appears to have been colonised by harestail.

Plate 33: Plot 9 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 34: Plot 9 viewed from corner ‘P’ to corner ‘D’, 2013. Spinifex and *Lachnagrostis billardierei* appear to be in slightly poor health compared to 2013, and lupin appears more prevalent.

Plate 35: Plot 9 viewed from E2807998 N6379823 at a compass bearing of 60°, 2011.

Plate 36: Plot 9 viewed from E2807998 N6379823 at a compass bearing of 60°, 2013. Lupin has expanded within and outside of the rabbit-proof fence and harestail has expanded within the rabbit proof fence. The completed rabbit-proof fence and cattle-proof fence are visible within this photo. Pīngao has been planted along the rabbit-proof fence.

Plate 37: Plot 10 viewed from corner ‘P’ to corner ‘D’, 2011.

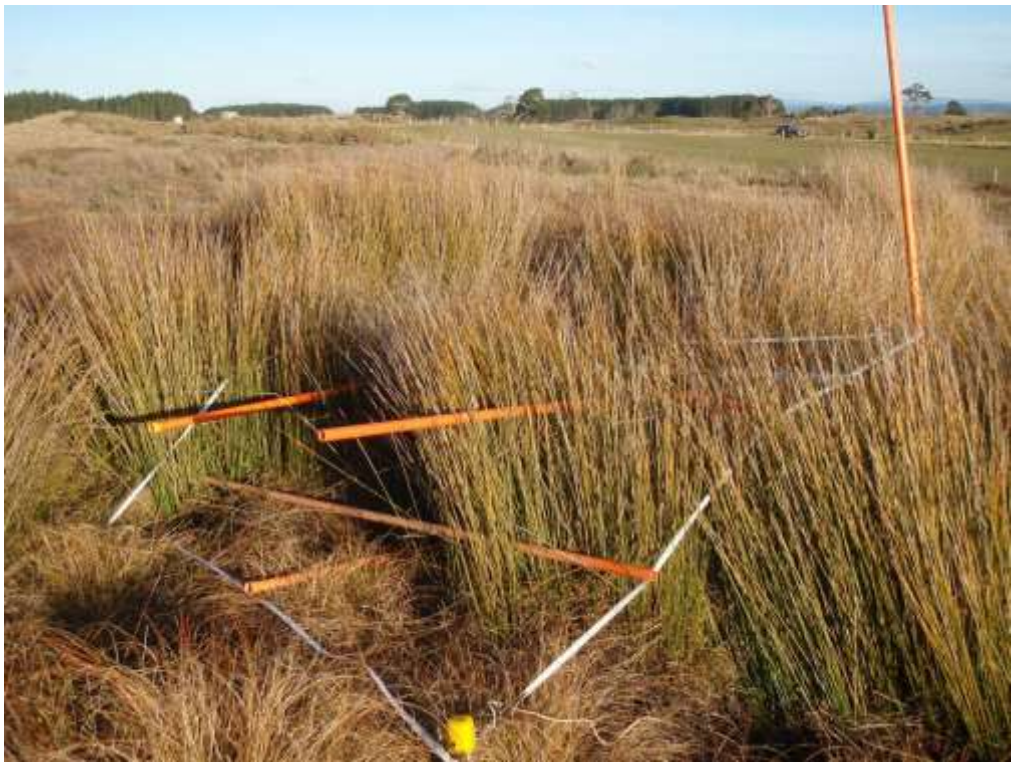

Plate 38: Plot 10 viewed from corner ‘P’ to corner ‘D’, 2013. *Carex testacea* cover has increased noticeably within this plot and wīwī appears denser and taller than in 2011.

Plate 39: Plot 10 viewed from E2807998 N6379823 at a compass bearing of 60°, 2011.

Plate 40: Plot 10 viewed from E2807998 N6379823 at a compass bearing of 60°, 2013. *Carex testacea* cover appears to have increased noticeably.

Plate 41: Plot 11 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 42: Plot 11 viewed from corner ‘P’ to corner ‘D’, 2013. Pōhuehue appears more prominent in this plot than in 2011 and wīwī appears to have increased density slightly.

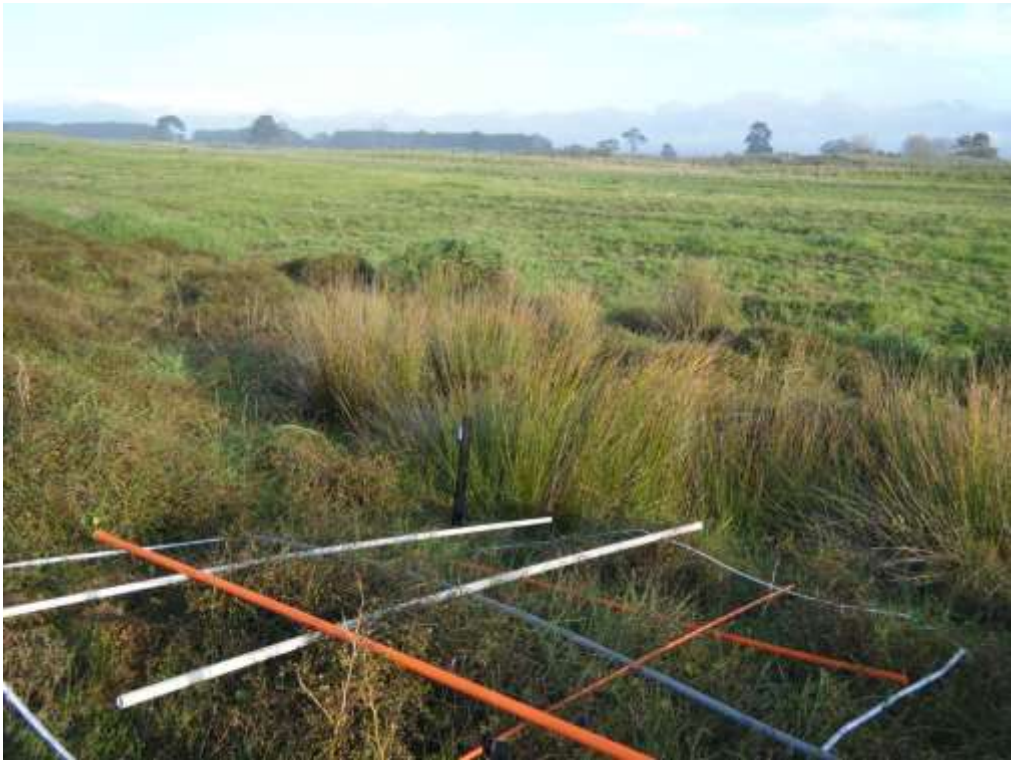

Plate 43: Plot 11 viewed from corner ‘P’ to corner ‘D’ looking outwards toward the adjacent farmland, 2011.

Plate 44: Plot 11 viewed from corner ‘P’ to corner ‘D’ looking outwards toward the adjacent farmland, 2013. Wīwī density appears to have increased and pōhuehue cover appears greater than 2011.

Plate 45: Plot 12 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 46: Plot 12 viewed from corner ‘D’ to corner ‘P’, 2013. There is no obvious difference in vegetation cover in this plot between 2011 and 2013.

Plate 47: Plot 12 viewed from E2807759 N6379988 at a compass bearing of 70°, 2011. In the mid-ground, a tauhinu bush is present on the crest of the foredune.

Plate 48: Plot 12 viewed from E2807759 N6379988 at a compass bearing of 70°, 2013. There is a noticeable increase in lupin cover inside and outside the rabbit-proof fence. Spinifex cover appears slightly reduced. Pīngao has been planted beside the rabbit-proof fence.

Plate 49: Plot 13 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 50: Plot 13 viewed from corner ‘P’ to corner ‘D’, 2013. Cover of *Carex testacea* has increased noticeably within this plot.

Plate 51: Plot 13 viewed from E2807587 N6380061 at a bearing of 270°, 2011.

Plate 51: Plot 13 viewed from E2807587 N6380061 at a bearing of 270°, 2013.
No significant visible change is evident within this area.

Plate 52: Plot 14 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 53: Plot 14 viewed from corner ‘P’ to corner ‘D’, 2013. Bare ground has been colonised by harestail. Pōhuehue outside the plot has increased in size.

Plate 54: Plot 14 viewed from corner ‘M’ to corner ‘A’ with the bach behind, 2011.

Plate 55: Plot 14 viewed from corner ‘M’ to corner ‘A’ with the bach behind, 2013. A slight visible increase in the cover and density of harestail and pōhuehue has occurred within this area.

Plate 56: Plot 15 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 57: Plot 15 viewed from corner ‘P’ to corner ‘D’, 2013. Wīwī appears taller and density appears slightly greater.

Plate 58: View from Plot 15 at a compass bearing of 315°, 2011.

Plate 59: View from Plot 15 at a compass bearing of 315°, 2013. Obvious visible growth in wīwī density and pōhuehue cover since 2011.

Plate 60: Plot 16 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 61: Plot 16 viewed from corner ‘P’ to corner ‘D’, 2013. Slight visible change: moss cover has increased, spinifex appears less robust.

Plate 62: Plot 16 viewed from E2807832 N6379932 at a compass bearing of 80°, 2011.

Plate 63: Plot 16 viewed from E2807832 N6379932 at a compass bearing of 80°, 2013. Põhuehue and harestail appear to have increased cover in the mid-ground since 2011. The rabbit fence is visible in the mid-ground.

Plate 64: Plot 17 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 65: Plot 17 viewed from corner ‘P’ to corner ‘D’, 2013. Little obvious change since 2011. Harestail cover within the plot may be slightly higher.

Plate 66: View from 10m east of Plot 17 at a compass bearing of 260°, 2011.

Plate 67: View from 10m east of Plot 17 at a compass bearing of 260°, 2013. Spinifex plants appear less dense than in 2011.

Plate 68: Plot 18 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 69: Plot 18 viewed from corner ‘P’ to corner ‘D’, 2013. No visible change within the plot since 2011 is evident.

Plate 70: Plot 18 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 71: Plot 18 viewed from corner ‘P’ to corner ‘D’, 2013. Lupin and harestail have visibly increased in cover in the mid- and background since 2011.

Plate 72: Plot 18 viewed from E2807862 N6379906 at a compass bearing of 90°, 2011.

Plate 73: Plot 18 viewed from E2807862 N6379906 at a compass bearing of 90°, 2013. Lupin and harestail cover has increased since 2011, and individual spinifex plants appear less dense than in 2011.

Plate 74: Plot 19 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 75: Plot 19 viewed from corner ‘P’ to corner ‘D’, 2013. *Carex testacea* density appears slightly reduced since 2011 and exotic grasses appear to be more prominent.

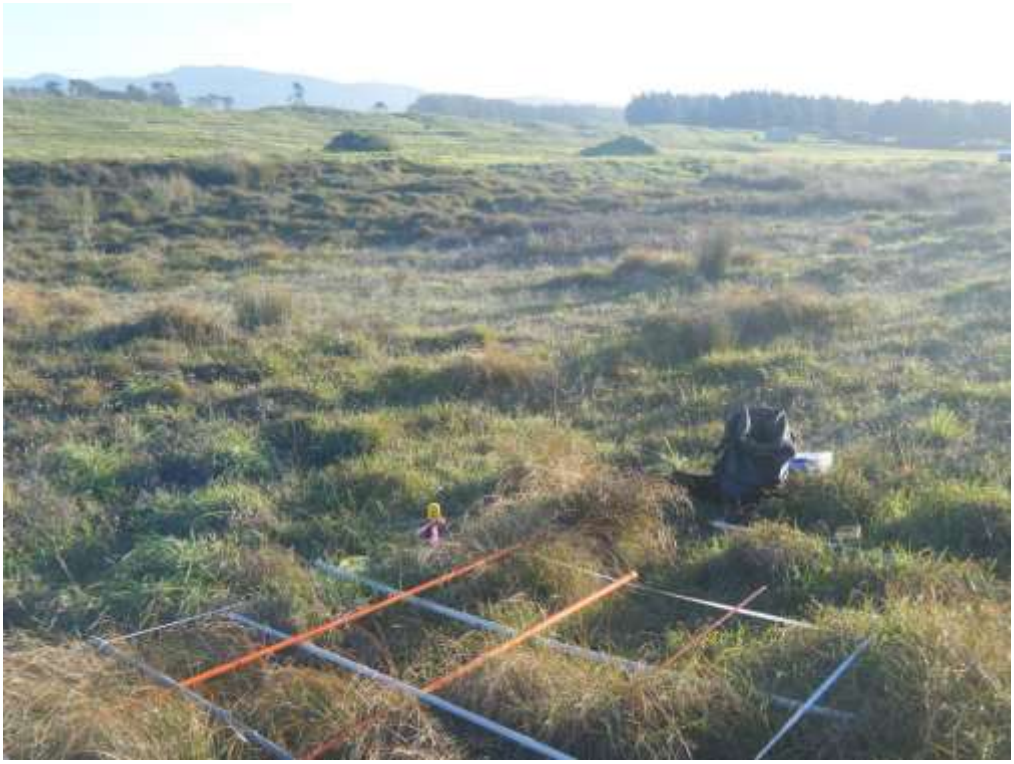

Plate 76: Plot 19 viewed from corner ‘D’ to corner ‘P’, 2011.

Plate 77: Plot 19 viewed from corner ‘D’ to corner ‘P’, 2013. Since 2011, pōhuehue cover appears to have increased in the mid- and background, wīwī density appears greater in the background, and bare ground has been colonised by harestail (mid-ground).

Plate 78: Plot 20 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 79: Plot 20 viewed from corner ‘P’ to corner ‘D’, 2013. Since 2011, *Carex testacea* cover appears to have increased slightly and bare ground has been colonised by harestail.

Plate 80: Plot 20 viewed from corner ‘D’ to corner ‘P’, 2011.

Plate 81: Plot 20 viewed from corner ‘D’ to corner ‘P’, 2013. Since 2011 *Carex testacea* and harestail appear more prominent in the wider area. Bare ground has been colonised by harestail.

Plate 82: Plot 21 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 83: Plot 21 viewed from corner ‘P’ to corner ‘D’, 2013. Since 2011, *Carex testacea* and pōhuehue appear to have grown in height and increased in density to fill most of the plot. Exotic grass cover appears reduced.

Plate 84: Plot 21 viewed from corner ‘D’ to corner ‘P’, 2011.

Plate 85: Plot 21 viewed from corner ‘D’ to corner ‘P’, 2013. *Carex testacea*, wīwī, and pōhuehue appear to have increased in density and size since 2011.

Plate 86: Plot 22 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 87: Plot 22 viewed from corner ‘P’ to corner ‘D’, 2013. Since 2011, exotic grasses appear less prominent, and spinifex and bracken appear more prominent. Pōhuehue appears to have increased in height.

Plate 88: Plot 22 viewed from approximately 10m southeast of the plot at a bearing of 310°, 2011.

Plate 89: Plot 22 viewed from approximately 10m southeast of the plot at a bearing of 310°, 2013. Since 2011, *Carex testacea* and pōhuehue have increased in size and cover in the background, and pōhuehue and bracken are more prominent in the foreground. Exotic grass cover is less prominent.

Plate 90: Plot 23 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 91: Plot 23 viewed from corner ‘P’ to corner ‘D’, 2013. Little obvious change since 2011. Possible slight increase in cover of moss, harestail, and hawkbit.

Plate 92: Plot 23 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 93: Plot 23 viewed from corner ‘P’ to corner ‘D’, 2013. Since 2011 both the cattle-proof fence and rabbit-proof fence have been constructed, pīngao has been planted along the rabbit-proof fence, and lupin and harestail have colonised previously bare sand between the two fences.

Plate 94: Plot 24 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 95: Plot 24 viewed from corner ‘P’ to corner ‘D’, 2013.
No obvious change evident since 2011.

Plate 96: Plot 24 viewed from corner ‘D’ to corner ‘P’, 2011.

Plate 97: Plot 24 viewed from corner ‘D’ to corner ‘P’, 2013. Since 2011 the rabbit-proof fence has been constructed and pīngao has been planted alongside the fence. Lupin and harestail have colonised areas of previously bare sand in the mid- and background.

Plate 98: Plot 25 viewed from corner A to corner ‘M’, 2011.

Plate 99: Plot 25 viewed from corner A to corner ‘M’, 2013. Since 2011, pīngao has been planted within the plot, and lupin has colonised the margins of the plot.

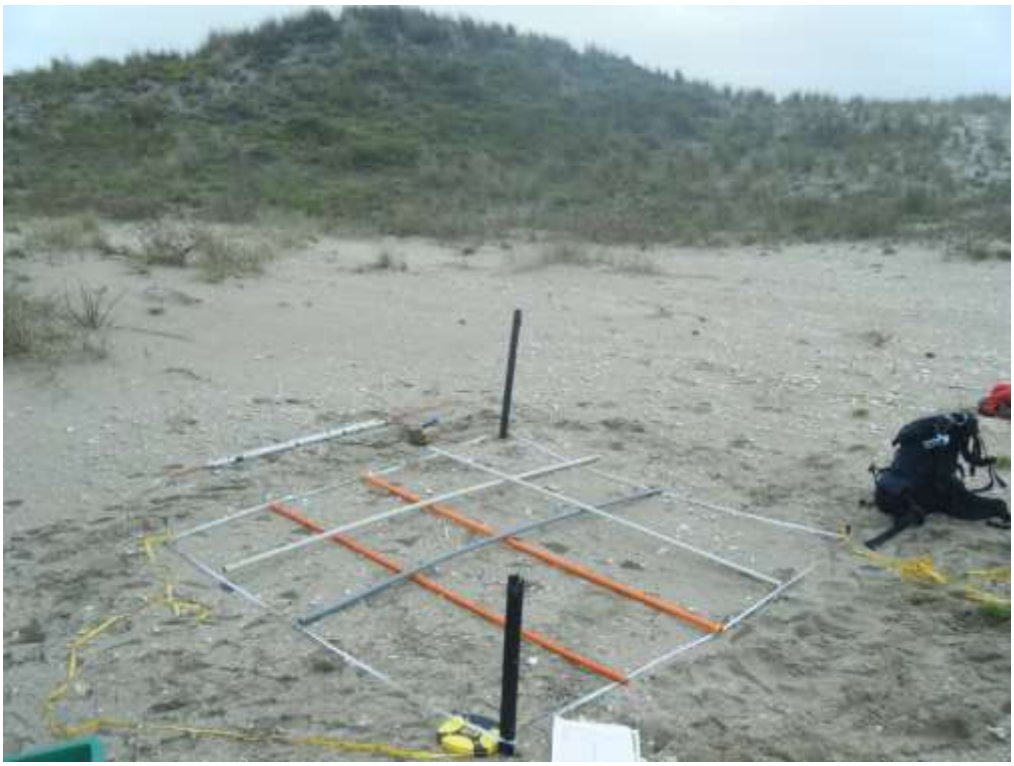

Plate 100: Plot 25 viewed from corner A to corner 'M', 2011.

Plate 101: Plot 25 viewed from corner A to corner 'M', 2013. Since 2011, pīngao has been planted within the plot and on the right hand side (midground). Lupin has colonised bare sand around the plot and at the base of the hummock in the background.

Plate 102: Plot 26 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 103: Plot 26 viewed from corner ‘P’ to corner ‘D’, 2013. Since 2011 (within the plot), *Carex testacea* and exotic grasses appear more prominent, pōhuehue appears to have reduced in extent.

Plate 104: Plot 26 viewed from corner ‘P’ to corner ‘D’, 2011.

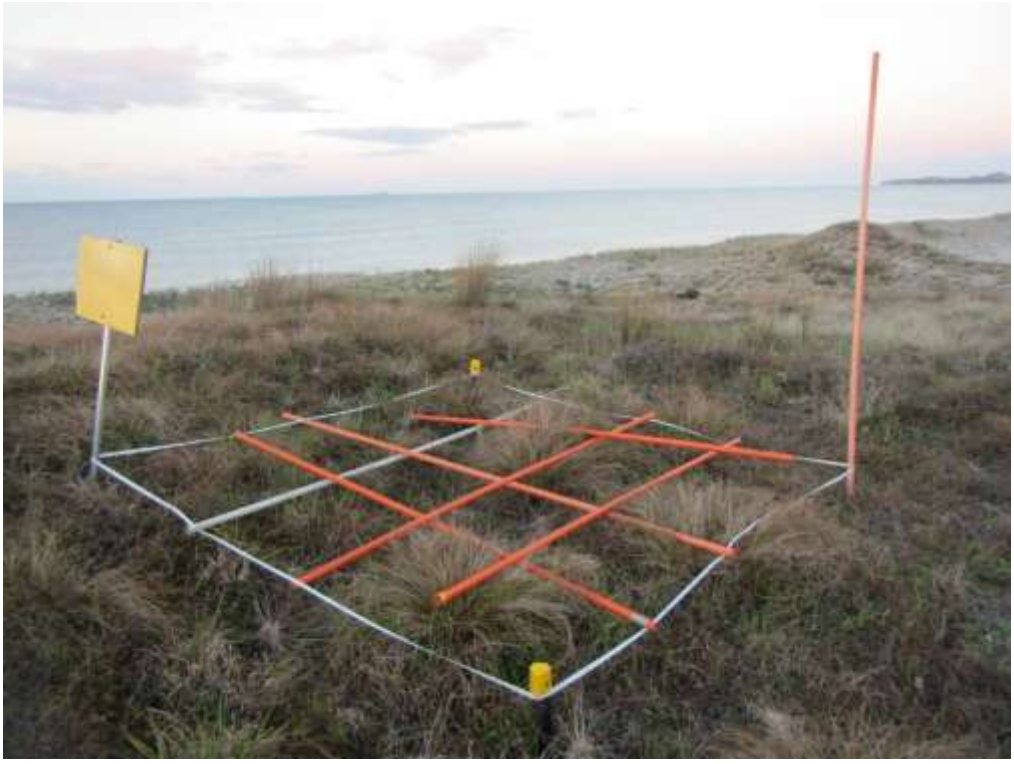

Plate 105: Plot 26 viewed from corner ‘P’ to corner ‘D’, 2013.
Carex testacea and wīwī appear more prominent than in 2011,
and pōhuehue appears to have reduced in extent.

Plate 106: A view westwards from Plot 26, 2011.

Plate 107: A view westwards from Plot 26, 2013. *Carex testacea* and pōhuehue appear more prominent in the foreground since 2011, and pōhuehue appears more prominent in the mid-ground (right). There is no obvious change in spinifex cover. Lupin has colonised bare ground in the background, particularly either side of the dune crest farthest from the sea.

Plate 108: Plot 27 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 109: Plot 27 viewed from corner ‘P’ to corner ‘D’, 2013. Little obvious change within the plot since 2011. Pōhuehue and wīwī in the background appear taller and denser than in 2011. *Carex testacea* (background, right) was not present in 2011.

Plate 110: Plot 27 from E2807868 N6379856 at a compass bearing of 140°, 2011.

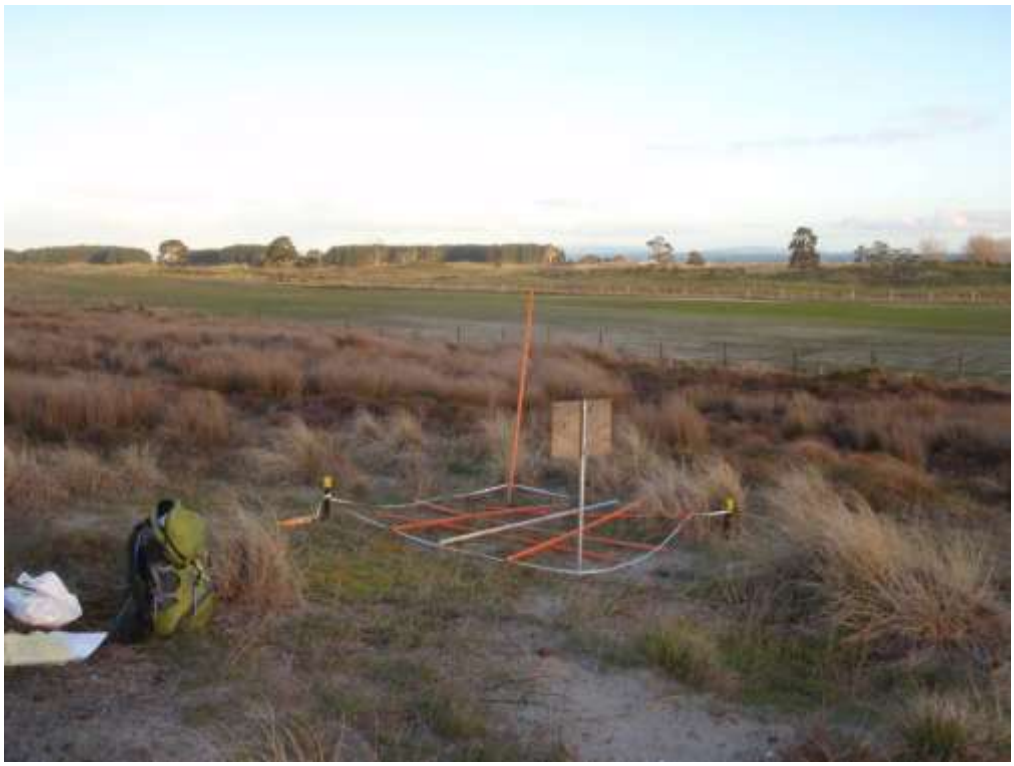

Plate 110: Plot 27 from E2807868 N6379856 at a compass bearing of 140°, 2013. Expansion of moss and harestail has occurred into areas of previously bare ground (foreground). Wīwī and pōhuehue appear taller and appear to have greater density than in 2011 (mid-(ground and background). Cattle fence has been constructed. Individual spinifex plant density appears slightly reduced.

Plate 112: Plot 28 viewed from corner ‘P’ to corner ‘D’, 2011.

Plate 113: Plot 28 viewed from corner ‘P’ to corner ‘D’, 2013. Little obvious change compared to 2011. Pōhuehue may be slightly taller or denser.

Plate 114: Plot 28 viewed from E2808025 N6379746 at a compass bearing of 83°, 2011.

Plate 115: Plot 28 viewed from E2808025 N6379746 at a compass bearing of 83°, 2013. *Carex testacea*, harestail, and pōhuehue (foreground) have increased in cover since 2011. *Carex testacea* and pōhuehue have increased in density in the mid-ground, and the rabbit-proof fence is evident (mid-ground). Lupin has colonised previously bare areas near the cattle-proof fence (background, right).

3. PHOTOGRAPHS OF PERMANENT PHOTOPOINTS

Plates 116 & 117: The view from Photopoint 1 at a compass bearing of 310 degrees on 16 June 2011 (Plate 116) and 16 July 2013 (Plate 117).

Change Since 2011

- Moderate growth and expansion of cover of pōhuehue, *Carex testacea*, and wīwī throughout.
- Gorse extent and height appears similar.

Plates 118 & 119: The view from Photopoint 1 at a compass bearing of 100 degrees on 16 June 2011 (Plate 118) and 17 July 2013 (Plate 119).

Change Since 2011

- Pōhuehue, Kentucky bluegrass, bracken, and harestail have colonised the sandy area in the foreground.
- Wīwī in mid-ground (right) appears denser than in 2011.
- Pōhuehue and *Carex testacea* cover has increased in the mid-ground to cover previously grassed areas.
- No obvious change in the background, though there appears to be a handful of lupin plants present on the right-hand side where previously none were evident (these may have been in poor health in 2011).

Plates 120 & 121: The view from Photopoint 2 at a compass bearing of 90 degrees on 16 June 2011 (Plate 120) and 16 July 2013 (Plate 121).

Change Since 2011

- Pōhuehue and *Carex testacea* have increased in cover and density in the mid-ground and foreground.
- Pīngao has been planted along the rabbit-proof fence.
- Little obvious change to the vegetation in the background.
- Wīwī individuals appear denser than in 2011.

Plates 122 & 123: The view from Photopoint 2 at a compass bearing of 245 degrees on 16 June 2011 (Plate 122) and 17 July 2013 (Plate 123).

Change Since 2011

- Pōhuehue and *Carex testacea* have increased in cover, size, and density in the mid-ground and background (left hand side).
- Little obvious change to the vegetation on the right hand side of the picture.

Plates 124 & 125: The view from Photopoint 3 at a compass bearing of 270 degrees on 16 June 2011 (Plate 124) and 16 July 2013 (Plate 125).

Change Since 2011

- There appears to be more lupin plants than in 2011.
- No other visible change evident.

Plates 126 & 127: The view from Photopoint 3 at a compass bearing of 140 degrees on 16 June 2011 (Plate 126) and 16 July 2013 (Plate 127).

Change Since 2011

- Planted whararikiki present in the mid-ground in 2011 (slightly right of centre) is no longer present.
- Pīngao has been planted along the rabbit-proof fence.
- No other visible change is evident.

Plates 129: The view from Photopoint 4 at a compass bearing of 180 degrees on 16 June 2011 (Plate 128) and 16 July 2013 (Plate 129)

Change Since 2011

- Wīwī, *Carex testacea*, and pōhuehue in the background appear to have increased slightly in cover and density.
- Spinifex cover (right hand side, mid-ground) appears slightly reduced.

Plates 130 & 131: The view from Photopoint 4 at a compass bearing of 100 degrees on 16 June 2011 (Plate 130) and 16 July 2013 (Plate 131).

Change Since 2011

- Little obvious change since 2011.
- There appears to be more lupin plants (mid-ground).

Plates 132 & 133: The view from Photopoint 5 at a compass bearing of 220 degrees on 16 June 2011 (Plate 132) and 8 July 2013 (Plate 133).

Change Since 2011

- *Senecio biserratus* is no longer present in the foreground of the photo but is present in the surrounding area.
- Pōhuehue plants appear slightly denser and taller throughout.
- Gorse cover has expanded in the background.
- Harestail cover has increased slightly (mid-ground).

Plates 134 & 135: The view from Photopoint 6 at a compass bearing of 240 degrees on 16 June 2011 (Plate 134) and 10 July 2013 (Plate 135).

Change Since 2011

- No obvious change to spinifex cover or density.
- There appears to be a slight increase in the number of lupin plants in the background (left).

Plates 136 & 137: The view from Photopoint 6 at a compass bearing of 90 degrees on 16 June 2011 (Plate 136; note that the GPS ref should read E2807784 N6380009) and 10 July 2013 (Plate 137).

Change Since 2011

- Pīngao has been planted along the outside of the rabbit-proof fence.
- Lupin cover has expanded since 2011, and lupin has colonised some of the bulldozer track.
- Harestail and catsear have also colonised the bulldozer track.
- Harestail has expanded cover in the foreground.
- Old fence posts present on the right of the 2011 picture have been removed.
- Spinifex appears less dense than in 2011.

Plates 138 & 139: The view from Photopoint 6 at a compass bearing of 270 degrees on 16 June 2011 (Plate 138; note that the GPS ref should read E2807784 N6380009) and 10 July 2013 (Plate 139).

Change Since 2011

- Pīngao has been planted along the outside of the rabbit-proof fence.
- Lupin cover has expanded since 2011, and lupin has colonised some of the bulldozer track.
- Harestail and catsear have also colonised the bulldozer track.
- Old fence posts present on the right of the 2011 picture have been removed.
- Spinifex appears less dense than in 2011.

Plates 140 & 141: The view from Photopoint 7 at a compass bearing of 90 degrees on 16 June 2011 (Plate 140) and 10 July 2013 (Plate 141).

Change Since 2011

- Harestail cover has increased substantially in the foreground (now covers approximately half of the area that was bare sand in 2011).
- The cover of moss in the foreground has increased by roughly three times since 2011.
- Wīwī (centre right) has increased in density and two new wīwī plants are present in the foreground (left).
- Lupin has colonised previously bare areas of sand, particularly in the mid-ground.
- Pīngao has been planted alongside the rabbit-proof fence (background, left).
- Spinifex appears less dense than in 2011.

Plates 142 & 143: The view from Photopoint 8 at a compass bearing of 90 degrees on 16 June 2011 (Plate 142) and 9 July 2013 (Plate 143).

Change Since 2011

- Little visible change evident.
- Lupin cover has increased in the foreground.
- The gorse bushes in the background appear to be dying.
- No obvious change in spinifex cover or density.

Plates 144 & 145: The view from Photopoint 9 at a compass bearing of 280 degrees on 16 June 2011 (Plate 144) and 9 July 2013 (Plate 145).

Change Since 2011

- Pōhuehue in the foreground and against the fenceline has increased in height and cover.
- Lupin cover has increased in the mid-ground.
- Fennel and gorse have colonised areas inside the rabbit-proof fence.

Plates 146 & 147: The view from Photopoint 9 at a compass bearing of 80 degrees on 16 June 2011 (Plate 146) and 9 July 2013 (Plate 147).

Change Since 2011

- Lupin has established in the mid-ground, left, since 2011
- Sheep's sorrel is less conspicuous in the foreground and mid-ground.
- Harestail has expanded cover to fill areas previously dominated by sheep's sorrel, or without live vegetative cover.
- Individual plants of wīwī appear slightly denser (background).
- *Carex testacea* plants appear slightly larger (mid-ground, left hand side, and background).

Plates 148 & 149: The view from Photopoint 10 at a compass bearing of 270 degrees on 16 June 2011 (Plate 148) and 9 July 2013 (Plate 149).

Change Since 2011

- Two pampas tussocks have established and grown significantly since 2011 (one in the background (right), and one beside the rabbit-proof fence (mid-ground)).
- Gorse has established and grown significantly at the base of the hillock in the background.
- Wīwī cover has expanded significantly inside the rabbit-proof fence.
- *Lachnagrostis billardierei* has established and grown significantly at the base of the hillock in the background (around the gorse bushes).
- Harestail has established and expanded cover significantly in the mid-ground.
- The bulldozer track has been colonised by harestail, blackberry, *Lachnagrostis billardierei*, and woolly mullein.

Plates 150 & 151: The view from Photopoint 10 at a compass bearing of 330 degrees on 16 June 2011 (Plate 150) and 9 July 2013 (Plate 151).

Change Since 2011

- Little obvious change evident.
- Slight increase in pōhuehue height in mid-ground.
- Possible minor increase in harestail cover on the hillocks in the background.

Plates 152 & 153: The view from Photopoint 10 at a compass bearing of NE on 16 June 2011 (Plate 152) and 9 July 2013 (Plate 153).

Change Since 2011

- Photo orientation off in 2013 so comment only made on area that is the same (roughly from the middle of the 2013 photo and to the left).
- Pōhuehue has increased in height and extent in the mid-ground.
- Harestail, and to a lesser extent *Lachnagrostis billardierei* , has expanded in extent and colonised the portion of the foreground that was previously bare sand.
- No noticeable change in the cover or extent of spinifex.

Plates 154 & 155: The view from Photopoint 11 at a compass bearing of 120 degrees on 16 June 2011 (Plate 154) and 9 July 2013 (Plate 155).

Change Since 2011

- Moss cover has increased in the foreground (right).
- Lupin has colonised previously bare sand in the mid-ground.
- Pīngao has been planted in the mid-ground.
- No obvious change in harestail or spinifex cover.

Plates 156 & 157: The view from Photopoint 11 at a compass bearing of 260 degrees on 16 June 2011 (Plate 156) and 9 July 2013 (Plate 157).

Change Since 2011

- Minor increase in harestail cover in the foreground and front of mid-ground.
- Pīngao has been planted along the rabbit-proof fence (mid-ground).
- Slight increase in pōhuehue cover at base of slope behind rabbit-proof fence.

Plates 158 & 159: The view from Photopoint 12 at a compass bearing of 270 degrees on 16 June 2011 (Plate 158) and 9 July 2013 (Plate 159).

Change Since 2011

- No noticeable change to vegetation in foreground.
- Minor increase in extent of hinarepe in mid-ground.
- Lupin appears to have higher cover in mid-ground and background (left).
- No discernible change in spinifex cover.

Plates 160 & 161: The view from Photopoint 13 at a compass bearing of 270 degrees on 16 June 2011 (Plate 160) and 9 July 2013 (Plate 161). (Vegetation Plot 6 is visible in the mid-ground).

Change Since 2011

- Several lupin plants have established and grown significantly in the foreground and background.
- Pīngao has been planted in the background (in front of lupin at base of hillock).
- No discernible change in spinifex cover.
- Cattle fence is present on right-hand side.

Plates 162 & 163: The view from Photopoint 13 at a compass bearing of 120 degrees on 16 June 2011 (Plate 162) and 9 July 2013 (Plate 163).

Change Since 2011

- Expansion and growth of lupin in the foreground and mid-ground. Now co-dominant with spinifex.
- No discernible change in gorse, wīwī, and pōhuehue in background.
- Slight increase in spinifex cover in background (left).
- Cattle fence is present between mid-ground and background.
- Hawkbit no longer present in foreground.

Plates 164 & 165: The view from Photopoint 14 at a compass bearing of 200 degrees on 16 June 2011 (Plate 164) and 10 July 2013 (Plate 165).

Change Since 2011

- Approximate three-fold increase in harestail cover in the foreground.
- *Lachnagrostis billardierei* plants in the foreground appear less dense.
- Establishment and growth of lupin has occurred in the mid-ground and background.
- No discernible change in spinifex cover.

Plates 166 & 167: The view from Photopoint 14 at a compass bearing of 80 degrees on 16 June 2011 (Plate 166) and 10 July 2013 (Plate 167).

Change Since 2011

- Pīngao has been planted along the outside of the rabbit-proof fence.
- The bulldozer track has been colonised predominantly by harestail and lupin, with some spinifex.
- Lupin cover has increased substantially on both sides of the rabbit-proof fence.
- No discernible change in spinifex cover.

Plates 168 & 169: The view from Photopoint 15 at a compass bearing of 70 degrees on 16 June 2011 (Plate 168) and 10 July 2013 (Plate 169).

Change Since 2011

- Harestail and ripgut brome cover has increased slightly in the foreground.
- Pōhuehue has increased in height slightly in the backgound.
- Spinifex in the mid-ground appears to have increased in height.
- No discernible change in wīwī cover or density.
- A single pampas tussock has established and grown significantly on the skyline (right).

LOCATIONS OF PERMANENT 2 × 2 M PLOTS ESTABLISHED AT TE TUMU KAITUNA 7B2

Plot No.	Location	Vegetation Type No.	Easting	Northing	P Tag	D Tag	Orientation from Corner P
1	Outside	2	2808030	6379841	W2 6639	W2 6638	191° to A, 99° to M
2	Inside	8	2807583	6380005	W2 6695	W2 6694	192° to A, 276° to M
3	Outside	2	2807580	6380133	W2 6692	W2 6691	354° to A, 89° to M
4	Outside	2	2807812	6379995	W2 6679	W2 6697	0° to A, 90° to M
5	Outside	8	2807553	6380097	W2 6606	W2 6690	20° to A, 107° to M
6	Outside	3	2808174	6379743	W2 6673	W2 6674	0° to A, 90° to M
7	Outside	3	2808157	6379728	W2 6671	W2 6672	0° to A, 90° to M
8	Inside	11	2807987	6379751	W2 6670	W2 6669	0° to A, 88° to M
9	Inside	2	2808019	6379827	W2 6688	W2 6640	178° to A, 272° to M
10	Inside	8	2807941	6379815	P5177	P5178	180° to A, 96° to M
11	Inside	9	2807848	6379835	P5183	P5182	188° to A, 95° to M
12	Inside	2	2807770	6379992	W2 6609	W2 6608	180° to A, 270° to M
13	Outside	8	2807582	6380061	W2 6665	W2 6666	0° to A, 88° to M
14	Outside	8	2807566	6380033	W2 6611	W2 6610	003° to A, 101° to M
15	Outside	9	2807542	6380034	W2 6612	W2 6613	004° to A, 90° to M
16	Inside	2	2807842	6379927	W2 6663	W2 6664	0° to A, 90° to M
17	Inside	2	2807736	6380002	W2 6678	W2 6677	0° to A, 90° to M
18	Inside	2	2807876	6379899	W2 6662	W2 6661	0° to A, 90° to M
19	Inside	8	2807728	6379935	W2 6675	W2 6676	002° to A, 93° to M
20	Inside	8	2807829	6379904	W2 6668	W2 6667	0° to A, 90° to M
21	Inside	8	2807664	6379976	W2 6615	W2 6614	003° to A, 99° to M
22	Inside	8	2807626	6379975	W2 6694	W2 6618	0° to A, 91° to M
23	Inside	2	2808076	6379775	W2 6655	W2 6656	355° to A, 85° to M
24	Outside	2	2807946	6379897	W2 6660	W2 6659	92° to A, 12° to M
25	Outside	3	2808133	6379720	(A Tag) W2 6686	(M tag) P5190	180° to A, 270° to M
26	Inside	8	2808024	6379785	W2 6657	W2 6658	0° to A, 90° to M
27	Inside	7	2807869	6379862	P5180	P5181	0° to A, 270° to M
28	Inside	2	2808034	6379743	P5191	W2 6641	295° to A, 25° to M

LOCATIONS OF PERMANENT PHOTOPOINTS AT TE TUMU KAITUNA 7B2

Photopoint	Location	E	N	Notes	Tag Number	Bearing	Photo In/Out Rabbit Fence
P1	On fence	2807573	6380029	Strainer post at bend in fence.	W2 6654	310	Out
P1	On fence	2807573	6380029	Strainer post at bend in fence.	W2 6654	100	In
P2	Outside	2807595	6380080	15 m east of old bach site, on old fence line (not rabbit fence). Marked with warratah.	W2 6616	90	In and Out
P2	Outside	2807595	6380080	15 m east of old bach site, on old fence line (not rabbit fence). Marked with warratah.	W2 6616	245	Out
P3	Outside	2807612	6380123	Warratah 60 deg and 70 m from bach, east of Vegetation Plot 3.	W2 6652	270	Out
P3	Outside	2807612	6380123	Warratah 60 deg and 70 m from bach, east of Vegetation Plot 3.	W2 6652	140	Out
P4	Inside	2807649	6380046	Warratah 60 deg and 70 m from bach, east of Vegetation Plot 3.	W2 6653	180	In
P4	Inside	2807649	6380046	Warratah 60 deg and 70 m from bach, east of Vegetation Plot 3.	W2 6653	100	In
P5	Inside	2807697	6379969	Warratah.	W2 6650	220	In
P6	On fence	2807784	6380009	Fence post.	W2 6649	240	In
P6	On fence	2807784	6380009	Fence post.	W2 6649	90	In and Out
P6	On fence	2807784	6380009	Fence post.	W2 6649	270	In and Out
P7	On fence	2807847	6379905	Fence post.	W2 6649	90	In
P8	Inside	2807965	6379822	Warratah.	W2 6651	90	In
P9	Inside	2807985	6379754	Warratah at Vegetation Plot 8.	W2 6651	280	In
P9	Inside	2807985	6379754	Warratah at Vegetation Plot 8.	W2 6670	80	In
P10	On fence	2808065	6379711	Strainer post at bend in fence.	W2 6648	270	In (and Out)
P10	On fence	2808065	6379711	Strainer post at bend in fence.	W2 6648	330	In
P10	On fence	2808065	6379711	Strainer post at bend in fence.	W2 6648	E-NE	Out
P11	Outside	2808110	6379770	Warratah.	W2 6647	120	Out
P11	Outside	2808110	6379770	Warratah.	W2 6647	260	In and Out
P12	Outside	2808161	6379728	Warratah at Vegetation Plot 7.	W2 6643	270	Out
P13	Outside	2808197	6379727	Warratah.	W2 6646	270	Out
P13	Outside	2808197	6379727	Warratah.	W2 6646	120	Out
P14	On fence	2807981	6379863	Fence post.	W2 6645	200	In
P14	On fence	2807981	6379863	Fence post.	W2 6645	80	In and Out
P15	On fence	2807826	6379858	Fence post.	W2 6644	70	In

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