Evidence relating to submission opposing granting of resource consents for a windfarm as proposed by Mighty river Power Ltd, in and around the Turitea Reserve, Manawatu

May 20 2009
By Gillian Lucy Rapson, 28 Parkland Crescent, Palmerston North.

The evidence herein presented relates to aspects of the **terrestrial plant ecology** of the proposed windfarm development.

Abbreviations:

- *EA*, i.e. *Ecological Assessment of the proposed Turitea windfarm, Palmerston North*, by Wildlands Consultants, July 2008, which is Appendix D of the *AEE,* and so is also included in reference to that.
- *MRP* is used for Mighty River Power Ltd.
- *Frame* means the numbered "slide" or frame of the powerpoint presentation. Note that the numbering is not always visible on every frame.
- "we" = Manawatu Botanical Society, "I/me/my etc" = Jill Rapson.

Summary of my evidence

I am opposed to granting of the consents applied for because:

- Turbines are **inappropriate** in or near a nature reserve, especially one of this degree of local importance.
- There is **insufficient information** in the *EA* to accurately assess the impact of the proposed construction on the vegetation type most affected (Horopito forest and scrub).
- There are so many inconsistencies in the *EA* that even the area of the vegetation type which would be affected is **unknown**.
- The affected vegetation is a seral stage, which is undergoing regeneration, and so is especially **valuable**, even more so if it is >1 century old, and relatively weed-free.
- Because of the extremely slowness of regeneration on that site, vegetation will be extremely **difficult to "restore"**.
- The proposed "restoration" and mitigation strategies are **optimistic** at best.
- There is no assessment of exposure to exotic species' **invasions** as a consequence of infrastructural activities within the reserve.
- There is no apparent provision for the **disestablishment** of any infrastructure on the site when its usefulness has terminated, and for the consequent restoration required.
- The **visual impact** from Palmerston North and from within the Turitea reserve would be unacceptably severe.
- Further degradation of the remaining remnants of natural vegetation would be unacceptable, and will be seen as increasingly unacceptable in the decades to come.

Approach behind evidence presented

Much of the novel evidence I present here is derived from a **visit** paid by the Manawatu Botanical Society (Frames 5-6) to the Turitea Ridgeline on 20 March 2009, by myself and four other members, under the guidance of Palmerston North City Council staff. Our visit lasted about 7 hours, and we drove along the ridgeline road inside the reserve to the Brown's Flat gate (Frames 7-14), making a total of 9 "formal" stops, at 8 of which we inspected the vegetation for periods of 10-40 minutes each stop (Frames 15-16). Our inspection was limited by time to the margins of the road, with occasional forays deeper into the vegetation, mostly along tracks cut for possum control. We did not go further than about 50m into the vegetation at any point, and mostly much less. At each formal stop we searched for species, ticking new ones we found off on the list in Appendix 1 of the *EA* (Frame 18), and listing any extra species we encountered.

An extensive reference collection of 120 species (a number with duplicates) has been deposited in MPN, the **herbarium** of Massey University, where the collection awaits curation (Frame 18). (A herbarium is a "dead plant library", where dried and flattened plants are stored in perpetuity, for future reference.) Additionally, some estimates of cover of species in the ridgeline vegetation were made, and visible aspects of the ecology and regeneration were considered.

Differential impacts on vegetation types of the reserve

One conspicuous feature of the *EA* for terrestrial vegetation of the Turitea Reserve, is that the whole reserve is considered, but the vegetation type most affected receives no specific attention. An analysis, given errors in the *EA* of the northern portion of the reserve demonstrates that the **ridgeline vegetation** (mapped as "Horopito forest and scrub") covers 8% of the northern portion of the reserve, and yet will host 48% of the turbines (Frames 2-4). Further information on this analysis can be found in my submission.

While the level of information presented for most vegetation types seems appropriate, given the likely impacts thereon, that for the affected vegetation type is woefully inadequate, at least in terms of allowing any considered assessment of how it might respond to further disturbance. It was this issue which lead to our **focus** on the ridgeline vegetation.

Floristics

There are a number of problems with interpretation of **Appendix** 1 of the EA. The Key (Frame 18) raises the first issues, because it is not clear exactly what these codes mean, and which are mutually exclusive, although any one species is only given a single code. For example, it is hard believe that Esler and Ravine did not record such common species as rimu and miro. Equally it is hard to believe that totara was not recorded by the EA workers. Similarly, it seems irrelevant to note who recorded the exotics, except to conclude that Ravine and Esler obviously didn't!

Listed as an exotic in the Turitea spp. list (App. 1, EA), the status of ***Wahlenbergia*** sp. is unknown (Frame 19). This genus has native members in New Zealand, but the taxon does not key out as a known native. Further Esler reports an unnamed sp. from the Gorge, and it may be this one. Alternatively this taxon may indeed be an exotic, as some *Wahlenbergia* are present in NZ as vagrants or casuals. However, it does not match with the most likely candidate, Australian *Wahlenbergia stricta*, some specimens of which, from Central Otago, are housed in MPN. A specimen has been sent to WELT at Te Papa for determination. Since we encountered the taxon only along the road, I have continued, in the meantime, to treat it as an exotic.

These interpretation problems do not affect the basic reliability of the **species list** compiled, as in fact, it is very hard to compile a complete and accurate list of species present in any area, as experience, search strategies and chance all play a role in encounters. The EA lists 300 species (one under two names) for the whole of the reserve (though, presumably private land and Brown's Flat were not thoroughly searched). Two species are listed as being on private land (Key: 5), but at least one of those is in the reserve. The list is effectively of the Turitea Reserve.

Our search (Frames 20-24) compiled an extensive species list (appended to the end of this evidence portfolio) of 142 species (not counting the hybrid, as there are probably other hybrids out there, including plenty of *Coprosma* hybrids). We deliberately searched in a range of different habitats along the ridgeline, but since our search was not a thorough one either, and we continued to **record new species** at relatively the same frequency until the end of our trip, it seems likely that the list is still incomplete.

Table 1: Species diversity in Turitea reserve, from various sources

Taxon (native, unless stated)	Listed in App. 1 of EA	Also seen by us	Added by us
Gymnosperms	6	2	
Monocot trees and shrubs	4	3	
Dicot trees and shrubs	66	37	1
Lianes	16	9	
Lycopsids etc	4	3	1
Ferns	63	31	1 (+ 1 hybrid)
Orchids	8	4	
Grasses	12	3	
Sedges	24 (not 25)	3	
Rushes	7	1	
Other monocot herbs	9	4	
Dicot herbs	41	6	2
Exotic trees and shrubs	7	5	1
Exotic grasses and rushes	11	4	1
Exotic herbs	22	12	8
Total native	**260**	**106**	**5**
Total exotic	**40**	**21**	**10**
Total	**300**	**127**	**15**

Of those species we encountered, 15 were not listed in Appendix 1 of the *EA*, meaning approximately 4.7% of the known flora in the reserve was not recorded in the *EA* (Frame 21). This equates to about 2 new species per hour of searching by 5 people. Some of those species we added are neither small nor inconspicuous. In addition we recorded one bryophyte, *Dawsonia superba,* which is considered to be the largest moss in the world, and always worthy of mention.

In addition, a number of species are listed in the EA, which we did not encounter during our trip, but which we reasonably could have expected to see. These are listed in Table 3:

So at least an additional dozen species could reasonably be expected to be present somewhere in the belt of vegetation we examined.

Table 2: Species added to known list (App. 1 of EA, during visit by Manawatu Botanical Society (including the fern hybrid)	
Native species added	
Asplenium bulbiferum x flaccidum	fern hybrid
Asplenium hookerianum var. colensoi	fern
Haloragis erecta	herb
Lagenophora petiolata	herb
Ozothamnus leptophyllus	tauhinau
Tmesipteris elongata	fern ally
Exotic species added	
Carex ovalis	sedge
Cytisus scoparius	broom
Digitalis purpurea	foxglove
Erica lusitanica	Spanish heath
Linum bienne	linen flax
Lotus suaveolens	hairy lotus
Parentucellia viscosa	bartsia
Rumex obtusifolius	dock
Stellaria media	chickweed
Trifolium fragiferum	strawberry clover

Table 3: Species and genera known to be in the reserve, and likely to be on or near the ridgeline, but not seen by us during our trip.
Anaphalioides trinervis
Clematis forsteri
Coriaria arborea
Dianella nigra
Elaeocarpus hookerianus
Epilobium spp.
Gaultheria depressa
Knightia excelsa
Lastreopsis glabella
Luzula picta
Metrosideros robusta
Muehlenbeckia complexa
Myrsine australis
Olearia colensoi
Rytidosperma spp.

Interestingly at least 45% of the species known to be present in the reserve are found within about 20m of the ridgeline. This is a very **high floristic diversity** in an area which can be roughly estimated at 48 ha (12km of road x 20m either side of ridgeline), i.e. **4.3%** of the 1100 ha estimated in the EA to comprise "Horopito forest and scrub, or **0.14%** of the area of the whole reserve. A strong case can be made for the ridgeline being the area of the reserve most meritorious of protection.

Nature of "Horopito forest and scrub"

For some time now, in customary use, and in the scientific literature, there has been a tendency to avoid use of the term "scrub", which has derogatory connotations in New Zealand, in favour of the term "shrub" which refers to habit, and contains no other value judgments. "Scrub" is now normally used to refer to gorse and other weedy shrublands, of which the clearance is excusable and even acceptable. It is therefore regrettable that the *EA* uses this term throughout.

It is also regrettable that, given the "Horopito forest and scrub" is the most affected vegetation type in the Turitea Reserve, that no greater attempt has been made to understand its composition and dynamics than that given in the *EA* statement recorded in Fig. 1.

2.3 Horopito forest and scrub

Horopito dominates this vegetation type, with kapuka, kanono, pate (*Schefflera digitata*), hangehange, makomako (*Aristotelia serrata*), mahoe, wheki, *Cyathea smithii*, rangiora, and kotukutuku (*Fuchsia excorticata*). Common lianes include bush lawyer (*Rubus cissoides*) and kareao (supplejack; *Ripogonum scandens*), with *Microsorum pustulatum* a common epiphyte. Occasional emergent miro are present. Many emergent dead standing tree trucks are often present above the canopy. Small open areas contain small examples of toetoe (*Cortaderia fulvida*) tussockland, sweet vernal (*Anthoxanthum odoratum*) grassland, kiekie (*Freycinetia baueriana* subsp. *banksii*) vineland, and crown fern (*Blechnum discolor*) fernland.

Figure 1: Description of "Horopito forest and scrub" from *EA*.

A quantification of the vegetation was beyond the scope of our visit (Frames 25-27), but some attempt was made to roughly estimate cover at 5 sites around the reserve (Table 4). The vegetation type is extremely variable and consequently more detailed analysis is desirable. Nevertheless, our analysis indicates the description is valid in terms of the vegetation being dominated by horopito (*Pseudowintera colorata*), though **cover ranged from 20-70%** depending on the area of shrubland considered. However, our data shows that the next most important components include *Coprosma rhamnoides* and kotukutuku (*Fuchsia excorticata*). On the other hand, we did not find sufficient hangehange (*Geniostoma rupestre*) or pate (*Schefflera digitata*) to rate either as <1% cover on average, and *Griselinia littoralis* (kapuka) was only a very minor component.

The other species listed in the description above are very minor components coverwise, though they are more conspicuous beneath the canopy. This is a standard feature of such vegetation descriptions. because of the density of the canopy layer, the understorey vegetation is not usually dense in this vegetation type.

Two rare species are noted in the *EA* as worthy of especial protection during potential construction. Of these, we did not see *Brachyglottis kirkii* var. *kirkii* during our trip, although *Raukawa edgerleyi* was seen more than once.

I believe that inadequate assessment of the vegetation of the Turitea ridgeline has been made to determine its vulnerability to disturbance.

Table 4: Composition of canopy of "Horopito forest and scrub" (n=5)	
Species	**Average cover (%)**
Pseudowintera colorata	45
Coprosma grandifolia	20
Coprosma rhamnoides	10
Fuchsia excorticata	7
Cyathea smithii	5
Melicytus ramiflorus	5
Raukawa edgerleyi	5
Griselinia littoralis	3
Aristotelia serrata	1
Beilschmiedia tawa	1
Cortaderia	1
Dicksonia squarrosa	1
Prumnopitys ferruginea	1

Weed invasion

There is little assessment of the exposure of the reserve to weeds, and yet it appears substantial, given the works proposed. This is especially concerning given that a number of weeds, some noxious, were not detected in the EA (Frames 28-29). Weeds will continue to present a growing and persistent problem in the reserve, and special care needs to be taken to limit further invasion and to mitigate the effects of those present.

Regeneration status

The original vegetation of the Turitea ridgeline, prior to the forest collapse engendered by herbivore damage in the 1950s was **rata/kamahi forest** (Esler 1978; Frame 31), that is, emergent northern rata (*Metrosideros robusta*), which starts life as a vine, before becoming epiphytic and emerging sporadically above a fairly uniform canopy of kamahi (*Weinmannia racemosa*), a species which is light-demanding for regeneration. Of these species, we saw no northern rata, not even as vines, and only a few plants of kamahi on our trip, and those neither large nor well-grown.

We were unable to make any assessment of the **regeneration trajectories** the "Horopito forest and scrub" was likely to pursue, as we had no time to examine seedling plots under ridgeline vegetation. However we did make a few excursions off the ridgeline, and go a few metres into the shrubland. On these occasions I do not recall seeing any seedlings of potential forest canopy or emergent species at all. In more open area only about 2 seedlings of miro were observed. Miro (*Prumnopitys ferrugineus*) is currently the only emergent species, those present being remnants of the previous, otherwise collapsed, forest cover, but it was not a significant component of the original forest cover (Frame 30).

Consequently there seems to be little possibility that there are sufficient seed (parent) trees for the natural canopy of the area to develop in the next few decades. Re-establishment of the original canopy may take **centuries**, even without further disturbance of the ridgeline vegetation.

Impacts of vegetation clearance

Widening the road and clearing of turbine platforms are major disruptions to the vegetation. Although the actual amount of vegetation cleared can seem relatively minor, the results are more insidious for occurring on ridgelines, which are very exposed in terms of climate. In addition, the steepness of the surrounding terrain (Frames 32-35) makes it clear that such disturbance will not be limited to the roadsides, and may in fact, involve substantial portions of adjacent hillside, with concomitant rehabilitation problems.

Species likely to be affected by ridgeline construction

Although there is no evidence, it seems likely that a number of species are now found in the reserve only along the ridgeline. A number of species are possibly so affected (Frames 36-38). Widening and other disturbance of that roadway may result in the elimination of such species from the reserve altogether. This would be an unacceptable loss of biodiversity.

Rehabilitation possibilities

Restoration science is still developing in New Zealand, and around the world. There has been considerable success with establishment of **lowland forest canopies**, which, although not usually compositionally similar to natural canopies, at least provide a more suitable microclimate for natural processes.

Restoration at **higher altitudes** in New Zealand (Frames 39-40), such has occurred on the Stockton Plateau, the Remarkables Skifield road, and the Turoa road, have not been conspicuous for their success. Certainly the two roadside "restoration" projects, which I have seen, have left behind remnants of erosion prevention materials, but little in the way of an established vegetation cover. Given the exposed nature of the Turitea ridgeline it seems improbable, even given the lower altitudes than the roadside projects above, that success there would be any greater. To date, appropriate techniques for restoration in such environments are unknown.

MRP has apparently contracted some **preliminary trials** on restoration plantings (Frames 41-42) on the Turitea ridgeline, which we did not encounter on our visit. However the image in the latest propaganda vehicle (Turitea Wind Farm Update May 2009) shows planting of a miscellaneous collection of shrubs into a disturbed substrate during a trial. Since it seems highly unlikely the plants were **eco-sourced** (grown from seed or cuttings native to the site), this would lead concerned ecologists to hope, for the sake of the reserve, all plants promptly died. Further the plants used were both small, and in PBs (small plastic bags). This is not an appropriate trial, as plants for restoration work are conventionally grown in root trainers, so their root systems are both deeper and tougher. A slide from a colleague of such a trial (replicated?) suggests establishment was poor. In any case, survival of such plants over a period of 2-3 years is not indicative of their ability to survive in the long-term, especially given the broken nature of the cover so obtained, and the extreme climate severity of the site.

One technique proposed for the Turitea ridgeline is **overseeding** (hydroseeding?) with grasses, particularly exotics, seed supplies of natives being hard to obtain. However, exotic grass swards present a major obstacle to restoration plantings in other environments, and I see no reason why that would not also apply here. In addition, at least one suggested species (browntop, *Agrostis capillaris*) is known to be an aggressive invader in New Zealand natural systems (Rapson and Wilson, 1988, 1992a,b; Wilson and Rapson 1995), and has been recorded invading many

mountainous habitats. It would seem most undesirable to increase the weedy population of the area by this means.

Direct transfer (Frame 43) is suggested as a solution to some of the rehabilitation requirements of this area. The technique has been trialled at mine sites in New Zealand, though not at the sorts of altitudes considered here. The technique has a number of advantages, particularly in terms of transfer of seed and soil organisms, but many of the concerns raised by initial studies would apply here, such as difficulty of establishment on poor soils, inability to transfer plants with deep roots, and impact on establishment of unpredictable and extreme weather conditions (Ross *et al.*, 2000, Bassett *et al.,* 2005).

I have not been able to access the two contract reports of MRP which detail the apparent success of the direct transfer tests. However, it is well known (Ross *et al.*, 2000), that it takes several years for the **effects of the transfer** to become apparent, exceeding the time line of studies to date. We saw one transfer site (Frame 43), which had several shrub species still present, although the taller ones had (not unexpectedly) died, and the disturbed substrate had become infested with exotic grasses (one of the big problems in restoration programmes), inhibiting growth of the shrubs. In addition, the mountain cabbage trees transferred, although surviving (probably due to being shallow-rooted), were rather **deformed** by the experience. There is little evidence that the technique might be efficacious on the Turitea ridgeline (Frame 44).

No evidence is, however, known to me to demonstrate that the communities produced by restoration plantings are, or well become, **undifferentiatable** from natural communities. While restoration continues to be practised, and it certainly can, correctly operated, establish a canopy, the ecosystem processes thereunder do not necessarily **mimic** those of natural communities.

Since the practice of restoration is only 50 years old in New Zealand (Greenwood, 1978), few trial plots are available in which this topic could even be examined, and most of the older ones have no obvious appropriate analogue. Personal observation of restoration projects convinces me that establishment of seedlings does occur, which is at least unimpeded by man, even if it is not uninfluenced. However, the regeneration to be seen under restoration projects appears to be of species which would not be so common in natural shrubland or young forest. The **long-term consequences** of any such differences remain unknown.

In a reserve, and one at such high altitude, it seems inappropriate to be **experimenting** with restoration techniques which appear to be at best hopeful, rather than assured.

Visual effects

While these are not the focus of this evidence, it is worth pointing out that turbines detract from the natural experience. In addition, they are no substitute for the natural ridgeline spectacle, in this case of rata/kamahi forest, turning red over the Xmas period (Frames 45-48).

Conclusions

Given the huge loss of natural vegetation in the Manawatu since human settlement (Frames 49-54), and the apparently insatiable ability of humans to degrade and depreciate the remaining vegetation, it has to be asked if there will ever be a society in which native remnants, especially those in reserves, will be simply allowed to do what they were set up to do, reserve native vegetation. Although the demands of modern life might seem important, they will probably appear irrelevant to future generations who might wonder what this landscape looked like prior to human disturbance. There must be a time to say we must fully protect what is left.

References

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The Turitea Ridgeline -

Evidence of botanical composition and evaluation of regeneration status of vegetation

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1

Horopito Forest and Scrub

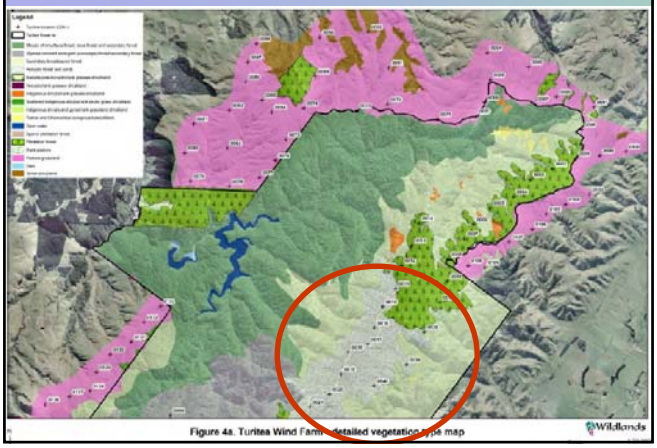


Table of vegetation types and proposed turbine densities in the northern part of the Reserve

Vegetation type	Area of vegetation type / ha	Proportion of vegetation type in measured area	Turbine no. in each vegetation type	Number of turbines / 10 ha of vegetation type	Proportion of turbines in each vegetation type
Mosaic of rimu/tawa forest	588.7	0.436	0	0.00	0.00
Secondary broadleaved forest	341.5	0.253	0	0.00	0.00
Plantation	174.1	0.129	11	0.63	0.48
Horopito forest and scrub	**107.6**	**0.080**	11	**1.02**	**0.48**
(Sparse emergent podocarps) / mixed secondary forest	95.7	0.071	1	0.10	0.04
Water/Dam	28.7	0.021	0	0.00	0.00
Indigenous shrub / rank grasses	8.0	0.006	0	0.00	0.00
Toetoe/*Chionochloa* tussockland	6.6	0.005	0	0.00	0.00
Totals	1351.0		23		1.00

3

Impact on Horopito forest and scrub

In the northern part of the reserve:

- Vegetation type Horopito Forest and Scrub forms only 8% of land cover.
- But it will contain 11 turbines.
- Over 4 ha are proposed to be cleared in this area = 60 housing sections (out of 25 ha to be cleared throughout the reserve = 357 housing sections for the whole reserve).

4


IG

What we did ...

Visit of one day (about 7 hours) - 20 March 2009.

Drove along road as far as Brown's Flat (14 km).

Looked about a bit and ticked off species already present on *EA* list.

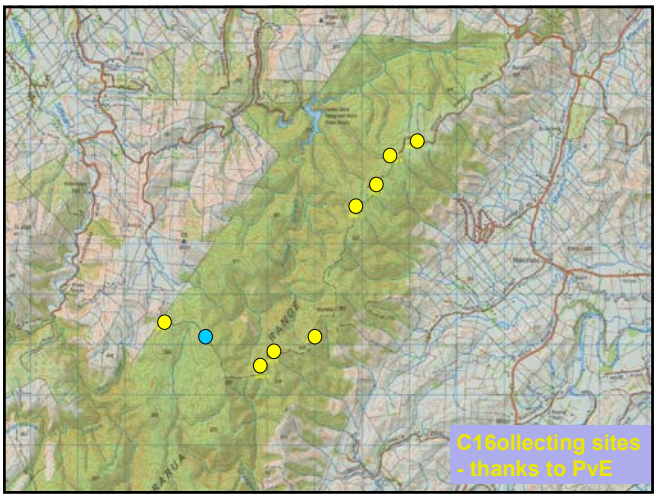
Stopped and explored roadside and adjacent vegetation at 8 sites, and stopped at another.

Collected as many reference specimens as possible for MPN (herbarium at Massey University).

Did some (very) rough estimates on composition of shrubland.

Discussed and considered regeneration.

15



Floristics

APPENDIX 1

VASCULAR PLANT SPECIES RECORDED AT TURITEA

Key

1. Current survey.
2. Recorded by Esler 1969 (and nomenclature 1999 update).
3. Recorded by Ravine 2004.
4. Recorded in current survey but not in previous surveys by Ravine (2004) or Esler (1969).
5. Recorded on private land only.

Indigenous Species

Gymnosperms

Dacrycarpus dacrydioides[1]	kahikatea
Dacrydium cupressinum[1]	rimu
Podocarpus hallii[2]	Hall's totara
Podocarpus totara[2]	totara
Prumnopitys ferruginea[1]	miro
Prumnopitys taxifolia[2]	matai

Monocot. trees and shrubs

Cordyline australis[3]	ti kouka
Cordyline banksii[3]	ti ngahere, forest cabbage tree
Cordyline indivisa[3]	mountain cabbage tree
Rhopalostylis sapida[1]	nikau

Dicot. trees and shrubs

Alectryon excelsus var. *excelsus*[2]	titoki
Alseuosmia pusilla[2]	
Ariaxoellia serrata[1]	makomako, wineberry
Beilschmiedia tawa[3]	tawa
Brachyglottis kirkii var. *kirkii*[1]	kohurangi
Brachyglottis repanda s.s.[1]	rangiora

How to interpret species list ?

I.e. not seen by Ravine and Esler.

But not seen in EA's survey?

Seen in EA's survey only?

Not seen in EA's survey?

Not seen by Esler?

Status of *Wahlenbergia* sp.

Listed as an exotic in the Turitea spp. list (App. 1, EA).

Unnamed *Wahlenbergia* may be present in the area.

Does not match with known exotic *Wahlenbergia* in MPN.

Status requires further work.

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Species seen on ridgeline

Taxon (native, unless stated)	Listed in App. 1 of EA	Also seen by us	Added by us
Gymnosperms	6	2	
Monocot trees and shrubs	4	3	
Dicot trees and shrubs	66	37	1
Lianes	16	9	
Lycopsids etc	4	3	1
Ferns	63	31	1 (+ 1 hybrid)
Orchids	8	4	
Grasses	12	3	
Sedges	24 (not 25)	3	
Rushes	7	1	
Other monocot herbs	9	4	
Dicot herbs	41	6	2
Exotic trees and shrubs	7	5	1
Exotic grasses and rushes	11	4	1
Exotic herbs	22	12	8
Total native	**260**	**106**	**5**
Total exotic	**40**	**21**	**10**
Total	**300**	**127**	**15**

On our trip along the ridgeline we saw 127 out of the 300 spp. listed for the reserve.

We also saw an additional 15 species not listed previously, a third natives.

20

Novel species on ridgeline

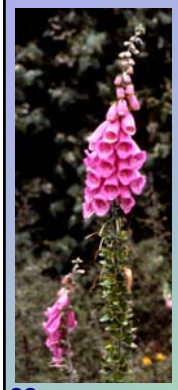
Native species added	
Asplenium bulbiferum x flaccidum	fern hybrid
Asplenium hookerianum var. colensoi	fern
Haloragis erecta	herb
Lagenophora petiolata	herb
Ozothamnus leptophyllus	tauhinau
Tmesipteris elongata	fern ally
Exotic species added	
Carex ovalis	sedge
Cytisus scoparius	broom
Digitalis purpurea	foxglove
Erica lusitanica	Spanish heath
Linum bienne	linen flax
Lotus suaveolens	hairy lotus
Parentucellia viscosa	bartsia
Rumex obtusifolius	dock
Stellaria media	chickweed
Trifolium fragiferum	strawberry clover

Discounting the hybrids (including *Coprosma* x), 5 natives were newly noted, one a shrub, tauhinau.

Two of the novel exotics are shrubs, both weedy, and at least one other, foxglove, is conspicuous.

21

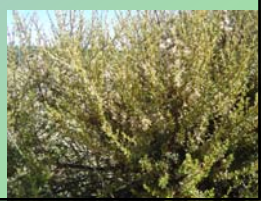
Novel species on ridgeline



Foxglove

Broom

Tauhinau



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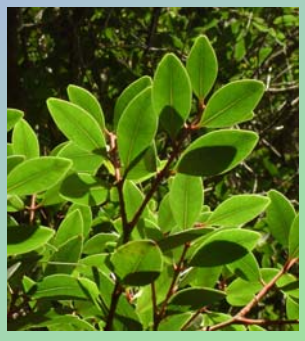
Species we could have found

Anaphalioides trinervis
Clematis forsteri
Coriaria arborea
Dianella nigra
Elaeocarpus hookerianus
***Epilobium* spp.**
Gaultheria depressa
Knightia excelsa
Lastreopsis glabella
Luzula picta
Metrosideros robusta →
Muehlenbeckia complexa
Myrsine australis
Olearia colensoi
***Rytidopsperma* spp.**



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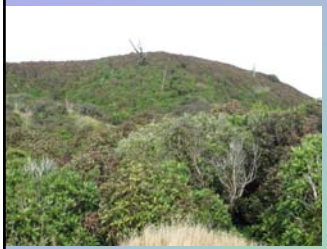
Ridgeline floristics



Out of 315 spp. present in the Turitea list, at least 142 (and possibly several more) are on or within 20 m of the ridgeline.

This amounts to 48% of the known flora.

This fraction was found in:

- 4.3% of the "Horopito forest and scrub", and
- 0.14% of the whole reserve.

This equates to an average of almost 3 spp. per ha of vegetation.

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What is horopito scrub?

2.3 Horopito forest and scrub

Horopito dominates this vegetation type, with kapuka, kanono, pate (*Schefflera digitata*), hangehange, makomako (*Aristotelia serrata*), mahoe, wheki, *Cyathea smithii*, rangiora, and kotukutuku (*Fuchsia excorticata*). Common lianes include bush lawyer (*Rubus cissoides*) and kareao (supplejack; *Ripogonum scandens*), with *Microsorum pustulatum* a common epiphyte. Occasional emergent miro are present. Many emergent dead standing tree trucks are often present above the canopy. Small open areas contain small examples of toetoe (*Cortaderia fulvida*) tussockland, sweet vernal (*Anthoxanthum odoratum*) grassland, kiekie (*Freycinetia baueriana* subsp. *banksii*) vineland, and crown fern (*Blechnum discolor*) fernland.

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EA

Horopito, kanono, karamu, mahoe, divaricate *Coprosma*, toetoe, treeferns

IG

Horopito scrub

Species	Average cover (%)
Pseudowintera colorata	45
Coprosma grandifolia	20
Coprosma rhamnoides	10
Fuchsia excorticata	7
Cyathea smithii	5
Melicytus ramiflorus	5
Raukawa edgerleyi	5
Griselinia littoralis	3
Aristotelia serrata	1
Beilschmiedia tawa	1
Cortaderia	1
Dicksonia squarrosa	1
Prumnopitys ferruginea	1

- Very rough estimates (5).
- Dominated by horopito.
- Cover of horopito ranges from 20-70%.
- Very mixed vegetation type with high species diversity.
- Cover very variable with location.
- Range of canopy heights (1-5m).

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Weed invasions

Biddibid on the move!

- 50 exotic species are known from the Turitea reserve.
- At least ten extra exotic species were noted during our visit.
- More are probably present in the reserve.
- Others will be present in the surrounding landscape

This is a small exotic flora for a reserve of this size, implying a relatively low level of exposure to past invasion, despite the history of forest collapse in the reserve.

I.e though very disturbed, it is still fairly native.

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Weed invasions

Some exotics noted are serious weeds or known to be aggressive, e.g.:

Lycesteria formosa - himalayan honeysuckle

Erica lusitanica - Spanish heather

Senecio glastifolius - pink ragwort (just outside reserve currently)

Agrostis capillaris - browntop

Weed sources: Vehicles, machinery, road-fill

Weed opportunities: Cleared land, disturbance, access routes

Placing turbines on the ridgeline would mean ==> More weeds and more weed problems to come.

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Regeneration status of ridgeline vegetation

Although not previously a ridgeline dominant, miro (*Prumnopitys ferruginea*) are now the most conspicuous trees present, being emergent. There are about two dozen live trees, and probalby they form many of the stags. Few seedlings of miro were found, suggesting little regeneration capacity.

What should occupy the ridgeline?

Kamahi - *Weimannia racemosa*

Rata - *Metrosideros robusta*

Ridgeline was Rata-kamahi forest prior to 1950s forest collapse.

Currently there are no rata on or near the ridgeline, and very few kamahi.
No seedlings of either were seen.

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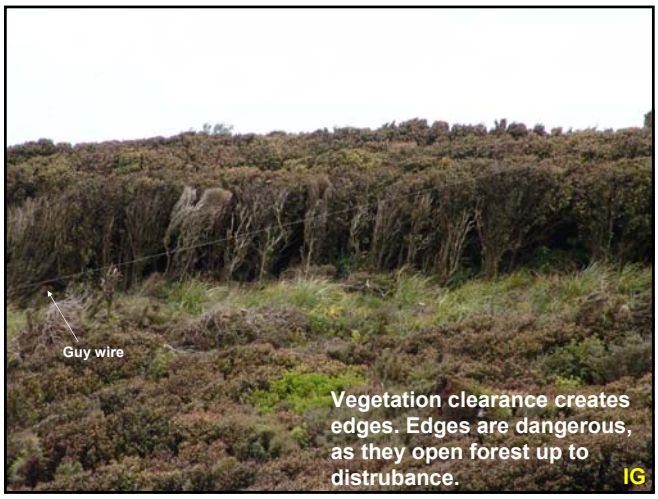
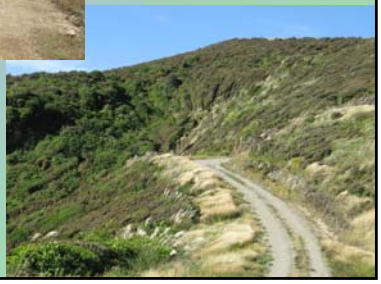
Impacts of vegetation clearance



Vegetation clearance creates edges. Edges are dangerous, as they open forest up to distrubance.

While some roadsides with easy contours are covered by largely exotic grassland, others are narrow, steep roadsides with margins of sculptured native vegetation.



13 km of road likely to be affected.

Road widened to at least 6-7m (maybe 10m).

Batters cut.

Some gullies likely to be extensively infilled.

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Species likely to be affected by roadworks

Mountain cabbage tree - *Cordyline indivisa*
Several seen alongside road, none seen elsewhere

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Species likely to be affected

Dracophyllum ?longifolium
in 3 patches (2 are 1-2 plants)
of about 30 plants in total alongside road.

Other species likely to be affected

Small herbs and shrubs of high altitudes or open areas:

Gautheria spp.
Libertia ixioides
Leucopogon fraseri
Nertera spp.
Oreomyrrhis colensoi
Oxalis spp.
Raoulia subsericea
Thelymitra and other "short grass orchids"

Some less frequent shrubs and herbs of "Horopito forest and scrub"

Information is insufficient to determine if road-widening will result in the local extinction of these species from the reserve.

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Rehabilitation

The original vegetation was rata/kamahi forest.

We saw no northern rata, and only a few plants of kamahi on our trip.
Little miro was present, and only half of those will ever set seed.
Few miro seedlings were seen.

Informal observations of seedling regeneration suggests there is very little, which implies that it will take many decades or centuries for the current vegetation to be replaced by the original.

Such a timetable will only be delayed by further disturbance, assuming seed sources do not decline in frequency and value.

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Severity of climate

Restoration plantings

From Turitea Wind Farm Update, May 2009

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Restoration Plantings

Direct transfer of vegetation

Direct transfer involves moving chunks of vegetation and substrate with a bulldozer or digger.

Costs:
High mortality rate of woody plants.
Unsightly (after the first year or so).
Readily invaded by exotic grasses (including exotic *Agrostis capillaris*, browntop, which is highly aggressive, especially at higher altitudes).

Benefits:
Moves soil.
Moves seed bank and small organisms.
Moves small herbs, especially rhizomatous species.

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Rehabilitation assessment

Optimistic projections based on little to no evidence

Does not match my "experiences":
Westland Plateaux
Turoa mountain road
Remarkables skifield road

Likely to be
- a prolonged, difficult, extremely expensive exercise,
- with doubtful chances of providing more than cover in the medium term, and
- continually decreasing prospects of allowing natural processes to re-establish.

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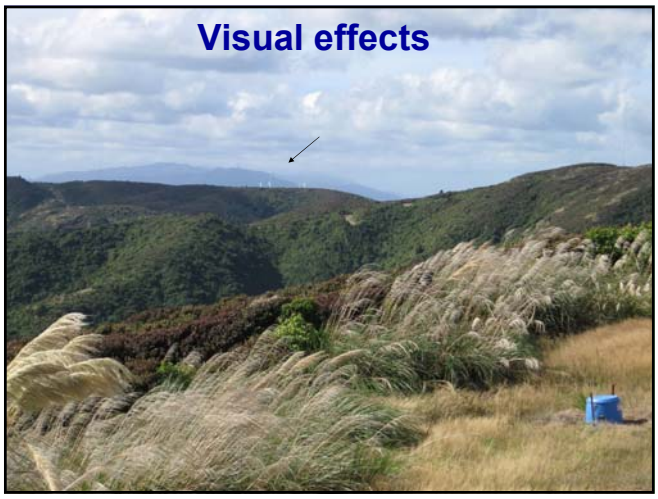
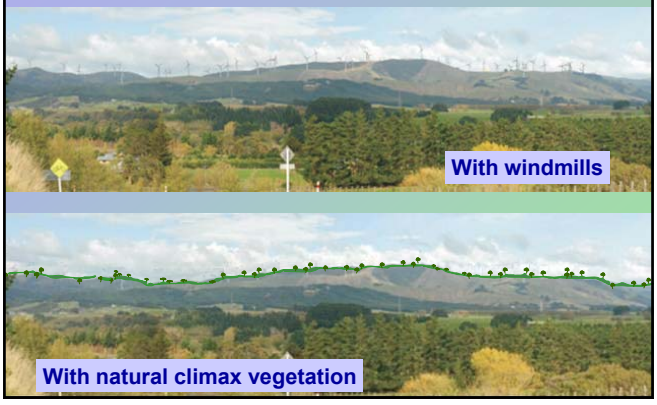
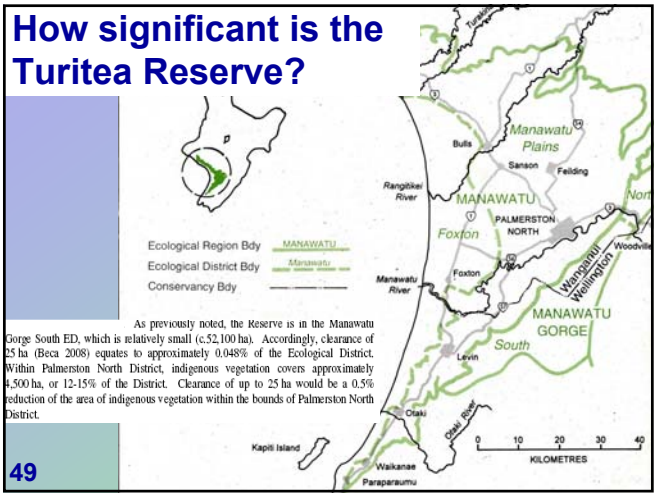
Visual effects



What could the ridgeline look like?



How significant is the Turitea Reserve?



As previously noted, the Reserve is in the Manawatu Gorge South ED, which is relatively small (c.52,100 ha). Accordingly, clearance of 25 ha (Beca 2008) equates to approximately 0.048% of the Ecological District. Within Palmerston North District, indigenous vegetation covers approximately 4,500 ha, or 12-15% of the District. Clearance of up to 25 ha would be a 0.5% reduction of the area of indigenous vegetation within the bounds of Palmerston North District.

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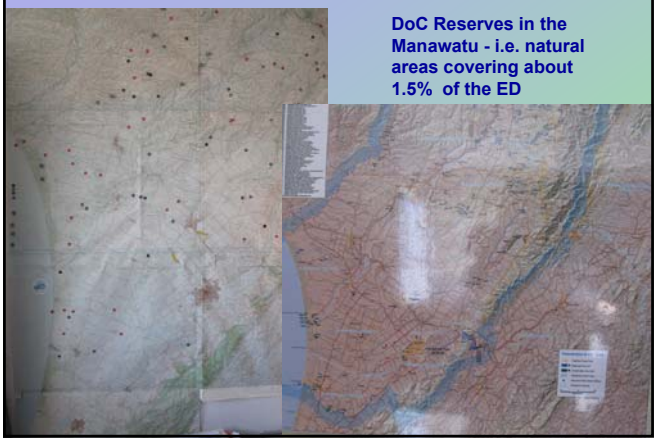
PNAs, RAPs, QEIIs



DoC Reserves in the Manawatu - i.e. natural areas covering about 1.5% of the ED

Rehabilitation assessment

Removal of concrete pads very difficult.

Improvement of compacted substrate very difficult.

Restoration of surrounding substrate difficult.

Restoration of areas under roadways, pads and other infrastructure very difficult.

Restoration success likely to be very patchy over the order of decades.

Standards which restoration is expected to achieve will get more stringent with time.

Costs unpredictable, but likely to be very high.

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Turitea Reserve assessment

- Highly disturbed vegetation over much of reserve (even at lower reaches).
- Massive past human and animal disturbance.
- Ridgeline and upper (>300m) vegetation especially disturbed.
- Location of high species diversity, especially of upper montane spp. (with little other local habitat available).
- Previous canopy of rata-kamahi missing, with little sign of recovery.
- 60 years of secondary succession established in favourable conditions (propagule-wise), has lead to little recovery.
- Growth rate slow, and rehabilitation likely to be very difficult.
- Future regeneration (post-windfarm) likely to be even slower than current regeneration
- Little native vegetation left in Manawatu (esp. PNCC district).
- Increasing pressure on remaning remnants.

==> Look after what we've got!

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Acknowledgements

Thanks to fellow explorers:

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To photographers and members of the Ecology Group who attend to the activities of the MBS.

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