Review of ecological baseline surveys prepared for the Simons Pass Dryland Reserve

Introduction

Simons Pass Station Limited holds resource consents to divert, take and use surface water for spray irrigation and stock water (CRC062867 and CRC082311). The consents required establishment of the 'Simons Pass Dryland Reserve' (*c.* 2500 ha) as environmental mitigation for land use intensification of Simons Pass and Simons Hill Stations associated with exercising of these consents. The objective of the Dryland Reserve is, through development and implementation of a Dryland Recovery Management Plan, promoting and achieving recovery of indigenous dryland ecosystems (clause 87 of CRC062867 / CRC082311).

Condition 86 and 88 of the consents required a baseline ecological survey of the Dryland Reserve species and communities within six months of commencement of the consent. Surveys were to include estimates of population densities of specified indigenous plant and animal species and communities, and were intended to help inform subsequent preparation of the Dryland Recovery Management Plan. Indigenous species and communities of interest for baseline surveys and management plan were specified in Condition 88. Conditions 86 and 88 are as follows:

86. Within 6 months of commencement of this consent, a baseline survey ("the Baseline Survey") of the population densities of the species and communities listed at condition 88 shall be carried out by a suitably qualified and experienced person approved by the consent authority, which shall be provided 10 working days after completion to the Stakeholders and Canterbury Regional Council Attention: Regional Manager RMA Monitoring and Compliance, for the consent authority to determine if the Baseline Survey complies with this condition, and if the consent authority determines that the Baseline Survey does not comply with this condition, it shall advise the consent holder of the reasons for this conclusion and require the consent holder to amend the baseline survey to ensure it complies.

88. The indigenous species and communities of the indigenous dryland ecosystems which shall be the subject of the restoration management shall include:

(a) tussock grassland, herbfield, mossfield and shrubland;

(b) plant species Lepidium solandri, Convolvulus verecundus, Pimelea sericeovillosa *subsp.* pulvinaris;

(c) native fauna in particular lizards, invertebrates and birds."

Copies of four baseline surveys for vegetation, birds, lizards and invertebrates were received by CRC in April 2018. I have been asked to review these surveys and comment on whether they comply with condition 86. In reviewing the baseline survey reports I have assessed

whether they are sufficient to inform the Dryland Management Plan, and measure progress against the stated objective of promoting and achieving recovery of indigenous dryland ecosystems. I have also considered whether or to what extent the baseline surveys will be able to demonstrate that potential adverse impacts on ecological values of the Dryland Reserve – from, for example, effects of adjoining land use activities; spread of introduced weeds – have been avoided or mitigated.

1. Baseline Vegetation Report

The 'Baseline vegetation report, Simons Pass Dryland Recovery Area' was prepared by Professor David Norton, University of Canterbury, dated 19 December 2017.

Methods

The baseline vegetation report draws on results of earlier vegetation survey carried out across Simons Pass Station in 2012-13, as part of evidence prepared for the Environment Court. The author noted there have been no further systematic vegetation surveys since the 2012-13 assessments were undertaken. The 2012-13 survey used a plot-based sampling procedure (derived from a 1km x 1km grid of sample points) to describe the main plant communities present on Simons Pass Station at the time. The report describes the sampling methods as following those of Hurst and Allen (2007). However, a full reference for this and other citations has not been provided in the baseline vegetation report.

A total of 133 10m x 10m plots were sampled in 2012-13. Twenty-three of the 133 vegetation plots were located in what was to become the 'Simons Pass Dryland Recovery Area' (Norton 2017, Figure 2). Plot data included information on the abiotic environment, proportion of main ground cover types (stones, soil, non-vascular plants, vascular plants), and the cover abundance of all vascular plants in different height strata. The baseline survey report did not provide any more detail on the cover classes or height strata used. This made interpretation of the results (i.e. Vegetation types described) problematic, as my understanding of the cover class typology used to annotate vegetation composition was not always consistent with the associated text description.

The methods section also noted that, in addition to the plot-based sampling, "extensive surveys" were made for Threatened and At-Risk plant species in 2012-13 and on several subsequent visits. In December 2017, the Dryland Recovery Area was revisited over two days and the plant communities and species present were assessed again, although no formal systematic surveys were undertaken.

Review comments on methods

I have noted the lack of full citation for the plot-sampling methodology, and gaps in detail with regard to the procedure for estimating and describing cover abundance of vascular plant species. While I appreciate that non-vascular flora were not the focus of the initial 2012-13 sampling, I consider they should have been more carefully considered in subsequent assessments. For example, 'mossfield' is noted in Condition 88 as one of the

indigenous dryland communities which shall be the subject of restoration management. Therefore, more comprehensive baseline information on species composition, abundance, location and extent of mossfield (as well as other plant species/communities noted in Condition 88) is required to help direct restoration management.

Nevertheless, I consider that data from the plot-based sampling method was an appropriate and useful starting point to inform the baseline vegetation survey. However the relatively low number of sample plots (23) from within the Dryland Recovery Area mean that, of itself, the method as described is insufficient for baseline survey purposes. This is implicitly acknowledged by the author in the 'Results' section where it is noted that "several further vegetation types [present in the dryland recovery area] were not sampled by these plots" (Norton 2017; p9, para 1). I consider that limitations inherent in the plot sampling intensity within the Dryland Recovery Area could, to a large extent, have been addressed by mapping the various vegetation types described, from both plot-based and non-plot assessments, at an appropriate scale. I also consider that providing map and GPS location information for particular species of interest (e.g. threatened species, wilding conifers) should have been part of the baseline survey method. I would have thought this sort of spatial information to be a fundamental part of the baseline survey. I will return to this point in comments on the 'Results and discussion section' below.

Comments on Results and discussion section

Plant communities

'Vegetation type 1' is described as "shrubby herbfield characterised by a sparse to dense layer of sweet briar over a mouse-ear hawkweed dominated ground layer". From the 'Atkinson notation' (Atkinson 1985) provided here, I would have interpreted sweet briar shrubs as the dominant cover. Not necessarily a big deal, but this ambiguity could have been resolved with a clearer description of procedure for estimating and describing species cover abundance in the 'Methods' section.

Non-vascular plants are described as "abundant", but no further detail on species composition and levels of abundance is provided here. This information is required to inform the baseline survey. The community is described as "confined to the alluvial terraces along the Pukaki River". Appropriate-scale maps showing location and extent of this plant community within the Dryland Recovery Area would be useful.

'Vegetation type 2' is described as "mouse-ear hawkweed dominated herbfield with very sparse sweet vernal and *Carex breviculmis,* and is confined to the alluvial terraces along the Tekapo and lower Pukaki Rivers." Again, mapping extent of 'Vegetation type 2' in these parts of the Dryland Recovery Area would be useful for baseline survey purposes. The description also notes non-vascular plants as "were abundant and the substrate was often dominated by gravels" without providing any further detail. In the absence of further information, I am left wondering whether this community could instead be described as mossfield, lichenfield, or even gravelfield.

‘Vegetation type 4’ is described as a grassy herbfield or depleted grassland that occurs on outwash plains. However the description then goes on to say that “grasses are largely confined to deeper soil phases, with non-vascular plants abundant on stony phases”. Once more, critical detail on non-vascular species composition and abundance is lacking. I wonder also whether the vegetation type might be better described as a mosaic (related to soil depth) of grass-herbfield and mossfield cover. And again, mapping the location and extent of this vegetation type on outwash plains landforms is needed for baseline survey.

Vegetation type 5 – I note the comment that this vegetation type has “the highest species richness of all vegetation types” and am left wondering why more information on floristic richness and species list for this and other vegetation types was not provided. I suggest this could be included in the appendix. Map location of this vegetation type within the DRA required.

Vegetation type 6 - Map location of this vegetation type within the DRA required.

Escarpment base shrubland (Norton 2017; p.9 para 1) - Map location of this vegetation type within the DRA required.

Melicytus alpinus shrubland on boulder banks (Norton 2017; p9 para 2) - Map location of this vegetation type within the DRA required.

Windrowed and fertilised alluvial terrace (p11, para 1) – This induced vegetation type *has* been mapped (Figure 2). However very little other information provided. From the photo (Figure 12) it appears to support non-vascular plant groundcover as well as scattered sweet briar shrubs. Could have potential as a site to manage for banded dotterel nesting habitat.

Area of wilding conifer forest (p.11, para 2) - Map location of this vegetation type within the DRA required. This is essential baseline survey information for future management plan.

Flora including Threatened and At Risk plant species

I agree that, while it is likely that further native and exotic species will be present through the 2500 ha Dryland Recovery Area, the list of *vascular* plant species in Appendix 1 is sufficient for baseline survey purposes. What is also needed, and could be shown in the same appendix, is to identify which species occur in the various plant communities described above, and an indication of their abundance (e.g. ‘dominant’, ‘common’, ‘scattered’, ‘occasional’, ‘sparse’) within each community.

Non-vascular flora was not assessed. It should have been.

I found the summary of the distribution and abundance of Threatened and At Risk vascular plant species within the Dryland Recovery Area useful (pages 14-19). I appreciate the difficulty in getting comprehensive information on distribution and numbers for many of these species. However, it would still be helpful to include map location of known populations as described in this section, particularly for the Nationally Threatened *Ceratocephala pungens, Lepidium solandri* and *Myosurus minimus*, as these species will be a focus of the future management plan. *Myosurus minimus* is known from only one site within the Dryland

Recovery Area, where it occurs (at least 50 plants counted) “in an old seasonally wet stream channel on the outwash plain” (Norton 2017; p16, para 2). It was not clear from the description whether this site was considered a wetland habitat; no wetland habitats or wetland plant communities were otherwise described in the Vegetation baseline report.

Also need to map the habitats where threatened and At Risk species are likely to be present within the DRA, as noted in pages 15-19; and provide maps and GPS location of exotic woody weeds not otherwise mentioned in the vegetation descriptions (i.e. *Betula pendula, Cytisus scoparius, Larex deciduousa, Salix fragilis, Ulex europaeus*).

Comments on Appendix – Plant species list

As noted above, need to relate species listed to occupancy of, and abundance within, vegetation types/plant communities also described.

Needs to include a list of non-vascular species.

I note that two wetland plants, pondweed *Potamogeton cheesemanii* and native rush *Juncus gregiflorus* are listed in the appendix. However, there was otherwise no mention in the report of wetland vegetation/habitats occurring within the DRA.

Conclusion

My overall conclusion is that there is not sufficient information in the ‘Baseline vegetation report’ to comply with baseline survey Consent Condition 86 and direct the development and successful implementation of a Dryland Recovery Management Plan. The main problems are:

1. Lack of spatially explicit (clear maps at appropriate scale) and quantitative information on location, extent, distribution, abundance of the various plant communities present, threatened species, weed species of concern (e.g. wilding conifers). I consider this level of information (i.e. what, where, how many) is a fundamental requirement of baseline survey.
2. The report does not adequately describe or assess non-vascular vegetation.
3. Report information is insufficient to allow monitoring/measuring of Dryland Recovery Management Plan objective to promote and achieve recovery of indigenous dryland ecosystems.
4. The presence of wetland plant species, as noted in the appendix to this report, and of wetland habitats, as noted in other baseline survey reports, were not described in the main body of the Vegetation baseline report.

2. Bird Baseline Surveys, Simons Pass Dryland Reserve, November 2017

This report (Sanders 2018) presents methods and results of a baseline survey of birds carried out in November 2017. It also discusses some potential bird habitat management options.

Comments on Methods section

The Dryland Reserve was divided into six 'management units' (Sanders 2018; Figure 1), although the basis for management unit designation was not clearly explained. Densities of native birds were estimated separately for each of the six management units. Walk-through index counts of birds were made using standard methods, which entail a standard search effort applied under standard conditions that can be repeated in future. It was intended that the methods and route reported should be repeated under similar conditions and at a similar time of year during future bird counts.

I consider the bird survey methods used were appropriate to the situation, and well-described in this section of the report and Appendix A. I acknowledge the author's recognition of the need to carry out repeatable survey methods for monitoring purposes. To that end, it would be useful to cite a reference document for the 'standard methods' used to help ensure consistency in future surveys.

Ideally, the management units shown in Figure 2 would link or integrate more closely with vegetation types/habitats as mapped and described in a baseline vegetation survey report. It is unfortunate that the existing baseline vegetation report does not really provide this context for the accompanying bird, lizard and invertebrate surveys. I note here that the lizard and invertebrate baseline surveys followed the same management units as shown in the bird survey report.

Comments on Results and discussion section

Survey results are summarised in this section with the full data set presented in Appendix B. Repeat-surveys conducted over part of the area recorded the same counts as the main surveys, providing confidence that main survey results were reliable index counts of the indigenous species of interest (i.e. specialist ground-nesting species) that might breed within the reserve.

Native species recorded included two classified as *Threatened* and one species classified as *At Risk* under the New Zealand threat classification system: black-fronted tern, banded dotterel and South Island pied oystercatcher. Overall, the number of species recorded was low, as were the numbers of individuals of each species.

However, the report noted that some areas of suitable habitat for ground-nesting birds were available and listed these locations: central parts of the Upper Downs unit; less-vegetated parts of the Lower Downs unit; and much of the Tekapo Flats unit. Breeding banded dotterel were recorded in all these units, with breeding SI pied oystercatcher recorded on the Tekapo Flats. The author commented that the Tekapo Flats provide a particularly large area of highly suitable habitat for these species, and also for black-fronted terns which have nested here in the past.

It would have been useful to expand the discussion to include comment on other noteworthy species, such as NZ pipit, which, although not recorded in this survey, are known to occur in these habitats and might turn up in the DRA in future.

The final section of the report contained useful discussion of bird habitat management options which I agree should be considered in development of the Dryland Recovery Management Plan.

Conclusion

I consider that the 'Bird Baseline Surveys' report complies with baseline survey Consent Condition 86 and will be able to help direct the development and successful implementation of a Dryland Recovery Management Plan.

3. Lizard Baseline Surveys, Simons Pass Dryland Reserve

This report (Tocher 2018) presents methods and results of a baseline survey of lizards undertaken in November 2017. It also includes a section with some suggestions for achieving the recovery of lizard values over the Dryland Reserve.

Comments on Section 2 - Context

Reports from earlier lizard surveys of/around the area carried out over the period 2001-2013 were reviewed with a total of four lizard species recorded in previous surveys: McCann's skink, Canterbury grass skink, spotted Mackenzie Basin skink and Southern Alps gecko. Comment was also made, in one of the earlier reports, that scree skinks were "possibly present". Taxonomic revisions and changes to indigenous lizard conservation threat status between 2001 and the baseline 2018 survey are noted in this report. Earlier survey reports, databases, taxonomic revision papers and threat status classification publications are all well-refenced in footnotes to the baseline survey report.

I note that one of the earlier survey reports referenced here, the Simons Pass pastoral lease Conservation Resources Report (DoC 2007), records the presence of lizards in an "ephemeral wetland habitat of the upper downs" (Tocher 2018; p4, para4). The presence of wetland habitats within the DRA should also have been discussed in the Vegetation baseline report.

Comments on Section 3 - Methods

A survey for lizards to determine 'baseline' population estimates was carried out over representative habitats of the six management units of the Simons Pass Dryland Reserve, November 20-22, 2017. The weather during the survey was extremely hot, reducing lizard activity. No nocturnal searches were made for Southern Alps gecko.

Comment was made in the methods section that field time was limited; the total Dryland Reserve survey area large (*c.* 2,500 ha) and difficult of access in places; and that slow careful searching is required to locate lizards. This meant that all lizard habitat present within the extent of the reserve was not able to be searched. Instead, a "selection" of sites within each management unit was searched.

It was apparent from comments in the methods section that lizard survey effort was highly constrained by time limitations. I am not sure whether the author considered this limited survey effort was sufficient to properly "estimate baseline lizard relative densities and habitat use" (Tocher 201; p6 para1). Obviously, no such estimate for Southern Alps gecko population densities was possible, as no surveys were carried out for this species.

I have looked at published guidelines and recommendations around surveying and monitoring techniques for New Zealand lizards. The methods described in the Lizard Baseline Surveys report do not always appear to follow these standard-practice guidelines.

The Department of Conservation herpetofauna inventory and monitoring toolbox (Lettink and Monks 2012) suggests pitfall traps, photo ID and artificial retreats as suitable field methods for density estimates, using mark-recapture or mark-resight as measures. With regard to survey period, for all indices of abundance a minimum of three days of survey effort under optimal conditions should be undertaken. However, most studies suggest 5-9 survey days as preferred (Hoare et al. 2010).

The 'systematic search' methods used in this study are more suited to answering questions of distribution and inventory (i.e. habitat use), according to the DoC toolbox. Frequency of occurrence, presence/absence and catch per unit effort measures as reported here are appropriate for distribution and inventory assessments.

The day searching of selected sites method as used in this study, is also discussed in the Society for Research on Amphibians and Reptiles in New Zealand (SRARNZ) 'New Zealand Lizards Conservation Toolkit' (Anderson et al. 2012). Here it is noted that catch-per-unit-effort indexes (e.g. number of animals/total hours of search) derived from day searching or Visual Encounter Surveys (VES) may indicate relative abundance (if highly standardised) for some, but not all species. However, the disadvantages of this method are: it cannot be used to indicate the true abundance or density of a population; and that it is not suitable for monitoring most lizard species as it is difficult to compare results over time, at different times of day, across habitat types, or between observers, unless highly standardised (Anderson et al. 2012). Other disadvantages or limitations of the method – that is strongly weather and season dependent; subject to biases due to observer's skill and environmental variables, and that individuals or species may have different detection probabilities – are also noted in the baseline survey report.

For lizard density estimate assessments, there remains the question of whether sampling effort was sufficient to provide adequate baseline survey data. As a general rule, at least three sampling sites are recommended for each defined study area (i.e. habitat type or management unit in this report). For statistical validity, sampling effort within each sample site requires a minimum of five replicates, but more are recommended (Hare 2012). Figure 8 shows that all management units except 'Rosehips Block' had more than three 'search locations' or sample sites. However, my reading of the methods section is that 'samples' or 'searches' at these sites were not replicated.

The 'Methods' section concluded with a table (Table 1) and descriptive account of habitat types used by lizards in the Dryland Reserve Area, from the November 2017 survey. These would perhaps sit better in the 'Results' section. Nevertheless, the table and accompanying paragraphs provide a useful summary of the range of vegetation types and (lizard) habitats

present, both for the whole Dryland Recovery Area, and within its six 'management units'. As already noted, it is unfortunate that these habitats were not mapped in the baseline vegetation survey report. However, the caption to Table 1 reminds us that not all habitats in all management units were visited, and therefore does not represent a complete inventory of habitats present in each management unit.

I was interested in the comment here that both exotic and native woody vegetation appeared equally utilised by Mackenzie Basin skinks for shade. This will be relevant for consideration in a future management plan that will (presumably) seek to control exotic woody vegetation.

Comments on Section 4 – Lizard species of the Dryland Reserve

I read this section of the report, together with preceding paragraphs of the 'Methods' section, as 'results', describing lizard habitat use within the reserve at the time of survey. Four lizard species were recorded over the course of the survey: Southern Alps gecko, McCann's skink, Mackenzie Basin skink and scree skink (Table 2). A fifth species, the Canterbury grass skink, although not recorded in this survey was considered likely to be present. It was noted that weather during this survey may have been too hot to encounter Canterbury grass skink, as this species relies on some moisture within its habitat. It was also considered possible that jewelled gecko might be present in a wooded gully at the north-western tip of the reserve "where the search was brief and conducted in high (unsuitable) temperatures for jewelled geckos.

I note that, in discussing potential habitats for Canterbury grass skink in the Dryland Reserve, the author mentions the presence in the reserve of "areas of ephemeral tarns". Plant communities of these wetland habitats were not described in the Vegetation baseline report.

The three populations of Mackenzie Basin skink and two populations of scree skink found during survey were not previously known from the area, and are considered nationally important (Figure 8).

Comments on Section 5 – Baseline lizard densities

In this section, baseline density estimates were provided for: scree skink ("*c.* 25/ha of suitable habitat"); Mackenzie Basin skink ("*c.* 17/ha of suitable habitat"); and Canterbury grass skink ("*c.* 0/ha over the reserve"). No density estimates were calculated for McCann's skink; instead, encounter rates (as shown in Table 3 for all species) were re-stated in the text. I understood this to be because encounter rates recorded for this (generally common and widespread species) were considered too "conservative", due to extremely hot temperatures during the survey, and because this species (like Southern Alps gecko) was not a focus of survey effort.

The author re-iterates, in this section, the critical importance of observer experience and suitable weather conditions if these measures are to be used as "reliable baseline metrics for subsequent surveys". I support these qualifications around repeatability of survey, but would add that I consider there was insufficient sample replication to provide "reliable baseline metrics". And without also quantifying the total current extent of 'suitable habitat' for the

various species present within the reserve, the density estimates provided (and these for only three of the total 5 lizard species recorded) are of only limited value for baseline survey purposes.

Comments on Section 6 – Future monitoring

I note the comment in this section that (with regard to Mackenzie Basin, scree, and Canterbury grass skinks) not all populations have been discovered, and in footnote 9, "all available habitat *was not searched* [author's italics]; and that there are almost certainly more populations of [Mackenzie Basin skinks and scree skink] yet to be discovered within the Simons Pass Dryland Reserve".

Comment of Section 7 – Lizard management options

This final section of the report contained useful discussion of lizard habitat management options which I agree should be considered in development of the Dryland Recovery Management Plan.

Conclusion

My overall conclusion is that there is not sufficient information in the 'Lizard Baseline Surveys' report to comply with baseline survey Consent Condition 86. I suggest that this is largely a result of insufficient time allowed or allocated for field survey (two days). In my opinion, judging from comments contained in the report and noted above, the author recognises these limitations.

I consider the current report could be used as a pilot study for designing and carrying out a more comprehensive baseline survey. Additional survey methods would provide improved baseline lizard population density data. For example, density estimates derived from pitfall trap capture, photo ID and monitoring artificial retreats are recommended in the literature.

The current report could be used to inform a management plan. It provides useful information on lizard species present (including important new population records) and habitat use. However, the 'Lizard Baseline Surveys' report does not provide adequate information on lizard population densities. It also does not provide sufficient baseline information for monitoring outcomes of conservation management actions within the Dryland Reserve, or monitoring potential impacts from adjoining land use.

Philip Grove

Science Team Leader – land ecology

Environment Canterbury.

June 2018

References

Anderson, P., Bell, T., Chapman, S., Corbett, K. 2012. New Zealand Lizards Conservation Toolkit – a resource for conservation management of the lizards of New Zealand. A SRARNZ Miscellaneous Publication. Society for Research on Amphibians and Reptiles of New Zealand. 68 pp.

Atkinson, I.A.E 1985. Derivation of vegetation mapping units for an ecological survey of Tongariro National Park, North Island, New Zealand. *New Zealand Journal of Botany 23:* 361-378.

Hare, K.M. 2012. Herpetofauna: indices of abundance. Version 1.0. Department of Conservation Inventory and monitoring toolbox: herpetofauna. DOCDM-493179.

Hoare, J.M.; O'Donnell, C.F.J.; Westbrooke, I.; Hodapp, D.; Lettink, M. 2010: Optimising the sampling of skinks using artificial retreats based on weather conditions and time of day. *Applied Herpetology 6*: 379–390.

Lettink M.; Monks J. 2012. Introduction to herpetofauna monitoring. Version 1.0. Department of Conservation Inventory and monitoring toolbox: herpetofauna. DOCDM-878835.

Norton, D.N. 2017. Baseline vegetation report, Simons Pass Dryland Recovery Area. Report prepared December 2017. 22pp.

Sanders, M. 2018. Bird Baseline Surveys, Simons Pass Dryland Reserve, November 2017. Report prepared for Simons Pass Station Ltd by Ryder Environmental Ltd, Dunedin, March 2018. 23 pp.

Tocher, M. 2018. Bird Baseline Surveys, Simons Pass Dryland Reserve, November 2017. Report prepared for Simons Pass Station Ltd by Ryder Environmental Ltd, Dunedin, February 2018. 23 pp.