Document 16

Daniel Ohs

From: Sharon Alderson
Sent: Friday, 7 August 2020 2:47 pm
To: Martin Kessick
Cc: Jo Macpherson; Mike Perry; Meredith McKay; Elaine Wright; Lakshila Abeysekara
Subject: ACTIONED URGENT : Tier 1 Monitoring Programme Budget cut

Kia ora Martin,
This email is to confirm that removal of $500k from Tier 1 Monitoring budget in BPRS has :

1) Been actioned for PSU ($100k)
2) Been referred to business accountant for Operations-Biodiversity Monitoring Team ($400k)

These changes are in advance of detailed redesign of the programme – we will have an overview of that for you next week.

Ngā mihi,
Sharon

From: Grace Zhou <gzhou@doc.govt.nz>
Sent: Friday, 7 August 2020 1:49 p.m.
To: Mike Perry <mperry@doc.govt.nz>; Bryan Charlton <bcharlton@doc.govt.nz>
Cc: Jo Macpherson <jmacpherson@doc.govt.nz>; Lakshila Abeysekara <abeysekara@doc.govt.nz>; Meredith McKay <mmckay@doc.govt.nz>; Sharon Alderson <salderson@doc.govt.nz>; Ellen Godber <egodber@doc.govt.nz>
Subject: RE: URGENT RE: Tier 1 Monitoring Programme Budget cut - apporting reductions for accountants

Hi Mike

Sure, I can action it today. But all our changes need to reconcile with Operations FPL and National FPL. Bryan is the Business Accountant who maintains Operations FPL, my email below is to notify of this change.

Bryan,

Management Accountant Ellen talked about this with me yesterday. Lou has informed that he wants to cut Bio Monitoring 20/21 budget by $500k, please refer to emails below - Mike Perry's Bio Monitoring team budget will be reduced by $400k, MIST (Bio business group) reduced by $100k.

Mike Perry's Bio Monitoring team is under Nat Ops (profit centre 9020). I'll reduce its budget by $400k.

Please advise if you have any questions.

Thanks

Grace Zhou
Business Accountant
Department of Conservation | Te Papa Atawhai
M: s.9(2)(a) | VPN: s 9(2)(a)

www.doc.govt.nz

From: Mike Perry <mperry@doc.govt.nz>
Sent: Friday, 7 August 2020 12:28 p.m.

To: Grace Zhou <gzhou@doc.govt.nz>
Cc: Jo Macpherson <jmacpherson@doc.govt.nz>; Lakshila Abeysekara <labeysekara@doc.govt.nz>; Meredith McKay <mmckay@doc.govt.nz>; Sharon Alderson <salderson@doc.govt.nz>
Subject: RE: URGENT RE: Tier 1 Monitoring Programme Budget cut - apporting reductions for accountants

Hi Grace

Can you action the FPL reduction as per below, if you need a GL please use temp wages for now.

Let me know if you also need Jo's approval

Regards
Mike

From: Lakshila Abeysekara <labeysekara@doc.govt.nz>
Sent: Friday, 7 August 2020 11:54 a.m.
To: Sharon Alderson <salderson@doc.govt.nz>; Meredith McKay <mmckay@doc.govt.nz>
Cc: Mike Perry <mperry@doc.govt.nz>; Jo Macpherson <jmacpherson@doc.govt.nz>
Subject: RE: URGENT RE: Tier 1 Monitoring Programme Budget cut - apporting reductions for accountants

Hi Sharon,

I do not have admin access to Operations group in BPRS, once confirmed, I can inform Graze who is their Management accountant to make the update.

Thanks

Lakshila

From: Sharon Alderson <salderson@doc.govt.nz>
Sent: Friday, 7 August 2020 11:45 a.m.
To: Lakshila Abeysekara <labeysekara@doc.govt.nz>; Meredith McKay <mmckay@doc.govt.nz>
Cc: Mike Perry <mperry@doc.govt.nz>; Jo Macpherson <jmacpherson@doc.govt.nz>
Subject: RE: URGENT RE: Tier 1 Monitoring Programme Budget cut - apporting reductions for accountants
Importance: High

Kia ora team – thank you for working through this quickly, so we can meet timeframe.

Lakshila please do adjust PSU accordingly.
Do you have permissions in BPRS to action BMT reduction once Jo signals approval? Or does Mike need to do that?

Note – we will discuss more in near future around resource allocations once we have the work programme defined etc.

Ngā mihi,
Sharon

From: Lakshila Abeysekara <labeysekara@doc.govt.nz>
Sent: Friday, 7 August 2020 11:24 a.m.
To: Meredith McKay <mmckay@doc.govt.nz>
Cc: Mike Perry <mperry@doc.govt.nz>; Sharon Alderson <salderson@doc.govt.nz>
Subject: URGENT RE: Tier 1 Monitoring Programme Budget cut - apporting reductions for accountants

Hi Meredith,

Thank you so much for sorting this quickly and sending the proportionate reductions

Sharon , could you please could confirm and approve the changes so I can update the budgets before 4.30 p.m. today.

Thanks

Lakshila

Lakshila Abeysekara
Business Improvement Manager
Planning and Support Unit- Biodiversity Group
Department of Conservation, 18-32, Manner Street, Wellington
M: s.9(2)(a)
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Conservation leadership for our nature ***Tākina te hī, tiakina te hā, o te ao tūroa***
Please consider the environment before printing this email

From: Meredith McKay <mmckay@doc.govt.nz>
Sent: Friday, 7 August 2020 11:11 a.m.
To: Lakshila Abeysekara <labeysekara@doc.govt.nz>
Cc: Mike Perry <mperry@doc.govt.nz>
Subject: Tier 1 Monitoring Programme Budget cut - apporting reductions for accountants

Hi Lakshila.
Mike and I have discussed the reductions split and how to apportion this for now.
Please see the table below with the WBS to reduce budgets and amounts for each.

Budget reductions	WBS	Type	GL code	Amount
BMT	D400546001	Operating	60105 - Wages	$400,000
MIST	D400827001	Operating	60105 - Wages	$100,000

Any questions let me know
Thanks
Meredith

Meredith Mckay
Monitoring & Information Systems Team Manager
Planning and Support Unit
Biodiversity Group
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Ōtautahi / Christchurch Office
Level 3, Grand Central
161 Cashel Street, Christchurch 8011
PO Box 4715, Christchurch Mail Centre, Christchurch 8140

s.9(2)(a)

Daniel Ohs

From: Meredith McKay
Sent: Wednesday, 4 August 2021 5:55 pm
To: Sharon Alderson
Cc: Mike Perry; Ben Reddiex; Morgan McLean; Jason Mackiewicz; Elaine Wright
Subject: URGENT - Confirming Tier 1 and LUCAS 2021-2022 Field Programme
Attachments: 2021-2021 Tier 1 and LUCAS Tier 1 programme costs and options for confirmation of programme - DOC-6740587.xlsx

Importance: High

Kia Ora Sharon

Please find attached the output you requested detailing the costs for the 2021-2021 Tier 1 and LUCAS Tier 1 programme to support your discussions with Ben and confirmation of the programme of work this season.

Work undertaken to prepare this;

- bottom up budget builds then compared with historic data other info
- tested and revised programme elements if required,
- develop the 2021-2022 programme of work and options,
- Elaine advised on the priorities if a FULL programme was not resourced.

The information to support your discussion is provided in 2021-2021 Tier 1 and LUCAS Tier 1 programme costs and options for confirmation of programme - DOC-6740587 (attached as well).

There are 5 worksheets:

1. Notes and Decision for Directors = Summary of NOTES for interpretation and DECISIONS required. DECISIONS are linked to/flagged in BUDGET and OPTIONS.
2. BUDGET and OPTIONS = the summary of per plot cost, cost for FULL vs PARTIAL programme, RISK and ISSUE re resourcing and two OPTIONS including the recommended option.
3. Key Messages = Copy of key messages from previous memos and A3's as reminder.
4. Budget to Catch up = you asked for a summary of what it would take to address the gap created by last year's decision.
5. Plot Details = Summary of plots by type in case this level of detail is needed for discussion or interpretation.

I thought it would help to create these into one pagers so you could easily print for your discussion.

NEXT STEPS;

1. Advise if:
    a. supporting memo required – did not prioritise as time sensitive but can deliver if needed/helpful,
    b. Briefing via teams required.
2. Discuss and come back with any Q or issues.
3. Decision as soon as possible.

Thanks
Meredith

Meredith Mckay

Principle Technical Advisor and Programme Lead Tier 1 Monitoring
Monitoring & Information Systems Team
Planning and Support Unit
Biodiversity Group
Department of Conservation | Te Papa Atawhai
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s.9(2)(a)

Links to files that were attached to this message:

Notes and Descision for Directors.pdf Microsoft Edge PDF Document, 116 KB
https://doccm.doc.govt.nz/cs/idcplg?IdcService=GET_FILE&dDocName=DOC-7271673&RevisionSelectionMethod=LatestReleased&allowInterrupt=1

BUDGET and OPTIONS.pdf Microsoft Edge PDF Document, 237 KB
https://doccm.doc.govt.nz/cs/idcplg?IdcService=GET_FILE&dDocName=DOC-7271674&RevisionSelectionMethod=LatestReleased&allowInterrupt=1

Budget to catch up.pdf Microsoft Edge PDF Document, 113 KB
https://doccm.doc.govt.nz/cs/idcplg?IdcService=GET_FILE&dDocName=DOC-7271675&RevisionSelectionMethod=LatestReleased&allowInterrupt=1

Key messages.pdf Microsoft Edge PDF Document, 190 KB
https://doccm.doc.govt.nz/cs/idcplg?IdcService=GET_FILE&dDocName=DOC-7271676&RevisionSelectionMethod=LatestReleased&allowInterrupt=1

Open WebCenter Content Server

MULTIPLIERS

PLOT TYPE	OPS (BMT)	BIO (MIST)	TOTAL PER SITE	Comment
LUCAS VEGE ONLY PLOT - FOREST	$8,800	$5,900	$14,700	MIST cost averaged across all types as similar between all types
LUCAS VEGE ONLY PLOT - NON FOREST	$8,800	$5,900	$14,700	
TIER 1 VEGE ONLY - FOREST	$8,800	$5,900	$14,700	
TIER 1 VEGE ONLY - NON FOREST	$8,800	$5,900	$14,700	
TIER 1 VEGE AND ANI - FOREST	$14,258	$5,900	$20,158	
TIER 1 VEGE AND ANI - NON FOREST	$14,758	$5,900	$20,658	
TIER 1 ANI ONLY - FOREST	$7,040	$5,900	$12,940	
TIER 1 ANI ONLY - NON FOREST	$7,540	$5,900	$13,440	

COSTS BY TYPE IN FULL MEASURE

PLOT TYPE	N= [SOURCE = DOC Tier 1 p	OPS	BIO	TOTAL	Comment
LUCAS VEGE ONLY PLOT - FOREST	17	$149,600	$100,300	$249,900	
LUCAS VEGE ONLY PLOT - NON FOREST	20	$176,000	$118,000	$294,000	
TIER 1 VEGE ONLY - FOREST	0	$0	$0	$0	
TIER 1 VEGE ONLY - NON FOREST	0	$0	$0	$0	
TIER 1 VEGE AND ANI - FOREST	160	$2,281,254	$944,000	$3,225,254	
TIER 1 VEGE AND ANI - NON FOREST	99	$1,461,026	$584,100	$2,045,126	
TIER 1 ANI ONLY - FOREST	6	$42,240	$35,400	$77,640	
TIER 1 ANI ONLY - NON FOREST	0	$0	$0	$0	
	302	$4,110,119	$1,781,800	$5,891,919	Total cost of FULL programme but note this does not include the additional 280K o OPS Unallocated Permanent salary (see below)

COSTS BY TYPE IN PARTIAL MEASURE

PLOT TYPE	N= [SOURCE = DOC Tier 1 p	OPS	BIO	TOTAL	Comment
LUCAS VEGE ONLY PLOT - FOREST	**17**	$149,600	$100,300	$249,900	
LUCAS VEGE ONLY PLOT - NON FOREST	**20**	$176,000	$118,000	$294,000	
TIER 1 VEGE ONLY - FOREST	**0**	$0	$0	$0	
TIER 1 VEGE ONLY - NON FOREST	**0**	$0	$0	$0	
TIER 1 VEGE AND ANI - FOREST	***68***	$969,533	$401,200	$1,370,733	Drop 92 Tier 1 Forest Vege plots from plan
TIER 1 VEGE AND ANI - NON FOREST	**99**	$1,461,026	$584,100	$2,045,126	
TIER 1 ANI ONLY - FOREST	**98**	$689,920	$578,200	$1,268,120	
TIER 1 ANI ONLY - NON FOREST	**0**	$0	$0	$0	
	302	$3,446,079	$1,781,800	$5,227,879	Total cost of PARTIAL programme b note his does not include the additional 280K of OPS Unallocated Permanent s lary (e below)

BUDGET SUMMARY (FPL + REVENUE)

BUDGET	FPL	MFE	TOTAL	Comments
EDC contract	$ -	$ 201,000.00	$ 201,000.00	976K revenue planned. However 201K fo DC co ract with IPI that comes off top of Revenue for both teams. Remained = 775K. OPS and BIO to have re lised savings i me/opex to offset this cost over the 3-4 years phasing in
OPS	$ 3,173,440 00	$ 460,000.00	$ 3,633,440.00	Less revenue to OPS and B O er 1 ogrammes to offset costs as: 1. each teams po tion of EDC o ract with IPI comes off top and is offset by active change of systems and practices with EDC to save time and 2. BIO holdback fundi g (see elow). **Decision with Directors**
BIO	$ 1,313,613.00	$ 315,000.00	$ 1,628 6	BIO hold back 50K of he LUCAS revenue as BIO did not restore funding and we must deliver on MFE commitments for QA QC (T aining Field Audit, QA/QC). irec rs to scuss the situation that OPS restored funds but BIO did not and options are: = BIO old bac revenue or 2 = BIO hav cost pressure. **Decision with Directors**
	$ 4,487,053.00	**$ 976,000.00**	**$ 5,46 ,053.00**	

BUDGET RISKS & ISSUES

Coarse Woody Debris	$ 80,000.00	The cost to add CWD back into field component of the programme not tested and included the costing model yet. We know it is approx. 2-3 hours per plot but is not required on all plots. The cost impact is only on OPS as included in BIO workings. Options are: 1. wait for this to be tested or 2. accept the risk. *Approx. cost (back of envelop) is 80K of FTE.* **Decision with Directors**
OPS Unallocated Permanent salary	-$ 280,000.00	In OPS there are approx. 280K of salaries of permanent staff time that are on the books but not used for Tier 1 over the winter or off season months. If we don't redeploy to other work the costs for the staff time remain with OPS as carrying capacity cost and go toward T1 budget. This is an issue for Directors to discuss and decide how to manage this. You can decide to take risk and know they will be redeployed once season over which means you can remove the 280K from T1 costs which means you get more plots in the plan OR you don't and get less plots. See options below. **Decision with Directors**

BUDGET vs COSTS

	T tal budget	Total cost (full program	Difference	Comments
*Adjusted with OPS Unallocated Permanent salary - **DO** redeploy*	**$ 5,463,053.00**	**$5,891,919**	-$ 428,866.39	Cost pressure if we DO redeploy OPS permanent staff and carry costs in T1 budget.
*Adjusted with OPS Unallocated Permanent salary - **DO T** redep y*	**$ 5,463,053.00**	**$6,171,919**	-$ 708,866.39	Cost pressure if we DON'T redeploy OPS permanent staff and carry costs in T1 budget.

OPTIONS

A

DELIVER	N= VEGE	N=ANI	$	Comments
FU MEASURE ALL L C S ALL TIER ANI ALL IER 1 VEGE	296	265	**$5,891,919**	Complete all 302 sites Assume we DO redeploy OPS Permanents Take on a $448K cost pressure or address funding shortfall 9(2)(g)(i) [redacted]

B

DELIVER	Description	N=	$	Comments
PARTIAL MEASURE: ALL LUCAS ALL TIER 1 ANI *TIER 1 NF VEGE ONLY*	197	265	$5,227,879	Accept No cost pressure [or seek funding required] to deliver FULL programme Assume we DO redeploy OPS Permanents AND adjust season by KEEP all ANI, KEEP all LUCAS VEGE but DROP 92 Forest VEGE from plan Could have up to 230K savings - redirect to programme improvements to seek future savings. [NOTE if don't redeploy could have up to 50K cost pressure] 9(2)(g)(i) [redacted]

Note					
1	2021-2022 Budget and Options	Summary of the budget workings and options are provided in 2021-2022 BUDGET and OPTIONS. Notes to support Directors are below. Decisions required are provided in each section of 2021-2022 BUDGET and OPTIONS and summarised below.			
2	Key Messages about why invest	Summary of the key messages from previous memo and A3 describing benefit of investing and the impacts of plots dropped already provided in KEY MESSAGE worksheet for reference/reminder			
3	Budget to catch up	Director PSU requested an estimate of what it would take to complete work dropped in previous year due to budget constraints. Estimates are 3M and workings are provided in BUDGET CATCH UP worksheet based on current costs. Savings could be possible based on delivery model.			
4	EDC and Revenue	Less revenue is available to both OPS and BIO as each teams portion of EDC contract with IPI comes off top and was planned to be offset by active change of systems and practices with EDC to save time			
5	Coarse Woody Debris	The cost to add CWD back into field component of the programme not tested and included the costing model yet.			
6	Quality Assurance elements	Not all quality assuance elements are costed - only those required to meet MFE commitments (Field audit) Examples of elements paused for now are Chewcard ID auditing and Plant ID auditing.			
Decisions required			**DECISION**	**WHO**	**DATE**
1	Apportioning the LUCAS revenue	BIO hold back 150K of the LUCAS revenue as BIO did not restore funding and we must deliver on MFE commitments for QA/QC (Training, Field Audit, QA/QC). Directors to discuss the situation that OPS restored funds but BIO did not and options are: 1 = BIO hold back revenue or 2 = BIO have cost pressure. **Decision with Directors**			
2	OPS Unallocated Permanent salary	In OPS there are approx. 280K of salaries of permanent staff time that are on the books but not used for Tier 1 over the winter or off season months. If we don't redeploy to other work the costs for the staff time remain with OPS as carrying capacity cost and go toward T1 budget. There is reasonable confidence we can redeploy but this is still a risk. This is for Directors to discuss and decide how to manage - ou could take the risk and know they will be redeployed once season over which means you can remove the 280K from T1 costs which means you get more plots in the plan OR you don't and get less plots. See options and recommendations. **Decision with Directors**			
3	Coarse Woody Debris	The cost to add CWD back into field component of the programme not tested and included the costing model yet. We know it is approx. 2-3 hours per plot but is not required on all plots. The cost impact is only on OPS as included in BIO workings. Options are: 1. wait for this to be tested or 2. accept the risk. Approx. cost (back of envelop) is s.9(2)(a) FTE. **Decision with Directors**			
4	Accept recommendation to implement Option A	Complete the FULL programme Complete all 302 sites Assume redeploy OPS Permanents Take on a $448K cost pressure or address funding shortfall **RECOMMENDED** to maintain programme integrity. It is recommended we proceed with the full programme and ensure that resourcing is secured via DOC and new ANZBS budget bids. Continuing with the full programme ensures DOC meets its all of gov national and international commitments, ensure we have the essential data for NI Deer/goat and park level reporting work and aligns with recommendations and commitments being made by DOC/MFE and MPI via ANZBS to fully implement monitoring system on and off PCL to report on C and Bio etc. s.9(2)(a) [redacted] **Decision with Directors**			

Document 20

Impacts of not fully funding programme and investing in catch up non forest plots.

Impact on internal and external commitments and risks for DOC with this scenario are.

1. **DOC**
   - A reduced programme has significant implications for contributions to reporting and decision making. Example includes recent question about CPL by minister and only data available to demonstrate any change was Tier 1. Or the recent assessment of DOC lands for the ANZBS. It is currently the only structured information the department has for any reporting.
   - The loss of **vegetation** measures on another 90 Forest plots and failure to systematically measure the sites pushes the cost burden into out years and means we will not have the data to complete two new requirements.
     - P**ark level reporting** for internal decision making and to support external engagement (e.g., Ministerial briefing on Ungulate pressure in NI Forests and successful budget bid for fund for management) no longer possible if do not measure forest plots.
     - Carbon reporting - estimates of carbon stock and stock change on PCL in forest will not be possible if we do not measure plots and obtain data.
   - Reduction in the number of sites measured introduces bias and impacts estimates in areas of under sampling; quality of outputs affected by loss of precision, inference, and timely access to data for reporting on trends in vegetation impacts across relevant NZ-wide scale.
   - 9(2)(g)(i) [redacted] Absence of a quality assurance programme means biodiversity data captured are of unknown quality.
   - DOC will no longer able to provide structured information across PCL needed to meet our national and international environmental reporting obligations. Examples include CBD and upcoming global assessment of all countries using core set of Essential biodiversity variations (EBVs) of which Tier 1 program is the core data contributing
   - These data form part of a highly valuable, publicly available dataset which is used by scientists in New Zealand and abroad for biodiversity and **climate-related science.**
2. **MFE**
   - **If we don't invest fully, DOC will not be able to mee commitments to quality assurance of data collected under MOU with MFE will not be met, Field Audit, Training and adequate data and information management.**
   - The NFPMP allows New Zealand to meet its mandatory international and domestic climate change reporting requirements. Measurement of forests is required to obtain accurate estimates of carbon stock and stock change as the natural forest estate changes through time. This information ensures MFE can track progress against our international climate change targets under the Paris Agreement and the 2050 target
   - Reputational risks for DOC as reduced investment counter to sector needs and commitments.
     - The Climate Change Commission's (CCC) draft advice for consultation is looking to shift New Zealand's forestry focus towards native forests to help New Zealand meet its climate change targets. The NFPMP will be essential in detecting removals from native forests and is therefore fundamental to successfully implementing the CCC's draft advice. The CCC also recommends in the first budget period (2022 - 2025) that the government make progress in maintaining and increasing the amount of carbon stored in pre-1990 forests through activities such as pest control. The NFPMP will be crucial in detecting shifts in carbon storage and understanding the drivers that underpin these.
     - The data collected in the NFPMP are also used widely across government including within MFE for informing policy development for the Zero Carbon Act and the 2050 target.
     - Ministry for Primary Industries (MPI) uses the data in its international and domestic forestry policy work.
3. **MFE/Stats NZ**; DOC is responsible for the production of several the national Tier 1 statistics agreed by Cabinet in 2016 which the programme delivers for DOC. There are significant implications for future MfE Land Domain Report and periodic Biodiversity Reports; Stats NZ Data Investment Plan focused on essential data assets for NZ.
4. **ANZBS and EMRS**; 9(2)(g)(i) [redacted]
5. **PCE**; 9(2)(g)(i) [redacted]

   1. **MFE notes on this** Collaborating with DOC is a mutually beneficial relationship and contributes to your ongoing commitment to monitoring the status and trend in terrestrial biodiversity across conservation land with the Tier One Programme. This relationship is especially important considering the Parliamentary Commissioner for the Environment's (PCE) report on New Zealand's environmental reporting system and funding. This report highlighted how 'huge' gaps in data and knowledge undermine our stewardship of the environment and called for concerted action to improve the system. The NFPMP is a clear example of addressing this data gap for one of New Zealand's most extensive land-use types – natural forests. The PCE's subsequent review on funding and prioritisation of environmental research in New Zealand highlighted Tier One monitoring as a 'ground-breaking, systematic sampling programme' and provides an important link between New Zealand's environmental reporting system and the science system.

2. The PCE's report further highlighted New Zealand's lack of consistent, authoritative time-series data and comprehensive spatial coverage. The NFPMP is a rare and valuable example of a programme that fulfils these deficiencies in that it is an unbiased systematic random sample of New Zealand's natural forests and has been ongoing since 2002. Such programmes are vitally important in their ability to detect real trends over appropriate timescales and need ongoing support.

6. **NZCA;** Last year the NZCA requested that the DG invest in and grow this programme in a letter to Lou Sanson. The reduced investment is a counter to NZCA request and there is reputational risk with the NZCA.

7. **Regional Councils:** Auckland and Greater Wellington have integrated programmes that parallel DOC and share data and outputs for reporting on performance at regional and national scales. Both councils reporting commitments would be impacted if DOC stop or scale back this programme.

8. **State Services Commission; Performance Improvement Framework (PIF);** Design and implementation of the programme was completed to address key performance issues raised by the SSC PiF programme. In follow up report in 2010 DOC reported on the implementation of Tier 1; "the department is undergoing transformational change. Our extensive programme includes internationally ground-breaking work in the monitoring and assessment of the health of New Zealand's unique plants and wildlife". This was noted by SSC with further advice that "DOC were required to be an active participant in providing impact data to contribute to improved environmental reporting. This has been achieved by the implementation and ongoing investment in the programme and as a result the 2016 follow up review found that "DOC has established capability in this regard but further work and capacity is required to make this a reality". Stopping or scaling back is a risk that DOC will fail to meet SCC expectations and sector commitments.

Document 21

Daniel Ohs

From: Meredith McKay
Sent: Friday, 29 May 2020 2:45 pm
To: Sharon Alderson
Cc: Elaine Wright; Mike Perry; Emma Percy
Subject: DRAFT FOR DISCUSSION WITH MARTIN - Scenarios for implementation of Tier 1 and LUCAS 2020-2021

Hi Sharon

Please find attached the draft as at today of the Scenarios for implementation of Tier 1 and LUCAS 2020-2021.

This is to support your initial discussion with Martin about what this is looking like and to hopefully support a recruitment decision soon, even if we can't get a decision on the other requirements.

We do have a little bit more work complete on this, but it's not enough to prevent a draft being released.

There are two copies, once in word with comments (answers to some of your questions and some of Elaine's feedback) and a second as PDF with no comments for easy printed and sharing online with Martin.

Some additional context material is below.

Thanks for your support with this.
Meredith

Some context
We agreed after the briefing with yourself, Jo and Ben meeting to go away work up Scenario 3-6 in more detail. And the shortly after the meeting the agreement was to focus on Scenario 6 and focus on what was required to make that scenario work. We were asked to provide

- Overarching statement re history of funding - Summary of the budget processes/history (or lack of) to date
- Actual costs required for delivery of each model (contracted against what we have received in BP)
- More detail on Assumptions we are making and why (e.g. in relation to effect of COVID on travel) More detail on dependencies we have to get a scenario up and running (dates, staff, money, training team time if need it, regional team model requirement)
- More detail curren state issues as pertains to each scenario
- More detail on the Cost/Benefits/Risks/implications of any change to delivery level (training or regionalisation etc)
- Spell out at high level what has to be done to get scenario achieved (e.g. Recruitment of 65 temp field staff by July 30, Recruitment (or contract in) x MIST by XX, Completion of LUCAS EDC testing by July 15...etc)
- Operational realities (not 100% sure what this will need to look like so Mike will ask you to put thinking cap onto this one)
  Effects on staff (workload and wellbeing) etc

Your expectations of us were to present a preferred scenario, with enough supporting info for a decision. For us to be clear what is required to make it work:

- assumptions (e.g. in relation to effect of COVID on travel)
- unresolved current state issues
- budget processes (or lack of) to date
- implications of any change to delivery level (training or regionalisation etc)
- operational realities

- This must include any effects on staff (workload and wellbeing) etc.

We have not achieved this exactly as planned but there were some reasons for this. It became apparent with our detailed work due to timing and the requirements for operations to complete the BMT structure we may achieve Scenario 6 even if funded etc. So as new scenario was developed based on Mikes thinking about what could be done in the time remaining.

After discussion with you late yesterday regarding this, we are would suggest you request the resourcing and support for a full programme (Scenario 6) and if BMT are not able to complete all the work, we look at alternative approach to complete this with the funding (e.g. contract some of the work out).

9(2)(g)(i) [redacted]

From: Meredith McKay <mmckay@doc.govt.nz>
Sent: Wednesday, 13 May 2020 12:20 p.m.
To: Sharon Alderson <salderson@doc.govt.nz>
Cc: Elaine Wright <ewright@doc.govt.nz>; Mike Perry <mperry@doc.govt.nz>; Emma Percy <epercy@doc.govt.nz>; Jo Macpherson <jmacpherson@doc.govt.nz>
Subject: Scenarios for implementation of Tier 1 and LUCAS 2020-2021
Importance: High

Hello Sharon

Please find attached the Scenarios for implementation of Tier 1 and LUCAS programme for 2020-2021 - DOC-6289314

This is a high level summary and does not capture all the details about what we would do and when which we would work on once we decide how to proceed.

1. On page one you will find the Context for the scenarios including:
   - Summary of existing pressures prior to Covid-19
   - Current state of programme with added pressures of Covid-19
   - The core assumptions we made when developing scenarios for implementation
   - A statemen on the preferred scenario for the programme
   - What we need to proceed
   - A matrix of the known operating constraints (Team size, Travel Restrictions, Post Season Prep, Pre-Season Prep) with varying scenarios for these and the resulting implementation model that would work with these constraints.

2. Pages 2-3 are seven scenarios that we tested with some key information by theme;
   - The sample size/number of plots
   - The utility of the data in each scenario
   - The result – what we would be delivering
   - Recruitment needs/expectations
   - Some advantages and disadvantages we have considered for each scenario
   - Last but importantly, the critical dates for key decisions/actions that we believe are critical for each scenario to proceed/be implemented.

3. On the last page is a key explaining what the Foundational Projects are and the some of the potential new work/approaches we may need to develop/deliver under Covid 19 restrictions

I think you will need some time to digest this and come back to us with any questions.

One suggestion we have is to meet with you next week and to walk you through/provide a briefing on the scenarios. If you had questions in advance of this you could send though for us to prepare for and address?

Could you consider this suggestion and if this works for you I can arrange this. If you have a different approach you would like to take let me know.

Thanks
Meredith

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s.9(2)(a)

-----Original Appointment-----
From: Sharon Alderson <salderson@doc.govt.nz>
Sent: Tuesday, 21 April 2020 12:01 p.m.
To: Sharon Alderson; Mike Perry; Emma Percy; Meredith McKay; Elaine Wright
Subject: UPDATE Scenarios for implementation of Tier 1 and LUCAS 2020-2021
When: Tuesday, 28 April 2020 12:00 p.m.-1:00 p.m. (UTC+12:00) Auckland, Wellington.
Where: Microsoft Teams Meeting
Importance: High

Kia ora koutou

Finding a time in your calendars without scheduled meetings, 'no meetings to be booked at this time' or 'sanity breaks' is proving impossible. I have found this half hour and am hoping that you will be willing to extend it into half an hour of the above already scheduled, if that makes sense!

Thanks,
Kerryanne

Join Microsoft Teams Meeting

Learn more about Teams | Meeting options

Links to files that were attached to this message:

SCENARIO PLANNING FOR TIER ONE PROGRAMME 2020 - DOC-6289314 (29 May 2020).pdf Microsoft Edge PDF Document, 262 KB
https://doccm.doc.govt.nz/cs/idcplg?IdcService=GET_FILE&dDocName=DOC-7268728&RevisionSelectionMethod=LatestReleased&allowInterrupt=1

SCENARIO PLANNING FOR TIER ONE PROGRAMME 2020 - DOC-6289314.docx
Microsoft Word Document, 75.5 KB
https://doccm.doc.govt.nz/cs/idcplg?IdcService=GET_FILE&dDocName=DOC-7268729&RevisionSelectionMethod=LatestReleased&allowInterrupt=1
Open WebCenter Content Server

DGTF BIODIVERSITY GOVERNANCE GROUP – DRAFT NATIONAL LEVEL MONITORING REPORT

Context

An ongoing task assignment (Lou to Bruce to Ken), incorporating both internal and external review, has confirmed the importance, the design and attributes of the National Level Monitoring programme (NLM) (otherwise known as Tier 1)[1]. Further work was signalled in 2016 as part of biodiversity system design work and confirmed in 2017 to encompass NLM, Intervention Level Monitoring (ILM: Tier 2) and Ecosystem Research Monitoring (ERM: Tier 3). This work began with a workshop of key DOC staff and external partners (MfE, StatsNZ and RC) and also confirmed the importance of NLM and the need to dialogue with others to develop a nation-wide programme fit to support State of the Environment Reporting under the ERA. While working on this programme, it was agreed in a subsequent task assignment to undertake a detailed examination of DOC's NLM programme to further assure it is fit for DOC's purpose and to seek to find $500,000 in operational savings, while not compromising the scientific integrity of the programme.

There is a further key context point. NLM has been subject to an ongoing inhouse refinement and continuous improvement process. This ongoing process has resulted in huge improvements over the years, including cost effectiveness and actual savings, without compromising, indeed improving the scientific integrity of the programme. These gains are documented in the review documents produced in 2016 and are a resource for this work.

Process

A team of Ken Hughey, Jeffrey Cornwell, Elaine Wright, Mike Perry, Meredith McKay, Carl McGuiness and Eila Gendig have worked on the task. In summary, we did the following:

- Through team process, we identified the purpose of our work, all key components of NLM and critical issues associated with these, and quality and quantity parameters
- Prioritised these components on the basis of the highest potential of identified savings; and decided to conduct further worked on these
- Where possible, we used data gathered on recent annual NLM work
- Set up an assessment template (see Appendix 1) against which to examine each priority – this compromised:
    - Identification of possible changes that could be made
    - Savings possible from the changes
    - Implications (+ve and/-ve) from the changes, in terms of:
        - Impact:
            - Programme science integrity
            - Relationships/reputation
            - DOC benefit
            - Risk

[1] Terminology, agreed across NZ Inc, is important. To all externals (including international groups we engage with) and internal DOC staff the monitoring system is referred to and formally labelled now as the National Biodiversity Monitoring and Reporting System (NBMRS). If we start using NLM outside DOC it will be very confusing and conflict with many RC and EMAR papers being used. Rebranding, if not done correctly, creates communication issues and uncertainty so needs to be done properly and considered in this context by EMAR.

        - Other
    - Implementation complexity
        - Time
        - Cost
        - Complexity
- Allocated the priorities to individuals in the team
- Met for a half day workshop to critically evaluate each of the priority reports
- Agreed on all findings for Ken Hughey to present to the DGTF biodiversity GG prior to DGTF presentation.

The team reached full consensus on the contents of this report.

Components of NLM work

Table 1 shows the identifiable components of the NLM work. Thirty two opportunities to potentially reduce costs were identified. Twenty-three of these were chosen as the most likely to contribute to immediate or reasonably immediate changes which would contribute financially and in other ways (shown in the shaded rows below).

Table 1. Components of NLM work that, if adopted, have the potential to change the programme's required budget, impact on the programme's structure and integrity and potentially lead to other improvements (Note: grey shaded cells represent the components we decided to analyse now for this TA).

Theme	Opportunity	Timing	Rationale
Technology	1. Logistics and master sample database (4b)	Analyse Now	Requires unplanned IT development. Would see benefits from better management of field movements and increased quality of the programme – strategic opportunity
Technology	2. Develop in-field data capture tools and improve data entry (10)	Analyse Now	Positive impact on quality and significant time savings through not needing to re-enter. Relies on IT development but could be done more easily for animal teams where concept has already been proven to give partial benefits at moderate cost using Survey 123
Technology	3. Field based plant identification options (3b)	For later analysis	Relies on technology and tools. Main benefit would result from increased reliability of identification. Would still rely on trained botanists. Future opportunity
Technology	4. Database management options (11)	For later analysis	Requires some IT development but would give efficiencies and better security of data
Technology	5. Remote sensing and automated data capture (14)	For later analysis	Potential to significantly reduce time in the field and improve data quality. Depending on technology developments and the marketplace. Needs to be considered through constant market scanning
Technology	6. Automated processing, e.g. acoustic (19)	For later analysis	Some work is ongoing. Will depend on developments in universities
Field workforce design and programme delivery	7. Spend longer time in the field (30 day trips and / or longer days) (1b)	Analyse Now	Negative impact on H&S. Require negotiation with staff and / or unions. Increase TOIL liabilities
Field workforce design and programme delivery	8. Review the mix of permanent v contracted staff (8)	Analyse Now	Increase number of core permanents staff. Removes significant overhead associated with continuous renewals. Gives continuity of access to specialist skills. Would require converting contract positions to permanent and running recruitment process
Field workforce design and programme delivery	9. Move to zero TOIL model for field work (21)	Analyse Now	Will extend the programme and will require negotiation with staff

Field workforce design and programme delivery	10. Review how work delivered (26)	Analyse Now	Exploring potential to (always) 'couple' vegetation and animal monitoring to reduce need for transportation and administration.
Field workforce design and programme delivery	11. Move from a dedicated team to embedding functions into the roles of existing staff (7)	Analyse Now	Might look like an initial saving however there is the opportunity cost of the time taken by staff to pick up extra duties. 9(2)(g)(i) [redacted]
Field workforce design and programme delivery	12. Review the placement of the team(s) (6)	Analyse Now	Might result in some minor efficiencies in logistics of the field programme but placement design has been reviewed several times already and could result in relocation costs and / or loss of access to existing experienced contractors with consequential re training costs
Field workforce design and programme delivery	13. Renegotiate terms of employment – particularly allowances (22)	For later analysis	Desirable to simplify this but could result in unhappy workforce and would need to be negotiated as part of the collective agreement
Field workforce design and programme delivery	14. Collaborate with others to share costs, resources and skills. (Councils) (24)	For later analysis	Starting to happen anyway. Would give some economy of scale and expand dataset
Commercial models	15. Greater contributions from beneficiaries of data (2b); option a) Sponsorship	Analyse Now	Would require negotiating opportunities and contracts but would increase the utility of the data and get benefit of their perspectives. May take a year or more to negotiate. Models could include sponsorship, review charging for use, sale of data and sale of IP.
Commercial models	16. Greater contributions from beneficiaries of data (2b); option b) Adoption of plots	Analyse Now	Would require negotiating opportunities and contracts but would increase the utility of the data and get benefit of their perspectives. May take a year or more to negotiate. Models could include sponsorship, review charging for use, sale of data and sale of IP.
Commercial models	17. Greater contributions from beneficiaries of data (2b); option c) Charging for use of data	Analyse Now	Would require negotiating opportunities and contracts but would increase the utility of the data and get benefit of their perspectives. May take a year or more to negotiate. Models could include sponsorship, review charging for use, sale of data and sale of IP.
Commercial models	18. Greater contributions from beneficiaries of data (2b); option d) Sale of IP	Analyse Now	Would require negotiating opportunities and contracts but would increase the utility of the data and get benefit of their perspectives. May take a year or more to negotiate. Models could include sponsorship, review charging for use, sale of data and sale of IP.
Commercial models	19. Sell skills and capacity to others (i.e. expand monitoring) (23)	Analyse Now	Would expand data set beyond PCL and generate revenue but requires establishing products and marketing them. Complexity in administering commercial environment
Commercial models	20. Completely outsource all NLM to 3rd party (9)	For later analysis	DOC established this capability because the market was unable to provide the national coverage and consistency required. There is no obvious supplier currently in the market.
Programme design, methods and indicators	21. 10 year cycle for forest vegetation (2018/19) (1)	Analyse Now	Could happen easily but impact and risk is unknown without analysis
Programme design, methods and indicators	22. 10 year cycle for vegetation and animals (2018/19) (2)	Analyse Now	Could happen easily but animal data would be almost irrelevant because of the lifecycle of many species measured
Programme design, methods and indicators	23. Run the programme regionally rather than randomised to limit travel (3)	Analyse Now	Would require negotiation with councils, MfE and Stats NZ. 9(2)(g)(i) [redacted] Cost savings cancelled out in years where surveys are a long way from workforce and higher susceptibility to interruption through adverse events (weather / fire etc.) because of limited ability to reschedule plots nationally
Programme design, methods and indicators	24. Move to 6 year cycle (4)	Analyse Now	Might save time and cost of field but would require redesign of the sample design and negotiation of variation with other agencies. Likely affect validity of existing data points
Programme design, methods and indicators	25. Review number of methods in each plot and	Analyse Now	Risks associated with changing or discontinuing methods through loss of data continuity

	how they are carried out (15) (17)		
Programme design, methods and indicators	26. Review grid size (16)	Analyse Now	Could reduce time in field through smaller grids but high risk through unknown impact on quality and utility
Programme quality	27. Plant identification (was under 3b on the board) (3b)	Analyse Now	Review balance of inhouse vs outsourced plant identification. In particular, is there benefit in bringing vascular plant identification in-house similar to non-vascular?
Programme quality	28. Delay planned research (5)	For later analysis	Easy to implement but would adversely impact relationship with partners and misses opportunities to implement improvements that can contribute to efficiencies
Programme quality	29. Further deferral of processing. (2)	For later analysis	On top of existing backlog.
Programme quality	30. Review Sample processing (13)	For later analysis	
Programme quality	31. Review QA programme and structure (18)	For later analysis	No doing QA could save a relatively small amount (<5% of total programme cost) but the value of the programme could be negated and the savings would likely result in loss of the MfE contribution which is greater than any savings that might be made.
Business processes for internal data use	32. Review how the data is used internally to increase utility in business and operational planning plus reporting (25)	Analyse Now	Won't directly result in saving in cost of delivering the programme but would ensure that DOC gets best value from its investment in monitoring
NEW – NBMRS Database	33. Database development and Info Management	Analyse Now	Would savings be made if the NBMRS DB development deferred/paused. $80K is for Info management of DB. We have no new work = maintain only. No plan to scale up any investment. The 80K is fixed cost to run and maintain the DB system each year.
New - Training	34. Training - transition animal to external provider (NMIT)	Analyse Now	Would savings be made if PMR were to also transfer the Tier 1 animal and bird training to an external provider (NMIT.

Examination of NLM programme component priorities in Table 1

Twenty three components, organised by theme, were subject to detailed examination: first a draft template report was completed for each; this report was presented to the review group and critically examined; following the examination an overall 'bottom line' conclusion was drawn for each report. All reports are attached as Appendix 3. The results from this work are shown in Table 2.

The key conclusions from analysing the bottom line comments in the components reported in Table 2 are:

- The programme is operating at near peak efficiency with huge gains having been made over the years – incremental further small gains are and will be made in the future. These gains are important but are not significant in terms of the net savings' target. This conclusion confirms the findings from the 2015/2016 Task Assignment review completed by PMR and Operations.
- It is clear that the cost structure of the programme is now largely 'fixed' – there is very little 'flexi' money available.
- Future step change opportunities, beyond 17/18 but for some as close as 18/19, lie in three main areas:

- Changing the vegetation monitoring cycling to 10-yearly – this is proposed to begin in 2018/19, subject to research confirmation that this is a scientifically defensible position. That alone, in 18/19, could deliver savings opportunities in the order of approx. $300-$450K pa
- Technological innovation leading to increased remote real time monitoring – this will require investment but will benefit DOC and NZ Inc, and will deliver enormous efficiencies and related opportunities.
- Technological innovation leading to electronic data capture for vegetation monitoring and some components of animal monitoring – this will require investment but will lead to significant benefit to DOC and NZ Inc, and will deliver enormous efficiencies and related opportunities
- Sharing costs with regional councils and other participants, who might in the future join a NZ Inc NLM programme – it is too early to consider the real benefits such an opportunity might lead to, but they are likely significant.

There are three areas we are aware of where there is constant speculation about the potential for significant savings to be made, namely:

- 23. Run the programme regionally rather than randomised to limit travel
- 24. Move to 6 year cycle
- 21 Move to zero TOIL model for field work (21)

All opportunities have been considered before, with region vs randomised considered in the initial programme design. Dealing with each separately:

- A regional north to south or similar programme could reduce travel cost in a signle season. But it comes with huge risks and downsides:
    a. To report on *ecological integrity* DOC needs to sample across all of PCL each year. Total change in sampling design introduces bias, lack of representation in the sample each year and loss of statistical power. This would require significant rework in the science and research into different analyses and different reporting for both National Level reporting and any Regional type reports that are in development now (e.g. Ruahine).
    b. Consistent with the above is the fact that the time between regions being revisited on the randomised method is 5 years, and this would change to at least 9 years on a regional approach – biosecurity incursions, such as myrtle rust, and their impacts on the state of the environment, would be much more difficult to monitor.
    c. It is not known if Statistics NZ or MFE would use the information as Tier 1 statistic any more leaving DOC with issues meeting Environment Reporting Act commitments.
    d. Other impacts that are negative include; lost ability to deliver on the agreed Tahr Monitoring programme and report back to Conservation Authority in time, increased relocation costs for staff (especially permanents), added costs associated with hosting 40 odd staff in these “regions”. With this approach there is a high risk of staff not able to go out if there are severe weather events and as you cannot move to a location away from this, they have to work at base. In reality, there is not

enough local work to deploy them to and this results > non-productive time than with the current design

e. Logistically, while sounding appealing, it could be very difficult to implement and savings over the 5 year timeframe may not actually occur – given NZ's geography and climate, whole regions can be 'down' due to weather conditions or random event such as Cyclone ITA or the Kaikoura EQ. In reality, the randomised approach provides programme managers greater flexibly to manage for these conditions as demonstrated last year with the Kaikoura EQ.

- Implementing a 6 year cycle could save money for field work, and could in theory be implemented in 18/19. But it would:
  - require negotiation with other stakeholders involved in the grid, MFE, councils etc
  - likely results in loss of MFE MOU
  - lead to even less ability to infer change over time and provide less insight to managers
  - extend the time period for completing the 3rd cycle of NLM
  - have data analysis implications that would require researching
  - complicate and possibly negate implementation of a 10 yearly vegetation monitoring cycle currently being explored for 18/19 financial year so may end up costing more long term.
- 9(2)(g)(i) [redacted]

Table 2. Key findings and bottom line messages from examination of key components of the NLM programme.

Theme	Opportunity	Benefit (Savings)	Impact	Complexity	Bottom line
Technology	1. Logistics and master sample database (4b)	M	L+	M	Further investment is necessary to yet develop a "Logistics database" in order to facilitate a well-planned annual work programme. Better logistics for the teams would result in less spending on transportation etc.
Technology	2. Develop in-field data capture tools and improve data entry (10)	K	M+	H	Potential for savings and data collection improvements in the relative short term (5yrs) but needs investment to yield the return, teach staff, and cooperate with CRIs.
Technology	3. Field based plant dentification options (3b)				
Technology	4. Database management options (11)				
Technology	5. Remote sensing and automated data capture (14)				
Technology	6. Automated processing, e.g. acoustic (19)				
Field workforce design and	7. Spend longer time in the field (30 day trips	Low	H-ve	L	Some savings potential, but a significant cost to staff and thus to the programme's quality, through poorer

programme delivery	and / or longer days) (1b)				quality work etc, as well as increased H&S risks. Requires negotiations with union for work contract/conditions.
Field workforce design and programme delivery	8. Review the mix of permanent v contracted staff (8)	In progress	In progress	In progress	Significant potential to yield gains as more permanent staff would reduce training needs and would increase productivity and ability to assist with other work.
Field workforce design and programme delivery	9. Move to zero TOIL model for field work (21)	H-	L-	H	Would significantly increase cost (~$200k PA) and number of staff required and reduce programme quality through poorer quality work etc. TOIL and wellbeing is actively managed and a change would require to work more in unfavourable conditions (shoulder season) to complete the annual programme. Impact on staff wellbeing, H&S, ability to conduct monitoring (e.g. restrictions on flowering…), staff numbers, supervision requirements and more.
Field workforce design and programme delivery	10. Review how work delivered (26)	In progress	In progress	In progress	Could reduce number of flights etc and lead to savings by more coupling of field teams (animals, vegetation), but would need to increase the number of botanists, which would increase costs.
Field workforce design and programme delivery	11. Review the placement of the team(s) (6)	L	L-	M	Team location matters and we are continuing to improve over time, incrementally. In the short term, a proposed 'base' in Wanaka will help with a small efficiency gain.
Field workforce design and programme delivery	12. Move from a dedicated team to embedding functions into the roles of existing staff (7)	In progress	In progress	In progress	Sounds appealing, but logistically very difficult given competing demands, level of expertise and skills within monitoring team, and unlikely to deliver a consistent national level monitoring programme.
Field workforce design and programme delivery	13. Renegotiate terms of employment – particularly allowances (22)				
Field workforce design and programme delivery	14. Collaborate with others to share costs, resources and skills. (Councils) (24)				
Commercial models	15. Greater contributions from beneficiaries of data (2b); option a) Sponsorship	L	L	L	Financial assistance or in-kind support from companies to test technology and equipment in the field; possibly in exchange for an opportunity for promotional material (photos, videos) may be possible and should be considered for future iterations..
Commercial models	16. Greater contributions from beneficiaries of data (2b); option b) Adoption of plots	M	M -	H	Zero-sum game: Volunteers conducting the monitoring reduce the workload of field staff but increase training costs. Potentially resulting in loss of MfE MOU.
Commercial models	17. Greater contributions from beneficiaries of data (2b); option c) Charging for use of data	NA	NA	NA	Not recommended, as government data should be freely accessible (NZ Government's "Declaration on Open and Transparent Government").
Commercial models	18. Greater contributions from beneficiaries of data (2b); option d) Sale of IP	L	L+	H+	Long-term game with serious up-front investment and uncertain benefit.

Commercial models	19. Sell skills and capacity to others (i.e. expand monitoring) (23)	L	L	M-	9(2)(g)(i) [redacted]
Commercial models	20. Completely outsource all NLM to 3rd party (9)				
Programme design, methods and indicators	21. 10 year cycle for forest vegetation (2018/19) (1)	NIL	-ve H	H	Would save money if attempted to implement 17/18 ($300k pa to $450K pa) 9(2)(g)(i) [redacted] Recommend the research is completed in 17/18 as planned and, if this proves possible, the transition would begin 2018/19 after completion of 3rd round of NLM plots on their 5 year cycle.
Programme design, methods and indicators	22. 10 year cycle for vegetation and animals (2018/19) (2)	NIL	-ve H	H	Massive savings ($1.5M pa) but animal monitoring time gap too large, putting at risk the utility of the data for regional, national and international reporting. Recommend the research is completed in 23/24 as planned and if this proves possible, the transition would begin 24/25 after completion of 2nd round of animal measures on their 5 year cycle.
Programme design, methods and indicators	23. Run the programme regionally rather than randomised to limit travel (3)	NIL	-ve H	H--	Might save money 9(2)(g)(i) [redacted]
Programme design, methods and indicators	24. Move to 6 year cycle (4)	NIL	ve H	H-	9(2)(g)(i) [redacted]
Programme design, methods and indicators	25. Review the number of methods in each plot and how they are carried out (15) (17)	In progress	In progress	In progress	Risks associated with changing or discontinuing methods through loss of data continuity
Programme design, methods and indicators	26. Review grid size (16)	NIL	-ve H	M	A larger grid size would reduce the potential reliability of statistic inference and decrease precision; would likely require a shorter timeframe between surveys.
Programme quality	27. Plant identification (was under 3b on the board) (3b)	NIL	M-	M-	No cash savings made with moving identification in-house 17/18 and it is not feasible for BMT (Biodiversity Monitoring Team) in 17/18 to complete the work in the timeframes needed for annual reporting.
Programme quality	28. Delay planned research (5)	NIL	H-	L	Deferring research into the 10 year cycle for forest vegetation and methods improvements prevents the opportunity for future savings
Programme quality	29. Further deferral of processing. (2)	In progress	In progress	In progress	Deferring sample processing prevents the data for a season being finalized and able to be used, creates issues with space at PMR base and effects the

					collection action agreements for accessioning and making the samples available via the herbaria
Programme quality	30. Review Sample processing (13)				
Programme quality	31. Review QA programme and structure (18)				
Business processes for internal data use	32. Review how the data is used internally to increase utility in business and operational planning plus reporting (25)	L	H+	L	Current practice does not result in the best use of data to inform management – requires a new way of working at the interface and for knowledge communication and there are plans to do this. Won't directly result in saving in ost of delivering the programme but would ensure that DOC gets best value from its investment in monitoring.
NEW - Database one	33. Database development and Info Management	L	H-	M-	We have no new work to develop databases and data management systems. Current spending is onmaintainance only. No plan to scale up any investment.
New - Training	34. Training - transition animal to external provider (NMIT)	Nil	M+	M+	No saving po ent al for 17/18 but with some development costs (salaries) will lead to at least $10K savings pa from 18/19 onwards and importantly, free up staff time at one of the more pressured times of the field season. With support and time from other parts of the organisation, the development costs could be absorbed in the current budget so no added costs to the programme for 17/18 to achieve this gain

Recommendations

That you:

1. agree that the NLM programme as currently delivered is highly cost efficient;
2. note there are opportunities, 2018/19 on in particular, for significant cost savings linked to already planned programme initiatives;
3. note there are other opportunities identified as a result of undertaking this task assignment and that the programme team should to explore these further, e.g., sponsorship;
4. note there are opportunities for step growth productivity and other improvements in the NLM programme but that these will require up-front investment over time.

Ken Hughey, Chief Science Advisor, 30 June 2016

Appendix 1: Template for analysis

Review of selected options for analysis *<template>*

<define data sources where numerical data and prior analysis can be referenced. Alternative methods are interviews with selected subject matter experts or opinion of expert team members>

<Overwrite italicised cues with relevant data>

Option

Theme	*<ref 6 x themes from 2 June workshop>*	Name	*<ref title from 2 June workshop>*	**ID**	*<ref ID from 2 June workshop>*

Executive summary

<Summarise the analysis and recommendation>			
Cost Benefit 17/18	**Impact**	**Complexity**	**Recommended to implement**

Context and background

<Background and additional information to describe the opportunity and other relevant information to help understand the approach>

Data sources

Numerical and quantitative	*<references>*
Interview	*<interviewees and dates>*
Other	

1 Estimated Annual Savings

High (optimistic)	*<Best case annual ongoing, all going wells>*
Low (Conservative)	*<Minimum expected ongoing savings>*
Likely ongoing	*<sustained ongoing savings>*
Expected 17/18	*<where "Likely" is not for a full year>*

Commentary on expected financial savings

<relevant information to support and explain estimates>

2 Assessment of impact

	Rating	Discussion
Impact on integrity of the programme	<+ H M L, Neutral or -ve H M L>	*<H (+ve or –ve) significantly improves or degrades the scientific validity of the programme* *M (+ve or –ve) Has a discernible impact but within acceptable tolerances* *L (+ve or –ve) some impct but negligible.* *Neutral, no impact>*
Impact on relationships and reputation	<+ H M L, Neutral or -ve H M L>	*<+ H significantly enhances DOC's reputation and / or builds strategic relationship* *+ M improves reputation or enhances an existing relat onship* *+ L has minor impact on relationship or reputation* *Neutral = no impact* *- H significantly degrades DOC's reputation and / or damages strategic relationship* *+ M noticeable but manageable impact on reputation or existing relationship* *+ L has minor impact on relationship or reputation*
Impact on DOC's benefit derived from the programme and its data	<+ H M L, Neutral or -ve H M L>	*<+ H significantly enhances DOC's ability to deliver biodiversity outcomes* *+ M useful improvement to ability* *+ L Some efficiency gains* *Neutral = no impact* *- H significantly affects DOC's ability to deliver biodiversity outcomes and demonstrate these to stakeholders.* *+ M noticeable but manageable impact on ability to deliver and demonstrate conservation outcomes* *+ L has minor impact on capability*
Risk introduced through implementation (uncertain impact)	<-ve H M L or neutral>	*Use risk matrix or likelihood x impact>*
Other indirect benefits / improved conservation outcomes	<+ H M L, Neutral or -ve H M L>	

3 Complexity of implementation

	Rating	Discussion
Time to implement	< H M L,>	*<H Unknown but unlikely to be available for 18/19 field season* *M (Likely to be available for 18/19 season but not before* *L Could be available for 17/18 field season >*
Cost to implement	< H M L,>	*<H Would require, business case, specific funding and implementation as a complex project* *M Could be accommodated within existing budgets through re-prioritisation* *L Could be funded through existing resources as BAU>*
Complexity	< H M L,>	*<H Dependence on novel and unproven methods. May be better to wait until they are mature and monitor marketplace developments* *M Path to implementation can be envisaged, relying on methods that are proven but not yet within DOC* *L Path to implementation is well understood and used successfully before within DOC*

Appendix 2 – Description of opportunities for savings and initial evaluation for potential benefits, impacts and complexity to implement.

Theme	Timing	Opportunity	Status and actions	Task No.	Benefit (Savings)	Impact	Complexity	Comments
Technology	Analyse Now	Logistics and master sample database (4b)	Corporate requirement/FSI discussion/Do some stuff under the radar		M	M+	H	Requires unplanned IT development. Would see benefits from better management of field movements and increased quality of the programme
Technology	Analyse Now	Develop in-field data capture tools and improve data entry (10)	Variant 2, partnership added,		M	M+	H	Positive impact on quality and significant time savings through not needing to re-enter. Does rely on IT development but could be done more easily for animal teams where the concept has already been proven to give partial benefits at moderate cost using Survey 123
Technology	For subsequent analysis	Field based plant identification options (3b)			L	L+	H	Relies on technology and tools. Main benefit would result from increased reliability of identification. Would still rely on trained botanists
Technology	For subsequent analysis	Database management options (11)			L	H+	M	Requires some IT development but would give efficiencies and better security of data
Technology	For subsequent analysis	Remote sensing and automated data capture (14)			H	H+	VH	Potential to significantly reduce time in the field and improve data quality. Depending on technology developments and the marketplace. Needs to be considered through constant market scanning
Technology	For subsequent analysis	Automated processing, e g. acoustic (19)			M	H+	H	Some work is ongoing. Will depend on developments in universities

Field workforce design and programme delivery	Analyse Now	Spend longer time in the field (30 day trips and / or longer days) (1b)	Draft - not peer reviewed outside Operations. Mike link to survey monkey annual report (if avail) or direct to link of data out of survey monkey (or presentation). Pre training PPT		Low	H-	M	Negative impact on H&S. Would require negotiation with staff and / or unions. Increase TOIL liabilities
Field workforce design and programme delivery	Analyse Now	Review the mix of permanent v contracted staff (8)	In draft still Smith to sound like increase core of people and add data on training etc and added costs for this Added costs also to add in are recruitment costs, audit resuts, DE queries, time for processing, turnover ratio to calc the costs with and what savings could be made, perhaps look at the restructure proposal for BMT and see what arguements were?, need to know what the added cost is and then savings in outyears due to this (eg nothing 17.18 and then saving start 18.19)[Use the integration document to drag out numbers about what saving in time for processing will be when use exp permanent ongiong staff]		M	M+	M	Increase the number of core permanents staff. Removes the significant overhead associated with continuous renewals. Gives continuity of access to specialist skills. Would require converting contract positions to permanent and running recruitment process

Field workforce design and programme delivery	Analyse Now	Move to zero TOIL model for field work (21)	Draft - not peer reviewed outside Operations. Demo changes the programme when to to get to current state - how we changed trip length to manage TOIL and get down from months. What done already Link to permanent and culture shift where they don't want toil so much but fixed term do (think that is what Mike P said) try to describe the impact of push to shoulder season which is caused by 0 TOIL and how the problem Options to do this may be more staff and contractors but issues as incrase staff/more supervision/PPe, Field bases etc Impact to optimal and plant not flowering Demo that not fatigues and H&S balance all good with current model Demo how TOIL actually is rahte n than the myth at SLT - Tier 1 is exception due to how well managed connect to permanents and training. DOnt forget to add what you have done to manage this (The rules for TOIL)		-ve	M-	M	Will significantly increase cost and number of staff required and extend the programme and will require negotiation with staff

Field workforce design and programme delivery	Analyse Now	Review how work delivered (26)	In progress. 1. Heli review Add onto Johns review and practices we put in place. And then the review of how you are doing with these practices (H&S and efficiences). Need for the softward and better/more auto/data driven ways to plan the work. Link to logisitic tech review 2. Couples vs de coupled due to optimal sampling Describe all the work you have done and why we moved to de couple and the savings we made due to this Make sure you describe the history of this in your document so its clear it has evolution. Link to TOIL review as linked. Add analysis and samp e design constraints All coupled = 70K saving but means more staff (=recruit costs) adn more skills and issues wi h this (poss toil issues) Make al the principles and practices you put in place are visible. Link to MM and EW on design and why optimal		L	L+	L	

Field workforce design and programme delivery	Analyse Now	Move from a dedicated team to embedding functions into the roles of existing staff (7)	In progress - JL working on this still Could look at JC work on hut inspectors as parallel work that could eg how it benefits the dept and saves funds etc (AMIS eg) If monitoirng legit activity why treat diff Link to training and added costs etc Bring up how local monitoirng is not being delivery and how BMT now being approached (eg tracking tunnesl) Raise models like in USA etc and canada		-	M+	M	Might look like an initial saving however there is the opportunity cost of the time taken by staff to pick up extra duties. 9(2)(g)(i) [redacted]
Field workforce design and programme delivery	For subsequent analysis	Renegotiate terms of employment – particularly allowances (22)	Not started - hand to Dept to do as out of scope for us as department issues and should be at that level		M	M-	H	9(2)(g)(i) [redacted]
Field workforce design and programme delivery	For subsequent analysis	Collaborate with others to share costs, resources and skills. (Councils) (24)	Not started and can happen later. Its underway with DOC, MFE, REG COUNCIL and EMAR. Pilot with GWRC as a practice.		L	M+	M	Starting to happen anyway. Would give some economy of scale and expand dataset

Field workforce design and programme delivery	Analyse Now	Review the placement of the team(s) (6)	Early draft - not reviewed at all Complete this Get MM etal to comment on added benefits Look at supervision issues Not big buck savings but span of control is compelling but depends on permanents to be delivered as you need good supervision end experience. Link to permanents topic. talk about what already looked at Phase implement and give costs as such. work on what field base resources you need (desk/phones etc). If want to follow up on Canadian model let MM know and will connet you for phone/Skype meeting		L	Neutral	M	Might result in some minor efficiencies in logistics of the field programme but placement design has been reviewed several times already and could result in relocation costs and / or loss of access to existing experienced contractors with consequential retraining costs

Commercial models	Analyse Now	Greater contributions from beneficiaries of data (2b); option a) Sponsorship	Completed Equipment and apparel soponsorship Go Pro sponsorship Tents etc Commercial sponshorships		H	L+	M	9(2)(g)(i) [redacted]

Commercial models	Analyse Now	Greater contributions from beneficiaries of data (2b); option b) Adoption of plots	Look at the citizen science section for the review and re purpose		H	L+	M	9(2)(g)(i) [redacted]

Commercial models	Analyse Now	Greater contributions from beneficiaries of data (2b); option c) Charging for use of data			H	L+	M	Would require negotiating opportunities and contracts but would increase the utility of the data and get benefit of their perspectives. May take a year or more to negotiate. Models could include sponsorship, review charging for use, sale of data and sale of IP.
Commercial models	Analyse Now	Greater contributions from beneficiaries of data (2b); option d) Sale of IP			H	L+	M	Would require negotiating opportunities and contracts but would increase the utility of the data and get benefit of their perspectives. May take a year or more to negotiate. Models could include sponsorship, review charging for use, sale of data and sale of IP.
Commercial models	Analyse Now	Sell skills and capacity to others (i.e. expand monitoring) (23)			H	M+	M	Would expand data set beyond PCL and generate revenue but requires establishing products and marketing them. Complexity in administering commercial environment
Commercial models	For subsequent analysis	Completely outsource all NLM to 3rd party (9)	More work to do		-ve	H-	H	DOC established this capability because the market was unable to provide the national coverage and consistency required. There is no obvious supplier currently in the market.
Programme design, methods and indicators	Analyse Now	10 year cycle for forest vegetation (2018/19) (1)	In draf - EW to complete		H	H-	L	Could happen easily but impact and risk is unknown without analysis

Progamme design, methods and indicators	Analyse Now	10 year cycle for vegetation and animals (2018/19) (2)	In draft - EW to complete Rotating panel Stats input Make the matix Mike to comment on impact and cossting Mike to comment on impact and cossting		H	H-	L	Could happen easily but animal data would be almost irrelevant because of the lifecycle of many species measured
Programme design, methods and indicators	Analyse Now	Run the programme regionally rather than randomised to limit travel (3)	In draft - EW to complete Can add the Cyclone ITA as eg of what natural distaster impact would have if went regional mike to estimate cost stuff find a good analogy like the polling one JC gave Mike P to put in words about how it could or could not be implemented imact MFE and lose funding and impact issues wi h network group Mike to comment on impact and csst ng		L	H-	H	Would require negotiation with councils, MfE and Stats NZ. Would likely negate confidence in programme. Cost savings cancelled out in years where surveys are a long way from workforce and higher susceptibility to interruption through adverse events (weather / fire etc.) because of limited ability to reschedule plots nationally

Programme design, methods and indicators	Analyse Now	Move to 6 year cycle (4)	In draft - EW to complete Issues with stakeholders. imact MFE and lose funding and impact issues with network group annaul sample size and lost ablity to report annually. Re randomisation incompatiblity with rest of nZ trade off in precision Myrtle rust eg here too		M	H-	H	Might save time and cost of field but would require redesign of the sample design and negotiation of variation with other agencies. Would likely affect the validity of existing data points
Programme design, methods and indicators	Analyse Now	Review the number of methods in each plot and how they are carried out (15) (17)	MM has not started yet		M	H-	L	Risks associated with changing or discontinuing methods through loss of data continuity
Programme design, methods and indicators	Analyse Now	Review grid size (16)	In draft - EW to complete annaul sample size and lost ablity to report annually. Re randomisation detection issues - loss of precision Get Ken FAQ for use/Myrtle rust FAQ as well Mike to comment on impact and ossting		H	H-	L	Could reduce time in field through smaller grids but high risk through unknown impact on quality and utility
Programme quality	Analyse Now	Plant identification (was under 3b on the board) (3b)			M	L+		Review balance of inhouse v outsourced plant identification. In particular, is there benefit in bringing vascular plant identification in-house similar to non-vascular?

Programme quality	For subsequent analysis	Delay planned research (5)	In draft but needs more work and peer review Graph need table with resecah by $ by year Explain research savings to date and what ROI was/is What investment is now and then grappsh to show when gains may by Future step changes and what look like - to graphs Look for cofund ops - 10yr/cycle & Envirolink tools etc		L	M-	L	Easy to implement but would adversely impact relationship with partners and misses opportunities to implement improvements that can contribute to efficiencies
Programme quality	For subsequent analysis	Further deferral of processing. (2)			L	M	L	On top of existing backlog.
Programme quality	For subsequent analysis	Review Sample processing (13)			L	M+	M	
Programme quality	For subsequent analysis	Review QA programme and structure (18)			L	H-	L	No doing QA could save a relatively small amount (<5% of total programme cost) but the value of the programme could be negated and the savings would likely result in loss of the MfE contribution which is greater than any savings that might be made.
Business processes for internal data use	Analyse Now	Review how the data is used internally to increase utility in business and operational planning plus reporting (25)	**Inform 18/19 business planning** Diary this and lock in as PPT and finding to inform 18/19 BP **Understand opportunities to deliver value to operational districts.** Does this overlap with Mike P and EW roadshow?		L	H+	L	Won't directly result in saving in cost of delivering the programme but would ensure that DOC gets best value from its investment in monitoring

			Focus group before the roadshow to get the right products for the audience Make sure this is about getting their requirements/ Do we think about doing this in advance and do as a co-design **Executive presentation** Present to SLT a summary following the 16/17 programme. Describe highlights of status and trend. Point out where these may be relevant to inform Directions and Expectations and future. strategic decisions. Lead: Planning and Support. LOCK US INTO MEETING **Deep Dive on targeted topic.** Book in meetings					
NEW - Database one	Analyse Now	Database development and Info Management	Draft only					$80K is for Info management of DB. We have no new work = maintain only. No plan to scale up any investment. The 80K is fixed cost to maintain the DB system.
New - Training	Analyse Now	Training - transition animal to external provider (NMIT)	Draft - not peer reviewed yet					

Manaaki Whenua
Landcare Research

Evaluating optimum measurement of biodiversity indicators

Prepared for: Department of Conservation

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Evaluating optimum measurement of biodiversity indicators

Contract Report: LC3298

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Contents

Summary

Project and Client

- The goal of this report was to evaluate the statistical power of grid-based tier 1 data collected across public conservation land in terms of the optimum frequency of remeasurement of vegetation across sample points in forests and shrublands, and in terms of the power of the current 8-km sampling intensity to detect changes in some individual species of pest mammals and native birds, and within Forest Parks and National Parks. The work was undertaken for the Department of Conservation between August 2017 and August 2018.

Objectives

- Evaluation of the frequency of remeasurement of vegetation across sample points in forests and shrublands is necessary because remeasurement to determine changes in carbon (through the Ministry for the Environment's LUCAS programme) has moved to a 10-year cycle from its original 5-year cycle. Since metrics of vegetation change such as changes in populations of widespread trees are used in reporting by both DOC and for national reports (e.g. Environment Aotearoa), DOC needs to know the costs and benefits of altering the frequency of measurement.
- Evaluating the power to detect change is needed now that data are available from the first four years' measurement of pest mammals and birds, including the capacity to determine change at scales from national to within Forest Parks or individual National Parks.

Methods

- We used data from Tier 1 plots nationally for vegetation from 2002 to 2017, and for pest mammals and birds from 2011 to 2017.
- We used layers provided by DOC to delineate the Tier 1 plots that occurred North Island Forest Parks and in two National Parks in the South Island (Kahurangi and Arthur's Pass National Parks).
- We evaluated changes in tree stem (≥2.5 cm diameter at 1.3 m height) mortality and recruitment (and dynamism; a combined measure of mortality and recruitment) across all tree species, and for 8 individual widespread, common tree species).
- We evaluated the power to detect change for the current sampling intensity of Tier 1 plots and across a range of sampling intensities (from >90% fewer points to >50% more points) in (i) pellet frequencies of ungulates; (ii) frequency of brushtail possums (assessed by chewcards and trap-catch), (iii) counts of bellbird and kea. We evaluated the power to detect changes in frequencies of ungulates and brushtail possums in North Island Forest Parks, and of bellbird and kea in Kahurangi and Arthur's Pass National Parks.
- We further evaluated the power to detect change according to whether management had been applied (nationally and at the scale of Forest Parks and individual National Parks).
- We custom-built a series of R-functions to determine differences in mammal frequencies and bird counts.

Results

- Over a 10-year period, c. 35% of all stems in plots either die or are recruited, whereas 22% of all stems in plots either die or are recruited over a 5-year period. The relationship between mortality, recruitment and dynamism at a 10-year and 5-year interval si non-linear.
- There was evidence of national decline (i.e. greater mortality than recruitment) in three widespread canopy tree species (*Griselinia littoralis*, *Metrosideros umbellata*, and *Weinmannia racemosa*), and national increases in two others (*Melicytus ramiflorus* and *Pseudowintera colorata*). Assessment over a 10-year period could mean that major changes, and the option to intervene to alter population trajectories, could be compromised compared with assessment at a 5-year period.
- Current Tier 1 sampling intensities are sufficient to detect a 1% change in ungulate pellet and brushtail possum frequencies nationally if management is homogeneous and there is no environmental variability, and ≥2.5% change if management were applied at 40% of sites. There is evidence that ungulate pellet frequency has increased c. 35% nationally between 2014 and 2017.
- Current Tier 1 sampling intensities in North Island Forest Parks are sufficient only to detect ≥5% change in ungulate pellet frequency if management is homogeneous and ≥15% if management were applied at 40% of sites.
- Current Tier 1 sampling intensities can detect a 5% change in bellbird counts nationally, but for kea (patchily distributed and only in the South Island) even 3000 sample points could not detect a 5% change in counts. However, there is evidence that kea counts between 2014 and 2017, kea counts in Tier 1 plots declined by c. 65%.

Conclusions

- Because of the non-linear relationship between demographic rates assessed at 5-year and 10-year intervals, and the frequency of natural disturbances (e.g. major tropical cyclone disturbances in 2014 and 2018), we believe that it is prudent to continue to assess these rates every 5 years. This is even more the case for individual species, especially given new threats (e.g. myrtle rust may alter demographic rates in New Zealand Myrtaceae trees, e.g. *Metrosideros umbellata* and *Leptospermum scoparium*).
- Current Tier 1 sampling is sufficient to detect quite small changes (≥2.5%) in frequencies of ungulates and brushtail possums and bellbird counts and much larger (≥10%) changes in kea counts. The sampling is sufficient to detect large changes in some smaller areas (North Island Forest Parks and large Kahurangi National Park) but inadequate to detect even large changes in much smaller Arthur's Pass National Park.

Recommendations

We recommend:

- Maintaining repeated measurements of all Tier 1 sample points for all metrics (vegetation, pest mammals, and birds) at 5-yearly intervals.
- Maintaining measurement of all Tier 1 sample points in forests at 5-yearly intervals to allow reporting of individual tree species.

- Maintaining measurement of pest mammals and birds at all Tier 1 sample points at 5-yearly intervals to allow detection of trends from unpaired samples.
- Using power analyses, such as those used in this report, to determine suitable sampling intensities to design Tier 2 networks within management units.
- Maintaining and improving systematic collection and collation about management history for each Tier 1 sample point to improve interpretation of trends.

1 Introduction

National environmental reporting requires robust and consistent sampling of the New Zealand landscape (Allen et al. 2003). National biodiversity and ecosystem function (carbon) reporting currently utilises an 8-km grid-based plot network encompassing public conservation land and other forest and shrubland (Holdaway et al. 2014).

The 8-km national plot grid was originally designed as a system for providing an unbiased estimate of the carbon stored in New Zealand's natural forest and shrubland (Coomes et al. 2002; Payton et al. 2004). The grid size (8 km) was determined based on the sample size required to estimate national carbon stock to a certain level of precision (i.e. a 95% probability that carbon stock estimates will be within 5% of the mean (+/– 10 Mg ha) (Payton et al. 2004). Plots were randomly allocated a sample year based on a theoretical 5-year cycle with no geographical stratification (Payton et al. 2004). With revisions of the mapped area of forest and shrubland (e.g. the creation of the LUCAS Land Use Map), new plots have been added to the sample universe. These were also allocated an ideal year of measurement using random sampling.

Subsequently, the Department of Conservation (DOC) has adopted the 8-km grid for its Tier 1 biodiversity monitoring (MacLeod et al. 2012). In doing so, they have extended the plot network to sample all points on the grid that are located on public conservation land (PCL). DOC adopted the original 5-year measurement cycle as for LUCAS/CMS. New plots were randomly allocated a measurement year, again with no level of geographic or land use stratification. In addition, DOC has widened the scope of methods to include animal (possums, ungulates and birds) monitoring at all sites.

The programme was designed to integrate both vegetation, mammal and bird measures to allow them to be presented in relation to spatial and temporal data for each component using a sampling intensity typically allowing a 5% shift in indicators/measures to be estimated with 90% confidence. The integrity of the national plot network for DOC, in terms of ability to report both regionally and nationally is dependent on consistency of design and methodology.

At the end of 2017/2018 field season the first 5-yearly rotation of Tier 1 with vegetation and animal measurement will be complete. At that stage, there will be sufficient measurements to make it possible to update initial predictions of precision with estimates of the precision achieved from the data. Due to this and the need to look for improvements; efficiencies and cost savings, there is a need to look at the option of moving from a 5-year to 10-year cycle for forest plots on the network.

DOC plans to investigate the efficacies of sampling on the 8-km grid by completing a review of the frequency of measurement depending on the features of the change actually observed, and the precision or sensitivity needed. This was the strategy followed for the carbon-monitoring objectives. It allows refinement of the frequency to meet a specified level of precision while minimising costs.

In addition, MfE's LUCAS programme has moved to a 10-year cycle of measurement of carbon-related aspects of vegetation in natural forests and shrublands on private and

public land. This has implications for 5-yearly measurements conducted by DOC and regional councils (who measure other aspects of vegetation and of birds and pest mammals) in natural forests and shrublands on public and private land respectively.

A full set of re-measurements is already available for vegetation data in forest and shrubland, providing a base for evaluation of precision achieved. A full 5-year cycle of re-measurements for animal measures and in grasslands starts in 2018/2019, but re-measurements with a 3- or 4-year gap are already available for approximately 160 grid points measured during the phased implementation. This will be the basis for initial assessment of achievable precision for animal measures, and in non-woody ecosystems, to be revisited when the second 5-year cycle is complete.

2 Background

2.1 Power analyses for conservation management and ecological monitoring: a unique problem

Assessing the power of monitoring networks to detect the effect of management poses several problems not usually encountered in classic power analyses. First, ecological metrics vary greatly in space (e.g. see Figure 3 in Overton et al., 2015), making it exceedingly difficult to use pilot studies (cf. data from the entire monitoring network) to properly explore power to detect change. This means that we can only properly assess power when we have completed a survey, and may often be asked to perform power analyses for detecting temporal change when we have only a single measurement in time. In this scenario, we need to devise a method for simulating datasets representing a hypothetical second measurement, which captures the process by which changes in populations and communities are detected by our ecological metrics.

Second, ecological data are often highly zero-inflated (especially for individual species) and even then, non-zero values are generally strongly right-skewed (many small and few large values – see Figure 6b below for an example of this). This means that parametric probability distributions (even zero-inflated versions) either poorly represent variation in ecological metrics amongst sites (e.g. normal, quasi-binomial, Poisson), or require data to be altered by adding an arbitrary amount to remove any non-positive values (log-normal, beta). Statistical methods based on parametric distributions all involve certain assumptions (e.g. the Poisson distribution assumes variance is equal to the mean, while the binomial distribution assumes that the shape of the mean-variance relationship is constant). The assumption that observations are independent and identically distributed (i.i.d.) is implicit, but often glossed over, in the application of parametric methods. Zero inflated distributions assume there is some theoretical reason for an excess of zero values, though in practice they are commonly applied for no other reason than the data have "too many" zeros. All such assumptions pose problems for obtaining robust statistical tests for significant change in ecological metrics in response to management. This is a serious issue when testing power across a wide range of data types, for a large number of different species and at different spatial scales. Non-parametric approaches minimise the number of assumptions required for power analyses, and provide the user with flexibility to adapt

significance tests and simulation methods to suit the sampling design by which data are collected.

Third, the areas for which conservation managers are responsible are usually much greater than the area over which funding permits effective management to be applied (Overton et al., 2015). Thus, power analyses for detecting conservation management effects need to consider what sampling intensity is required to detect an effect across the entire area of interest when only a portion of that area receives management.

Finally, expected change in non-managed areas may often be directional. For instance, pest animal densities might (on average) increase or native species abundance might decrease where management is not applied. The possibility of non-zero effects from lack of management needs to be considered when the application of management is patchy (Overton et al., 2015).

In this report, we develop a novel system for significance testing and power analyses that deal with each of these problems.

2.2 Temporal sampling intensity: How can we choose an appropriate return-time?

The answer to this question is highly dependent on how rapidly ecological metrics change through time. We are fortunate to have full vegetation survey data for two survey periods (2002–07 and 2009–14), with which to assess the annual rate of change in both for individual species and plant communities. In this report, we use international best practice (Kohyama et al. 2018) to estimate annual rates of population change for a range of widespread native tree species and dynamism (i.e. annual rate of stem turnover) of the tree communities sampled in all remeasured LUCAS plots (i.e. those on public conservation land and private land). We use these data to estimate the impact of a 5- vs 10-year return time for vegetation surveys on our ability to detect major changes in tree populations in a timely fashion.

3 Objectives

On the basis of recommendations of a workshop held with stakeholders (11 September 2017), complete analysis of repeated-measures plots to:

- optimise sampling intervals for a 10-year cycle of measurement of the 8-km grid (for LUCAS) that does not compromise 5-year sampling of biodiversity indicators (by DOC and regional councils).
- evaluate the benefits of coupling biodiversity indicators measured on the 8-km grid, and the risks of not measuring some indicators simultaneously (e.g. uncoupled measurement of vegetation from those for birds and mammals), i.e. within-sample point coupling. This will include evaluations of static measurements of forest and shrubland (e.g. cover, biomass, species richness) and dynamic measurements (e.g. biomass increment, mortality/recruitment) with

respect to bird and mammal measures (dynamic measures assessed as 5-year and 10-year intervals; 2002–07 and 2009–14 intervals, separately or combined).

- evaluate scales of resolution, i.e., benefits and risks of coupling multiple biodiversity indicators at regional as well as national scales. Quantitative evaluations (power analyses) exploring trade-offs of longer versus shorter intervals of dynamism in forests/shrublands and the ability to link that to mammal/bird indicators/measures.

After discussion of results and by agreement with the Department of Conservation, produce material for this report and an accompanying PowerPoint presentation that outline:

- the relationship between the two census intervals (two 5-year intervals vs one 10-year interval) for tree dynamism among all species combined
- differences in trees' mortality and recruitment rates for some selected individual species between the two census intervals
- the power to detect changes in ungulate abundance nationally, based on Tier 1 data collected to date, and an evaluation of trend among years
- the power to detect changes in ungulate abundance in North Island Forest Parks, based on Tier 1 data collected to date
- the power to detect changes in two common widespread bird species nationally, based on Tier 1 data collected to date
- the power to detect changes in four common widespread bird species in two National Parks of different size, based on Tier 1 data collected to date.

4 Methods

4.1 Datasets used

To estimate vital rates for Tier 1 plots and individual tree species, we used stem diameter data from the 2002–2007 and 2009–2014 LUCAS survey periods. Only live stems recorded within the main 20 × 20 m plot with a valid National Vegetation Survey (NVS) databank code were included. Only plots with live stems recorded in both survey periods (n = 912) were analysed. We made this choice as vital rates – mortality and recruitment – cannot be annualised (following Kohyama et al. 2018) unless live stems occur in both survey periods (note this does not exclude plots where all stems present in the first survey period die, so long as there is some recruitment). We required annualised rates to assess the impact of changes in survey intervals on the amount of stem turnover (see section 4.3 for more details). Methods for diameter measurements followed standard LUCAS protocols (Payton et al. 2004). Vital rates are presented for the 26 target species listed in Mason et al. (2018).

For power analyses of the Tier 1 system's ability to detect change in ungulate abundance and to test for significant differences in pellet counts between individual years, we used faecal pellet counts from the first Tier 1 measurement period (2014–2017). Only Tier 1 locations where faecal pellet transects were performed were included (n = 1078). Where possible standard Tier 1 protocols for faecal pellet sampling were applied, but in some

locations, survey effort (number of sub-plots recorded) was lower. To account for this, we express faecal pellet data relative to survey effort (i.e. the number of sub plots sampled). The distribution of pellet counts is highly right-skewed (many small counts, few extremely large) so we chose to express pellet data as local frequency (proportion of subplots containing at least one pellet).

For possum power analyses we used trap catch, wax tags, and chew card counts from the first Tier 1 measurement period (Allen et al. 2013; Forsyth et al. 2018). Data were corrected for differences in sampling method between plots and were expressed as trap catch index equivalents (corrected data provided by Paul van Dam-Bates, DOC). Possum data were collected for 1065 plots.

For bird power analyses, we used Tier 1 bird counts for individual species which were expressed as mean count per species per Tier 1 sample location. Bird count data were collected from a total of 1069 Tier 1 locations.

4.2 A novel system of power analyses for conservation management

4.2.1 Assessing available power analysis tools

Most power analysis systems do not provide the flexibility to fully cope with the complications associated with ecological data (i.e. multiple sources of uncertainty, diverse data structures combining measurements, allometric equations and other conversion parameters, Holdaway et al. 2014). One option that does provide some flexibility to include multiple sources of variation is the 'simr' package (Green & McLeod 2016), which performs power analyses for mixed effects models generated in R. We explored the use of this package early in the project, but decided a customised approach was required due to several key areas of uncertainty (in addition to those identified around use of parametric distributions in 2.1):

- **simr requires data to be analysed by mixed effects models:** Building robust mixed-effects models for complex datasets based on derived metrics (i.e. metrics calculated from many individual measurements) such as those provided by Tier 1 is very difficult. The derived nature of most ecological metrics requires a higher level of flexibility than is provided by mixed effects models to fully incorporate all sources of uncertainty (e.g. Holdaway et al. 2014; Mason et al. 2018) in power analyses. Further, the effects of management on Tier 1 metrics are often not suited to modelling in a restrictive framework. For instance, we might want to use a population growth equation to model possum responses to management between Tier 1 surveys. This will involve not only uncertainty associated with measurement error, but also uncertainty around key population parameters (i.e. intrinsic rate of increase and carrying capacity) as well as spatial variation in such parameters (particularly for carrying capacity). In these instances, it is much easier and more transparent (i.e. easier for peers to critically assess power analyses) if the user is able to apply customised functions to model management effects. Also, as mentioned above, Tier 1 metrics often do not conform to parametric distribution functions, meaning it may be unwise to model them using mixed effects models.

- **Opacity of simulation methods:** It requires considerable effort, even for a statistically literate user, to discover exactly what simr does. To simulate datasets for power analyses it uses the *simulate.merMod* function in the lme4 package. The source code is available here: https://github.com/lme4/lme4/blob/master/R/predict.R**,** but because the procedures are deeply embedded in the lme4 package, this code is very difficult to interpret. This makes it very difficult to critically assess the code simr uses to simulate new datasets. Further, the comments provided within the code indicate that it is still being actively developed. Given the complex nature of Tier 1 data, it is dangerous to assume that the simulation methods provided by *simulate.merMod* are appropriate. For a nationally significant piece of monitoring infrastructure like Tier 1, it is important to provide maximum transparency as to how results are obtained, so that evidence for management decisions can be readily queried by non-experts from a wide range of stakeholder groups. Such transparency is best obtained through custom-made approaches since this allows us to **clearly document every step of the power analysis process**.
- **Simulated datasets may violate model assumptions:** Even with the simple model structure proposed by Green and McLeod (2016), 0.5% and 2.8% of simulated datasets (in their examples "model1" and "model2" respectively) could not be modelled with the specified model structure. This is surprising given that the data were generated using the same model structure. We tested simr on Tier 1 faecal pellet data simulated to have a 5% increase in local frequency between survey periods. We converted local frequencies to counts of sub-plots containing faecal pellets to allow use of a Poisson distribution (as in the Green and McLeod example). Tier 1 location was the random effect (source code is provided in the file SimRPelletTest.R). We found that between 9% and 12% of simulations (across 10 separate trials with 100 simulations each) produced data that could not be modelled with the specified model structure when function *powerSim* was used to test power of the resulting model. This shows that a non-negligible proportion of simulations may be unsuitable for analysis using the very model structure that generated them. This further highlights the possibility that parametric processes could be unsuited to testing for differences in Tier 1 metrics.
- **Limited number of distribution types supported:** In particular, lme4 does not support any zero-inflated or "quasi" distribution types. These can be applied to mixed effects models using the MCMCglmm library, and simulation methods do exist for the resulting models using function *predict.MCMCglmm*. Source code is available here: **https://github.com/cran/MCMCglmm/blob/master/R/predict.MCMCglmm.R**, but this is even more difficult to decipher than the code for *simulate.merMod*. In any case, to implement this approach would require a custom-built power analysis system without providing full transparency on simulation methods, and no guarantee that zero-inflated distributions would improve our ability to perform robust power analyses.

The above points are intended to highlight potential issues with assessing the power of parametric models to detect change in the derived metrics provided by Tier 1. Both mixed effects models and the simr package are useful tools for ecologists when a) they are employed in a way that is appropriate for the data and question at hand, and b) all

assumptions and the limitations they pose for statistical inference are both clearly stated and easy for non-expert users to assess.

4.2.2 Paired vs unpaired study designs

In conservation management, we are generally interested in how our chosen monitoring metrics change through time. The most powerful way of doing this is through a paired, or repeated measures design, where a fixed set of locations is surveyed repeatedly (or effects of treatments are assessed in adjacent plots, as for use of exclosures to assess ungulate impacts), since this controls for spatial autocorrelation and environmental heterogeneity. For Tier 1 locations, we can use repeated measures to determine changes in vegetation since there are now 2–3 measurements. Repeated measurements of Tier 1 locations for pest mammals and birds has just begun (2018–2019); however, it is possible to assess annual trends within 5-year Tier 1 survey periods. This requires comparison of different Tier 1 locations (since a random subset of the Tier 1 network is surveyed each year). These two study designs require different approaches in power analyses. The approaches we use in either design are outlined in Figure 1. In basic terms, the process for an unpaired design generates a second dataset by applying a specified effect size (expressed as a proportion of observed values) to the observed data. Significance is assessed for random samples from either dataset using a randomisation test based on overlap between the non-parametric probability distributions of either dataset (details provided in section 4.4.1). For a paired design, we obtain a random sample from the observed data and then apply the desired effect (including uncertainty around the mean effect size) to this sample. Significance is assessed using a randomisation test based on the sign of paired differences (i.e. between samples but within locations). Details are provided in section 4.4.2.

Unpaired

t1 = sample(ObsData)

t2 = sample(ObsData+Effect)

Significance

P(Overlap(t1,t2) >= Expected)

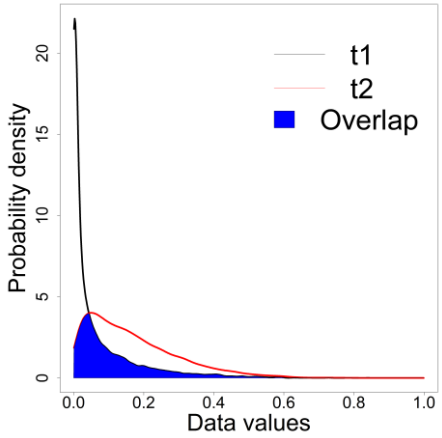
Paired

t1 = sample(ObsData)

t2 = t1+Effect

Significance

P(PairedDiff(t1,t2) ≠ Expected)



Plot	t_1	t_2	Diff
x_1	t_1x_1	t_2x_1	+
X_2	t_1x_2	t_2x_2	-
.		.	
x_N	t_1x_N	t_2x_N	+

Figure 1: Schematic outline for power analyses and significance tests for Tier 1 metrics (e.g. bird counts) under paired and unpaired sampling designs. For unpaired designs, overlap is used as a test statistic (see 4.4.1 for details), and power is assessed by comparing simulated datasets drawn from a kernel distribution based on the observed data (i.e. t1) and a second distribution where the specified effect size (e.g. % change in bird counts) is added to the observed data (i.e. t2). For a paired (or repeated measures) study design, a novel test statistic based on the direction, but not the magnitude of paired differences is used to test significance (see 4.4.2 for details). Power is assessed using simulated datasets generated by sampling from the observed data (i.e. t1) and adding the effect size to the simulated data (i.e. t2).

4.2.3 Patchy management application and non-zero "null" effects

Patchy management application and non-zero "null" effects are both part of the same problem, since the influence of non-management effects will be inversely proportional to the proportion of area where management is applied. Consequently, power analyses require simulation of effects both for managed and non-managed areas. Key in this is obtaining estimates of the net effect for a given combination of management effects and effects of no management (termed null effects). We term the proportion of non-managed area "Noise", to reflect the idea of the Signal:Noise ratio, where management effects represent the signal we are trying to detect (Fig. 2).

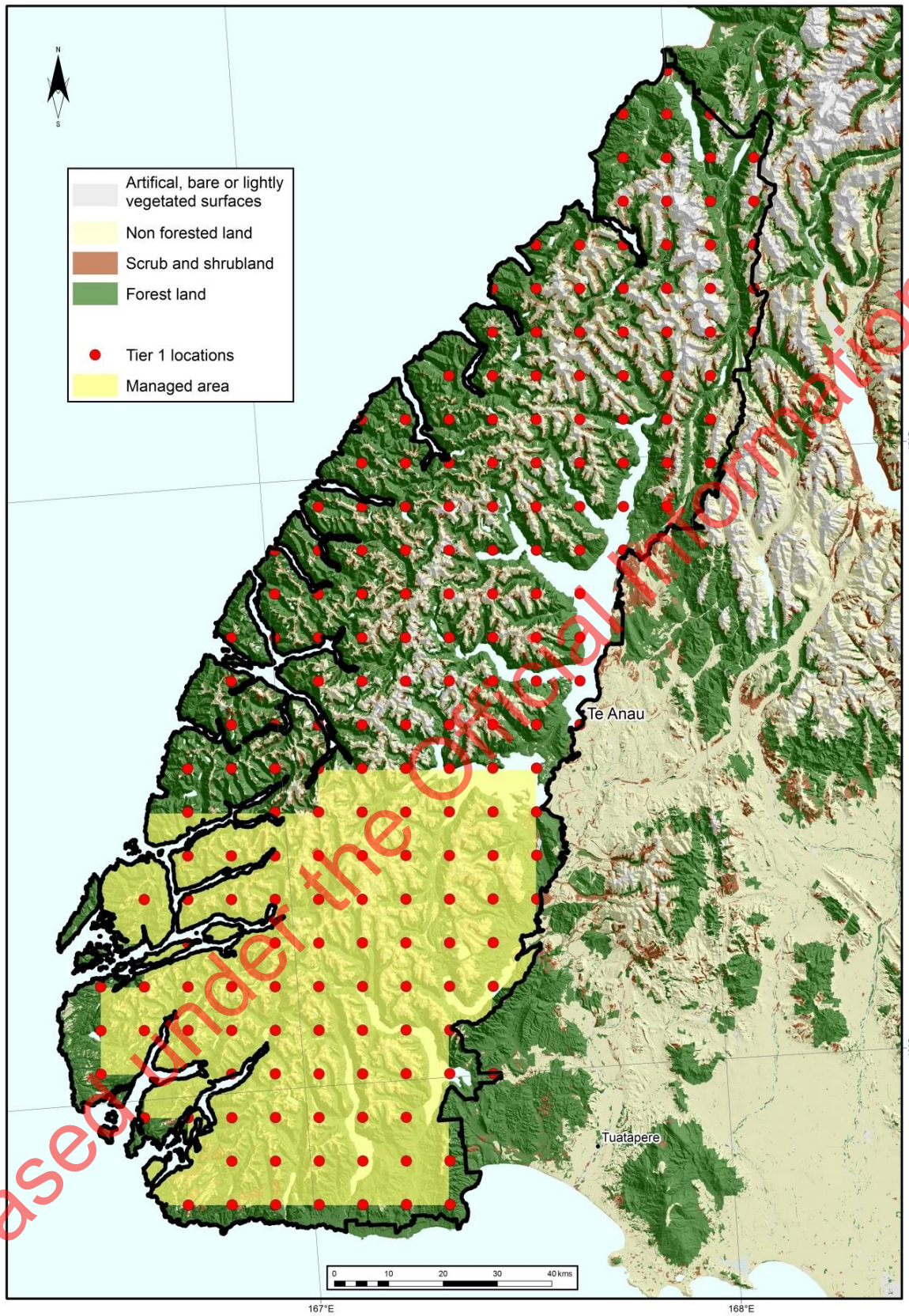


Figure 2: An example of the "Noise" concept, as applied to Fiordland National park. Here, the southern 40% of the park is managed (e.g. for possum control), while the northern part is unmanaged. In this scenario, Noise is 0.6 (1-0.4, with only 0.4 of the total park area being managed).

In doing this, we need to consider both the mean and variation of management and null effects. For simplicity, we consider the scenario where the variability of either effect is summarised using a normal distribution, although in practice a user could write customised functions to apply any type of distribution (parametric or non-parametric). If we consider only the sites which have non-zero values and use a randomisation test which incorporates both the size and direction of paired differences, then calculating the net management effect is a relatively simple process (basically calculating the weighted mean):

$$NetEffect = Mean_{Managed} (1\text{-}Noise) + Mean_{Null} \times Noise \quad (1)$$

In this way, when Noise (i.e. proportion of area not managed) is zero the net effect is equivalent to mean management effect. Being able to estimate the expected net effect for any given combination of management effect size and "Noise" provides a check that the simulations on which our power analyses are based are correct. If the mean effect observed in simulations scales predictably with our expected NetEffect, this would indicate the simulations are behaving as expected.

It is easy to rework equation 1 to find the mean management effect required to achieve a net effect of zero:

$$Mean_{ManagedZero} = -Mean_{Null} \times Noise/(1\text{-}Noise) \quad (2)$$

Thus, assuming a null effect of –0.05 (e.g. 5% decline in bellbird populations **between Tier 1 survey periods** (cf. per annum) where no predator control is applied) and Noise of 0.6 (i.e. 60% of area of interest receives no predator control) the mean management effect required for a net effect of zero is:

$$-0.05 \times 0.6 \times/(1\text{-}0.6) = 0.075$$

Thus, for this scenario we would need to increase bellbird populations by 7.5% (on average) between Tier 1 survey periods in areas subject to predator control to maintain the present population level across the entire area of interest. This could be viewed as the "break even" point for management planned over a given proportion of the area of interest.

Tests of significance using quantitative paired differences can be unduly influenced by outliers and ecological metrics can be particularly prone to this. One solution is to consider only the sign of paired differences. In this instance, it is slightly more complicated to calculate the net effect, but an analytical solution is still possible:

$$NetEffect = sgn(-Mean_{Null}) \times [Pdir_{Managed} \times (1\text{-}Noise) + Pdir_{NullNeg} \times Noise] + sgn(Mean_{Null}) \times [(Pdir_{ManagedNeg} \times (1\text{-}Noise) + Pdir_{Null} \times Noise)] \quad (3)$$

Where: $Pdir_{Managed}$ and $Pdir_{Null}$ are, respectively, the probability that the metric will change in the same direction as the mean management or null effect; $Pdir_{ManagedNeg}$ and $Pdir_{NullNeg}$ are, respectively, the probability that the metric will change in the opposite direction to the mean management or null effect. See Box 1 for a worked example:

Box 1: Worked example for net effect calculation when manged effect and null effect have opposite signs

$Mean_{Null}$ = -0.05

Noise = 0.6

$Pdir_{Managed}$ = 0.75

$Pdir_{ManagedNeg}$ = 0.25

$Pdir_{Null}$ = 0.75

$Pdir_{NullNeg}$ = 0.25

NetEffect= $sgn(-Mean_{Null})$ x [$Pdir_{Managed}$ x (1-Noise) + $Pdir_{NullNeg}$ x Noise] + $sgn(Mean_{Null})$ x [($Pdir_{ManagedNeg}$ x (1-Noise) + $Pdir_{Null}$xNoise)]

= sgn(0.05) x [0.75(1-0.6)+0.25x0.6]

+ sgn(-0.05) x [0.75x0.6+0.25x(1-0.6)]

=[0.3+0.15]-[0.375+0.1]

=-0.025

Or a **net decrease** of 2.5% of survey locations.

Where:

$$\operatorname{sgn}(x) := \begin{cases} -1 & \text{if } x < 0, \\ 0 & \text{if } x = 0, \\ 1 & \text{if } x > 0. \end{cases}$$

For indices estimated using data collected on a continuous scale (e.g. total woody biomass), $Pdir_{Null}$ = 1-$Pdir_{NullNeg}$. In this case, it is possible to re-work the net effect equation to find the value of $Pdir_{Managed}$ that gives a net effect of zero for a given null effect:

$$Pdir_{ManagedZero} = [0.5-(1-Pdir_{Null}) \times Noise]/(1-Noise) \quad (4)$$

If all Pdir terms are provided as constants, then it is also possible to find what proportion of the area would need to be managed for a net effect of zero:

$$P_{AreaManagedZero} = 1\text{-}NoiseZero = -([(Pdir_{Managed}-0.5)/(Pdir_{Managed}+Pdir_{Null}-1)-1])$$

Where the probability distribution for management effects is parametric it is then a simple matter to find the mean effect size required for a net effect of Zero from the corresponding probability distribution (e.g. using the R function qnorm for a normal distribution):

$$Mean_{ManagedZero} = qnorm(p = Pdir_{ManagedZero}, mean = 0, sd = SD_{Managed}) \quad (5)$$

Where: $SD_{managed}$ is the standard deviation of management effects. When an analytical solution to finding $Pdir_{ManagedZero}$ is not possible (i.e. $Pdir_{Null} \neq 1\text{-}Pdir_{NullNeg}$) a function minimisation approach is required to find the $Mean_{Managed}$ value that provides a net effect as close to zero as possible (i.e. the value that best satisfies):

$$0 = sgn(-Mean_{Null}) \times [Pdir_{Managed} \times (1\text{-Noise}) + Pdir_{NullNeg} \times Noise] + sgn(Mean_{Null}) \times [(Pdir_{ManagedNeg} \times (1\text{-Noise}) + Pdir_{Null} \times Noise)] \quad (6)$$

This situation arises when ecological indicators expressed on a continuous scale are based on binomial or count data. This is because changes only occur when effects are large enough to produce an increase that can be detected by the sampling design. It is worth noting that when the "Managed" and "Null" Effect probability distributions are known the same approach can be used to find the proportion of area under management (1 - Noise) that most closely approximates a net effect of Zero. Where indices (and effects) are expressed on a continuous scale we can simulate effects in the binomial data on which they are based as follows:

$$X_{it1} = N_{it1}/Nsub_i. \quad (7)$$

$$X_{it1}' = X_{it1} \times (1+\Delta_i) \quad (8)$$

$$N_{it2} = || X_{it1}' \times Nsub_i || \quad (9)$$

$$X_{it2} = 0 \leq N_{it2}/ Nsub_i \leq 1 \quad (10)$$

Where X_{it1} is the occurrence probability in location i at time t1; N_{it1} is the number of occurrences; $Nsub_i$ is the number of subsamples; Δ_i is the effect being added; X_{it1}' is the interim simulated occurrence probability for time t2; N_{it2} is the simulated number of occurrences and X_{it2} is the final simulated occurrence probability. In the power analyses we performed, this applies to indices of ungulate and brushtail possum (*Trichosurus vulpecula*) abundance, where abundance at each sampling location is estimated, respectively as the occurrence probability of ungulate faecal pellets across 120 circular sub plots or the proportion of chew cards showing sign of possum bites across 40 bait stations.

The same process can be applied to count data if N_{it1} is the sum of counts across subsamples. The only difference being:

$$X_{it2} = 0 \leq N_{it2}/ Nsub_i \quad (11)$$

In Tier 1, this applies to bird abundance, which is measured as mean 5-minute bird counts across 5 observation points. When effects are simulated this way the value of all Pdir terms in simulations is decoupled from the probability distribution of management and null effects. We can, nonetheless, use simulations to obtain estimates for each of the Pdir terms for a given management or null effect size. Here we sample effects for each location in the observed data from either the managed or null effect distribution, apply these effects via equations 7–10/11 and then calculate the relevant Pdir terms. An estimate is obtained by taking the mean of each Pdir term across simulations. When estimating

$Mean_{ManagedZero}$ for indices based on binomial or count data, this process needs to be repeated for each iterative step of the function minimisation procedure.

The relative proportion of zero and non-zero values (e.g. occurrence probability of species across the monitoring plot network) may also change between survey periods. Simulating this can be tricky if the potential range of the species in question covers only a portion of the area of interest. If we assume either that the species can occur over all the area of interest, or we restrict our area of interest to the potential range of the species, it is possible to estimate the change in occurrence probability as follows:

$$PoccNew = Pocc \times (Mean_{Managed} \times (1-Noise) + Mean_{Null} \times Noise) \quad (12)$$

Where Pocc and PoccNew are occurrence probability in the first and second survey period respectively. This assumes that the managed and non-managed proportional increase in occurrence probability is the same as that for local abundance. This allows us to incorporate changes in occurrence probability in estimating the "break-even" management effect size (or noise values) by using iterative function minimisation to find the effect size (or noise value) that most closely satisfies the following:

$$0 = Pocc \times (Mean_{Managed} \times (1-Noise) + Mean_{Null} \times Noise) + sgn(-Mean_{Null}) \times [Pdir_{Managed} \times (1-Noise) + Pdir_{NullNeg} \times Noise] + sgn(Mean_{Null}) \times [(Pdir_{ManagedNeg} \times (1-Noise) + Pdir_{Null} \times Noise)] \quad (13)$$

While in theory it would be possible to include separate managed and null effects on Pocc in estimating net effects, this can make it challenging to use a function minimisation approach to find break-even effect sizes (i.e. if we have to fit values for break-even management effects on both Pocc and the direction of change in abundance in occupied sites). This is because fitting two parameters increases the chance of multiple local minima occurring (i.e. multiple almost equally valid combinations of the two parameters). Therefore, if managed and non-managed effects on Pocc are different from those on the direction of local abundance change, this approach is not recommended. However, it is still possible to estimate the proportion of area treated (i.e. 1-Noise) required to achieve a net effect of Zero by using function minimisation to find the Noise value that best satisfies the following:

$$0 = Pocc \times (Mean_{ManagedPocc} \times (1-Noise) + Mean_{NullPocc} \times Noise) + sgn(-Mean_{Null}) \times [Pdir_{Managed} \times (1-Noise) + Pdir_{NullNeg} \times Noise] + sgn(Mean_{Null}) \times [(Pdir_{ManagedNeg} \times (1-Noise) + Pdir_{Null} \times Noise)] \quad (14)$$

Where: $Mean_{ManagedPocc}$ and $Mean_{NullPocc}$ are, respectively, the mean managed and null effects on occurrence probability. Thus, if we have information on manged and null effects on Pocc and the direction of change in abundance, we can estimate the proportion of the area we would need to manage to 'break even' (i.e. achieve a net effect of zero).

The power analysis framework outlined above provides a flexible approach for formally linking conservation planning and monitoring network design. It is robust for:

- indices based on continuous, binomial or count data
- indices that follow any probability distribution (parametric or non-parametric) across Tier 1 locations

- managed and non-managed effects that follow any probability distribution
- scenarios where management can be applied only to a portion of the area of interest (e.g. public conservation land), and there is a non-zero non-treatment effect in unmanaged areas.
- scenarios where both occurrence probability and abundance within sample points could change between surveys.

In this report, we use the above approach to test our power to detect effects in the absence of "Noise" and with a high level of noise (0.6) at different sampling intensities. For simplicity, while incorporating noise we assume the "Null" effect is zero, although we have performed analyses for non-zero null effects for ungulates, possums and birds (examples are provided in supporting material submitted with this report).

4.3 Sampling intervals for measurement of the 8-km grid (for LUCAS)

We explored the effect of sampling interval by comparing the amount of plot-level stem **dynamism** (or turnover) in LUCAS plots for five- and ten-year measurement intervals. To do this we first calculated annualised plot-level vital rates (**mortality** and **recruitment**) following the methods of Kohyama et al. (2018). We then used these annualised rates to estimate **the number of stems** surviving (a), dying (b) and being recruited (c) for 5- and 10-year measurement intervals. Using these values, we express dynamism in each LUCAS plot for either interval length following the Jaccard dissimilarity index (Jaccard 1912):

$$D = 1-a/(a+b+c) = (b+c)/(a+b+c) \quad (15)$$

We also explored a novel index of **relative recruitment** (or proportional population change) for five- and 10- year survey intervals:

$$RR = (c–b)/(a+b+c) \quad (16)$$

With values of RR **< 0 indicat ng 'population"' decline** and values **>0 indicating 'population' increase** within plots. We also used this index to examine the effect of interval length on the amount of national population change for individual species. To do this we calculated annual mortality and recruitment rates for each species in each plot where it occurred. We then used these annual rates to estimate relative recruitment for five- and ten-year measurement intervals. National population change for each species was then estimated by taking the mean of relative recruitment values across plots (weighted by the number of stems of that species in each plot, i.e. a + b + c)

4.4 Sampling intensity for animal abundance in Tier 1

We conducted power analyses to test the ability of the Tier 1 network to detect changes in ungulate pellet counts between years within a survey period (See 4.4.1 Two-Sample Unpaired). We also tested for significant differences between individual years for ungulates and individual bird species. Finally, we conducted power analyses to test our ability to detect changes between survey periods for ungulates, possums and individual bird species (See 4.4.2 Two-sample paired). Different approaches were adopted in power

analyses and significance testing for unpaired and paired sampling designs. A schematic outline of both approaches is provided in Figure 1 above.

4.4.1 Two-sample unpaired differences

Significance test

This is founded on a non-parametric test for **significantly lower overlap** than expected by chance between two **probability density functions** (PDs) defined by **kernel density estimators** (KDEs). KDEs essentially define a distribution around individual data points, with this distribution being defined by kernel function the "**bandwidth**", which itself is proportional to the standard deviation (or an alternative measure of variation) of the observed dataset. The overall PD function is constructed by summing the kernel distributions for each data point. The standard deviation is the only parameter required in using KDEs to estimate PD functions. This approach is especially useful for datasets that are difficult to describe using parametric PD functions (e.g. ungulate faecal pellet local frequency), or for analyses across a large number of datasets which may have vastly different distribution types. This greatly increases accessibility to non-expert users who may have difficulty testing the goodness of fit provided by different parametric distribution types. It also has the advantage of not requiring any data transformations (e.g. adding some arbitrarily small amount to zero values to permit modelling as log-normal distributions). The main disadvantage is that KDE-based significance tests may be slightly conservative (lower Type 1 error, higher type 2 error) compared with parametric approaches (at least for datasets where parametric assumptions are satisfied). The KDE approach to defining PDs has been in use for decades and is commonly used in functional ecology to describe species niches, which are often poorly summarised by parametric PD functions (Mouillot et al. 2005; Mason et al. 2008; Vergnon et al. 2009; Carmona et al. 2016).

For this project, we custom-built a series of R-functions which call the *density()* function to generate KDE-based PDs and the *integrate.xy()* from package "sfsmisc" to calculate overlap between two PDs. Expected overlap values are estimated by free random assignment of observations to either sample, with the number of observations per dataset being kept the same as in the observed data. *P*-values are recorded as the proportion of randomisations giving an overlap value equal to or lower than that between the observed datasets. The significance test is implemented using the custom-built function:

KernelOverlapSigTest (min,max,Nrand,Data1,Data2,BandWidth)

Where: min and max define the lower and upper boundaries of KDE-based PDs; Nrand is the number of randomisations; Data1 and Data2 are the observed datasets being compared. These arguments are all provided to the function by the user. This function and the other custom-built functions it calls are fully documented (with comments) in the supplementary files KernelOverlap.r and UnpairedOverlapSig.r. We apply this function in testing for significant difference in **faecal pellet local frequency** and **mean bird counts** between individual measurement years**.**

A weighted option is also provided by the custom-built function:

KernelOverlapSigTestWeighted(min,max,Nrand,Data1,Data2,Weight1,Weight2,Band Width)

Where: Weight1 and Weight2 are weights for each observation in the dataset. In randomisations, the weights are always kept with the same data values as in the observed data.

KDE-based PDs require two key decisions – which type of bandwidth estimation method and which type of kernel function. We explored all possible combinations of bandwidth estimation methods and kernel functions supported by the *density()* R function. In general, almost all kernel functions produced similar PDs, but PDs from different bandwidth estimation methods varied markedly. Amongst different bandwidth estimation methods the Sheather and Jones (1991) 'direct plug-in' method (termed sj-dpi in the *density()* function) provided a good compromise between over-fitting to individual data points and over-smoothing. Based on these tests, we recommend using a combination of a Gaussian kernel and Sheather and Jones direct plug-in bandwidth (where the sample size permits this – when this is not possible, we suggest using Scott's (2015) rule of thumb, termed nrd in the *density()* R function). These analyses are documented in the supplementary file PelletYearSigTestKernelBWTest.r and results are presented in the file PelletYearsKernelsBandWidths.pdf. In the future, it would be possible to provide a function that automatically selects the combination of bandwidth estimation method and kernel function that best suits the data.

Power analyses

These are performed on pellet data using the custom-built function:

PelletPowerUnpaired(LocalFreq, EffectSize,SampleSize,Nperm)

Where: LocalFreq is the local frequency of pellets in each Tier 1 location and $0 \leq LocalFreq \leq 1$; EffectSize is the effect size to be tested in power analyses (must be >-1 and <1); Sample size is the number of observations in per simulated dataset and Nperm is the number of simulated datasets to be generated.

We designed our power analyses to cope with zero-inflated datasets. To this end we treat zeros and non-zero values differently. First, we calculate the **proportion of zero values** in the observed data (i.e. LocalFreq) termed **Pzero1**. Then we place non-zero values in a separate dataset called **NonZero1.** Next, we generate a second dataset incorporating the user-defined effect size as follows:

$$Pzero2 = Pzero1 + (1-Pzero1)*EffectSize \quad (17)$$

$$NonZero2 = NonZero1 + EffectSize*NonZero1 \quad (18)$$

Where: $0 \leq Pzero2 \leq 1$; $0 \leq NonZero2 \leq 1$. Then we generate a **KDE-based PDs including only the non-zero values** for both datasets (**Kdense1** and **Kdense2**).

For each simulated data set we use Pzero values to simulate the number of zeros as follows:

RandProb = runif(n= SampleSize, min = 0, max = 1) (19a)

Nzeros = length(RandProb[RandProb<=Pzero]) (19b)

Where: runif and length are standard R functions. Then we generate non-zero values by sampling from the KDE-based PDs:

PermSample = sample((NonZero), size = SampleSize-Nzeros,replace = T) (20a)

PermSampleb = sample(PermSample+rnorm(n=length(PermSample),sd = Kdense$bw)) (20b)

Where: Kdense$bw is the band-width of density distribution Kdense. Finally we, combine the Zeros and non-Zeros to form two datasets for significance testing using function *KernelOverlapSigTest()* described above. The process is repeated Nperm times. Implementation of overlap-based significance tests is fully documented in "KernelOverlap.R" and "UnpairedOverlapSig.r".

The *PelletPowerUnpaired()* function returns a vector containing

Effect size, sample size, mean observed and expected overlap and p-values (taken across simulated datasets) and the proportion of simulated datasets giving a significant result ($p < \alpha$). Power tests were conducted for the following **effect sizes** –0.5, –0.3, –0.2, –0.1, –0.05, 0, 0.05, 0.1, 0.2, 0.3, 0.5) and **sample sizes** (50, 100, 200, 500, 700). Implementation of these power tests is fully documented in file "PelletPowerUnpairedOverlap.R". Results for these power analyses are not presented in this report, but are available in the file "PelletPowerUnpairedOverlap.pdf". Results for zero effect size were summarised to estimate Type 1 errors (i.e. the probability of falsely rejecting the null hypothesis) when using a Gaussian kernel and either "nrd" or "sj-dpi" options for bandwidth in function *density()*. These results are available in files "_UnpairedPowerType1_gaussian_nrd_.csv" and _"UnpairedPowerType1_gaussian_SJ-dpi_.csv", respectively.

Weighted unpaired power tests were also conducted with effect size of 0 (for Type 1 error assessment). These analyses are documented in "PowerOverlapWeighted.r".

4.4.2 Two-sample paired differences

Significance test

This is founded on a new non-parametric test statistic:

PairedDiff = [N(t2>t1)-N(t1>t2)]/Npairs (21)

Where: N(t2>t1) is the number of pairs where sample 2 is greater than sample 1; Npairs is the total number of pairs. The advantage of this test is that, by only documenting the direction of shifts between samples (but within pairs) it provides equal power to detect increases or decreases even in datasets where values are constrained by fixed upper and/or lower values. For monitoring data, the lower bound is generally zero, and many

monitoring datasets exhibit extremely right-skewed distributions (many small, few large values). This results in test statistics incorporating both the size and direction of shifts within pairs having lower power to detect decreases than increases.

We used randomisation tests to test whether observed values of "PairedDiff" differ significantly from those expected by chance. The randomisation simply randomly allocates data between samples but within pairs.

The significance test is implemented by the custom-built function:

TwoSamplePairedSig (Nrand,Sample1,Sample2, DoPlot)

Where Sample1 and Sample2 are paired observations (e.g. repeated measures of plots or paired plots subjected to different experimental treatments); DoPlot allows the user to choose whether or not to plot paired differences between samples. This function returns the observed and expected (mean across randomisations) values of "PairedDiff" and the proportion of randomisations (p) giving values ≤ or ≥ the observed. Significance is assessed by doubling the smaller of the two p-values to obtain a two-tailed test.

A weighted option is also provided by function *TwoSamplePairedSigWeighted()*. Here the test statistic is modified to incorporate weights for paired observations:

PairedDiffWeighted = [N(t2>t1)*W(t2>t1)-N(t1>t2)*W(t1>t2)]/Npairs (22)

Where: W(t2>t1) is the summed weight of pairs where the value in sample 2 is greater than sample 1 and the sum of weights across all pairs = 1.

Power analyses

Power analyses for paired (or repeated measures) sample designs were performed for **faecal pellet**, **possum** and **bird count** data using function:

PowerPairedNullEffectBinomial (LocalFreq, NullEffectSize, SDNullEffectSize, EffectSize, SDEffectSize, SampleSize, Nperm, Noise, Max, NsubSamples, NetEffect)

Where: *SDEffectSize* is the user-defined standard deviation of effect size (reflecting uncertainty around the mean effect size); *Noise* is a user-defined parameter determining the proportion of plots experiencing the effect (e.g. if *Noise* = 0.1, 90% of plots are assumed to experience the effect); *Max* is the user-defined upper bound for observed values. A lower bound of Zero is assumed, since monitoring data are generally non-negative.

This function implements steps 1–4a of *PelletPowerUnpaired()*, with several key differences. Firstly, the number of occurrences in the second sample is dependent on both Nzeros1 and *Noise*:

NetEffectOcc = EffectSize*(1-Noise) + NullEffectSize*Noise (23)

Nzeros2 = Nzeros1*

(1-sign(NetEffectOcc)*

length(RandProb2[RandProb2<=abs(NetEffectOcc)*Pocc1/Pzero1])/length (RandProb2)),digits=0) (24)

Thus, for negative effect sizes, the Nzeros2 will usually be greater than Nzeros1, and vice versa. The next major difference is in applying effects to non-zero values. First, we simulate the number of plots with non-zero values (in both survey periods) that experience the effect:

NonZeroProbs = runif(n= SampleSize-max(Nzeros1,Nzeros2), min = 0, max = 1)
Naffected = length(NonZeroProbs[NonZeroProbs>Noise]) (25)

For these plots, we then randomly sample effect sizes from the management effect probability distribution, and then apply these effects via equations 7–10/11 (depending on whether we are dealing with binomial or count data). This is performed by function:

AddBinomialEffect (DataIn,NsubSamples,EffectSize,SDEffectSize)

For pairs where no effect is experienced, a random shift with mean of NullEffectSize is applied to data in sample 1:

AddBinomialEffect (DataIn,NsubSamples,NullEffectSize,SDNullEffectSize)

When pairs shift from zero to non-zero values (i.e. Nzeros1>Nzeros2), values for the second sample are simulated as in 4a above by sampling from non-zero values in the second sample:

PermSample = sample((NonZero2), size = Nzeros1– Nzeros2, replace = T) (26)

The *PowerPairedNullEffectBinomial ()* function returns the same vector as *PelletPowerUnpaired()*, with the differences being:

- that significance is defined as $p < \alpha/2$ to reflect the fact that this is a two-tailed test.
- noise level and the median and 95% confidence intervals for observed values of the test statistic (obtained by bootstrap sampling across simulated datasets) are returned.

Implementation of this approach is fully documented (with comments) in file PowerPairedReportVersionFinal.r".

For **possum**, **faecal pellet** and **bird** data, paired power analyses were conducted for the following **effect sizes** –0.2, –0.15, –0.1, –0.05, –0.025, –0.01, 0, 0.01, 0.025, 0.05, 0.1, 0.15, 0.2), **sample sizes** (50, 100, 200, 300, 500, 750, 1000, 1300, 2000), and **noise levels** (0.00, 0.60).

In this study, all animal indicators were assumed to have *SDEffectSize* of 0.05 (or effect measurement error of 5%), as we do not yet have an agreed system for generating uncertainty around management effects for animal abundance and occurrence. Results for

zero effect size were summarised to estimate Type 1 errors (i.e. the probability of falsely rejecting the null hypothesis) for each dataset where paired power analyses were applied.

We also conducted power analyses for different subsets of the Tier 1 plot network. For each subset, we assessed power to detect change based on existing sampling intensity and double existing sampling intensity (i.e. for twice as many plots) for ungulates, possums and birds with at least 2 occurrences and occurring in at least 5% of the plots within the subset. In this report, we present results for the following combinations of indicators and plot subsets:

1 Ungulate pellet frequency in **North Island Forest Parks**

2 Individual bird species counts in a large and a small national park – South Island robin (*Petroica australis*) and kākā (*Nestor meridionalis*) in **Kahurangi National Park** (4,529 km^2) and rifleman (*Acanthisitta chloris*) and kea (*Nestor notabilis*) in **Arthur's Pass National Park** (1,144 km^2).

5 Results

5.1 Demographic change in tree species

5.1.1 Plot-level dynamism for all tree species combined

The mean **amount** of plot-level dynamism was estimated at 22% for a five-year return time and 34.5% for a 10-year cycle (based on annualised mortality and recruitment estimates in remeasured LUCAS plots, Fig. 3a). In plain terms, this means that over a 10-year period we can expect that almost 35% of all stems will either die or be recruited into the measured stem population. Recruitment rates were 11% over 5 years and 18% over 10 years, while corresponding rates of mortality were 10% and 17%, respectively (Fig. 3b,c). There was a slight excess in recruitment (relative recruitment of 0.7% over 5 years and 0.9% over 10 years; Figure 3d). There is a non-linear relationship between 5-year and 10-year values for tree dynamism, recruitment, mortality and relative recruitment. There was no apparent relationship between stem densities in plots and recruitment and mortality rates, i.e. no concentration of high mortality rates in dense, self-thinning tree stands (cf. Peltzer et al. 2014).

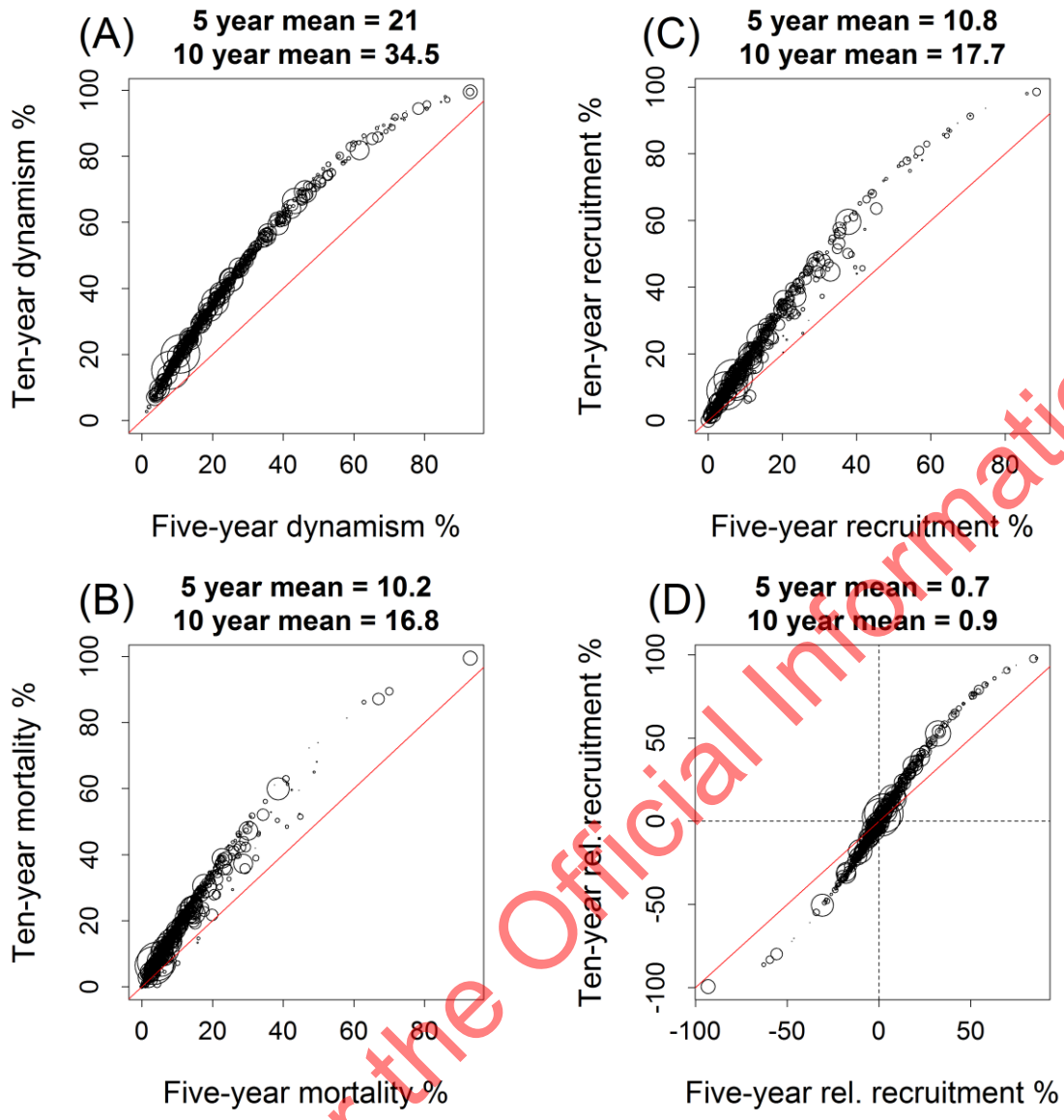


Figure 3: Effect of changing from a 5- to 10-year measurement return time on the amount of plot-level stem dynamism (A), recruitment (B), mortality (C), and relative recruitment (D). Red lines indicate a y=x curve. All estimates were based on annualised mortality and recruitment rates for each plot (see section 4.3 for details). Each circle represents a separate plot, with the size of the circle being proportional to the relative abundance of stems per plot. The means presented in sub-figure titles are weighted by these abundances.

5.1.2 Individual tree species

We estimated change in tree species populations based on mean relative recruitment rates across LUCAS plots calculated annually, and for both 5- and 10-year intervals. Means were weighted by the number of stems of the target species in each plot. Figure 4 shows the median and 90% confidence interval estimates of mean relative recruitment from 1000 bootstrapped samples of plots where the target species was present.

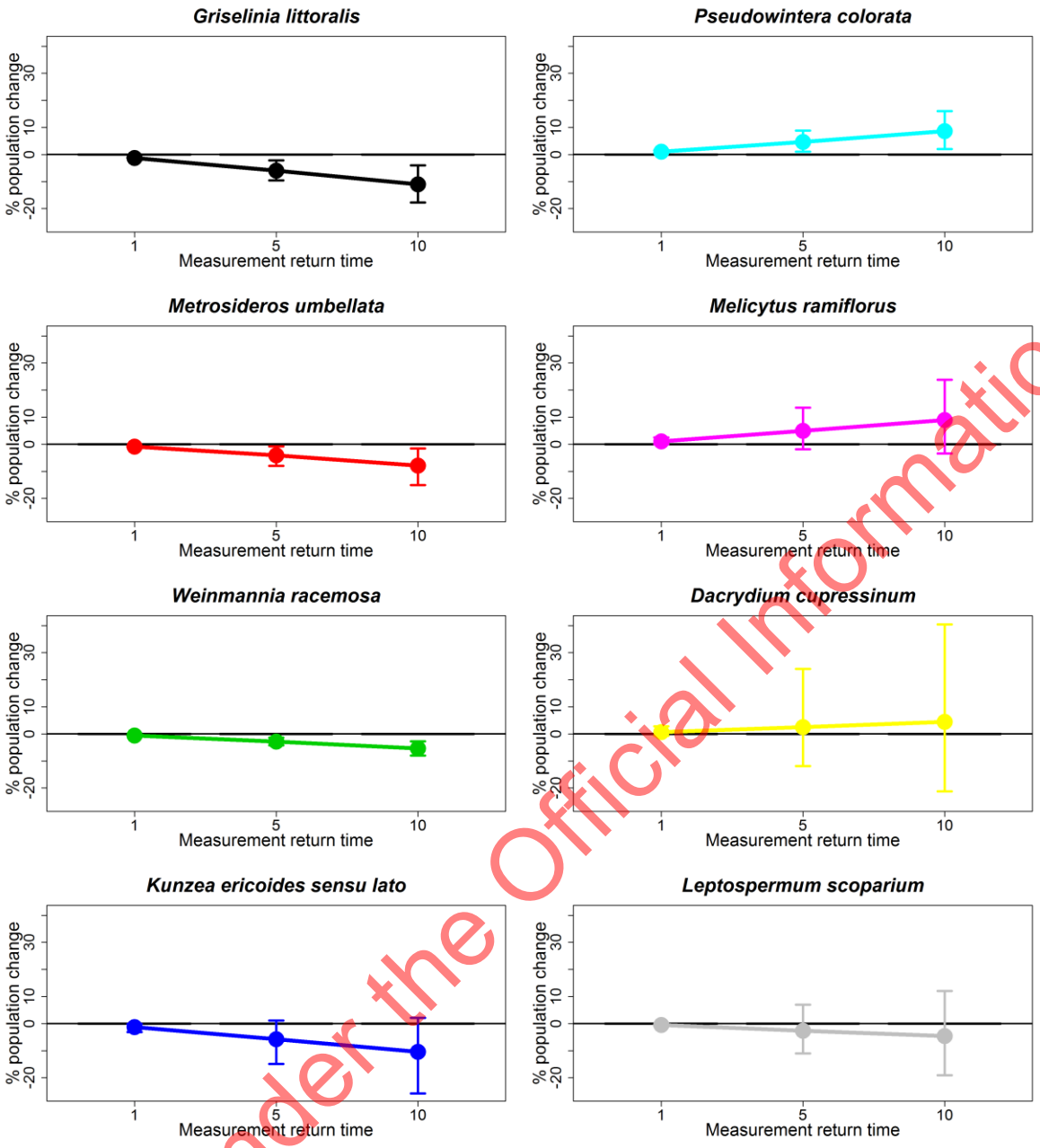


Figure 4: Effect of changing from a five- to ten-year measurement return time on changes in tree species populations. All estimates were based on annual mortality and recruitment rates for each species in each plot where it occurred. Population change was estimated as the weighted mean of relative recruitment taken across plots (see section 4.3 for details).

There was strong evidence for population decline in three widespread canopy tree species, i.e., *Griselinia littoralis*, *Weinmannia racemosa* and *Metrosideros umbellata*. If we converted to a 10-year measurement return time, then considerable declines in these species may have occurred before we have a change to detect them (e.g. 17% for *G. littoralis*, which is browsed preferentially by ungulates). In contrast, there is evidence of population increases of *Pseudowintera colorata* and *Melicytus ramiflorus* (the latter also browsed preferentially by ungulates). Also, there some evidence, although not statistically significant at a 5-year measurement interval, for a population decline of one species that often dominates during early stages of succession after disturbance (*Kunzea ericoides* s.l.),

but not of another (*Leptospermum scoparium*). This might indicate that *K. ericoides* is being replaced by other species where it is most common, whereas *L. scoparium* is not. In the case of *K. ericoides*, apparent population changes may also reflect the adoption – not necessarily uniformly by all field teams – of a new taxonomic treatment of *Kunzea* in New Zealand (de Lange 2014) in the most recent survey period, which recognises seven new taxa on the main islands of New Zealand, with *K. ericoides* s.s. confined to the northern South Island. Further critical evaluation of the data would be needed to determine whether the apparent decline of *K. ericoides* s.l. populations could be an artefact of adoption of the new taxonomic treatment.

Another consequence of changing to a 10-year return time is that the precision of our estimates for population change decreases markedly (i.e. the 90% confidence interval becomes much wider), especially for species that occur sparsely across plots (*K. ericoides* and *L. scoparium*), or are often sparse in the plots in which they occur (*Dacrydium cupressinum*). If novel pathogens such as myrtle rust (*Austropuccinia psidii*, first detected in New Zealand in 2017) or rapid ʻōhiʻa death (*Ceratocystis fimbriata*, widespread on the Island of Hawaiʻi but not yet detected in New Zealand) induce rapid changes in demography (reduced recruitment rates or enhanced mortality rates), then the capacity to detect their effects (on dominant species such as *M. umbellata* and potentially *K. ericoides* and *L. scoparium* in the case of myrtle rust) could be severely compromised if measurement intervals of plots were spread over a decade rather than two 5-year censuses. In the case of *K. ericoides* and *L. scoparium*, this could have economic consequences for DOC (i.e. links to the honey industry and concessions on public conservation land).

5.2 Sampling intensity for animal indicators in Tier 1

5.2.1 Changes in ungulate populations nationally

The power to detect either increases or decreases in ungulate populations nationally is almost identical (compare Fig. 5a with 5c, and Fig. 5b with 5d). The current sampling intensity in Tier 1 (>1000 sample points) is sufficient to detect a 1% change in pellet frequency (with power of ≥0.9, or at least a 90% chance of obtaining a significant result) if we assume either even management across all public conservation or no environmental variability (i.e. Noise = 0; Figs 5a,b). However, current sampling intensity can only detect a ≥2.5% change when Noise is 0.6 (i.e. where only 40% of public conservation land is managed, or analyses incorporate a likely level of environmental variability; Figs 5c,d).

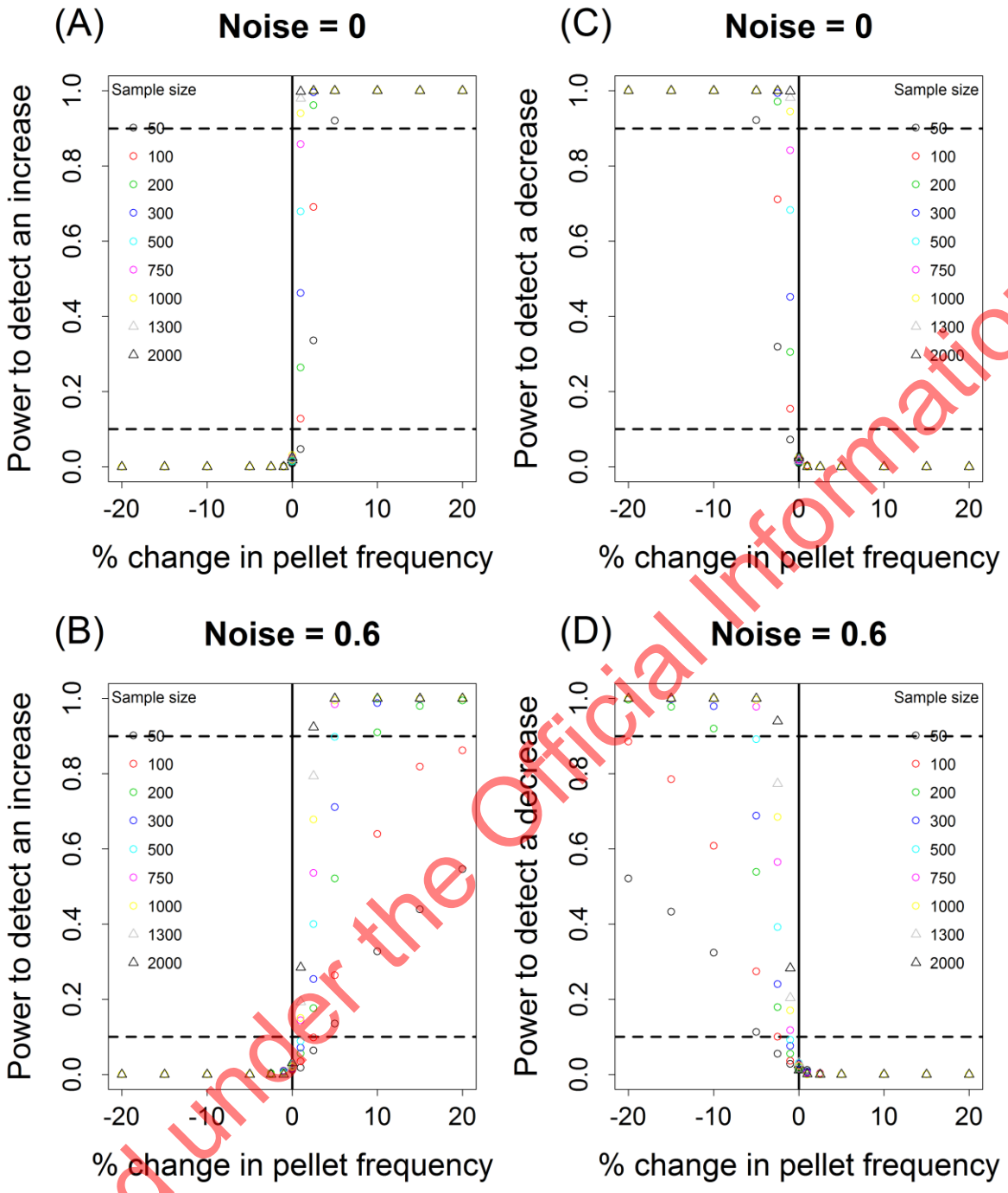


Figure 5 Power to detect an increase (A, C) or decrease (B, D) in ungulate pellet frequency at two different noise levels. Noise indicates the likelihood of an individual plot experiencing the specified effect size (± measurement error). For noise = 0, there is no variability attending each data point (e.g. management effort is uniform across all points – either all sites are managed or all sites are unmanaged). For noise = 0.6, each plot has a 40% chance of experiencing the effect (i.e. 40% of sample points are managed). The horizontal dashed lines indicate power to detect change of 0.1 and 0.9 (or 10% and 90% confidence of detecting a change).

Ungulate pellet frequency from a different random set of sample points over four successive years, showed frequencies in 2016 and 2017 were significantly greater than those in 2014, and those in 2017 also exceed those in 2015 (Fig. 6a). The proportion of

sample points with zero pellet frequency was substantially less in 2016 and 2017 than in 2014 (Fig. 6b). If measurement frequency of sample points for ungulates were taken over a decade interval rather than by two 5-year censuses, then the confidence limits about the sample points in Figure 6a would be much larger, and our power to detect change much lower (since ~half the number of plots would be measured within a single year), with the result that there would be no significant differences among years. Repeated measures will give greater confidence, but there is strong evidence already, from the current sampling intensity, of an increase in ungulate pellet frequency nationally.

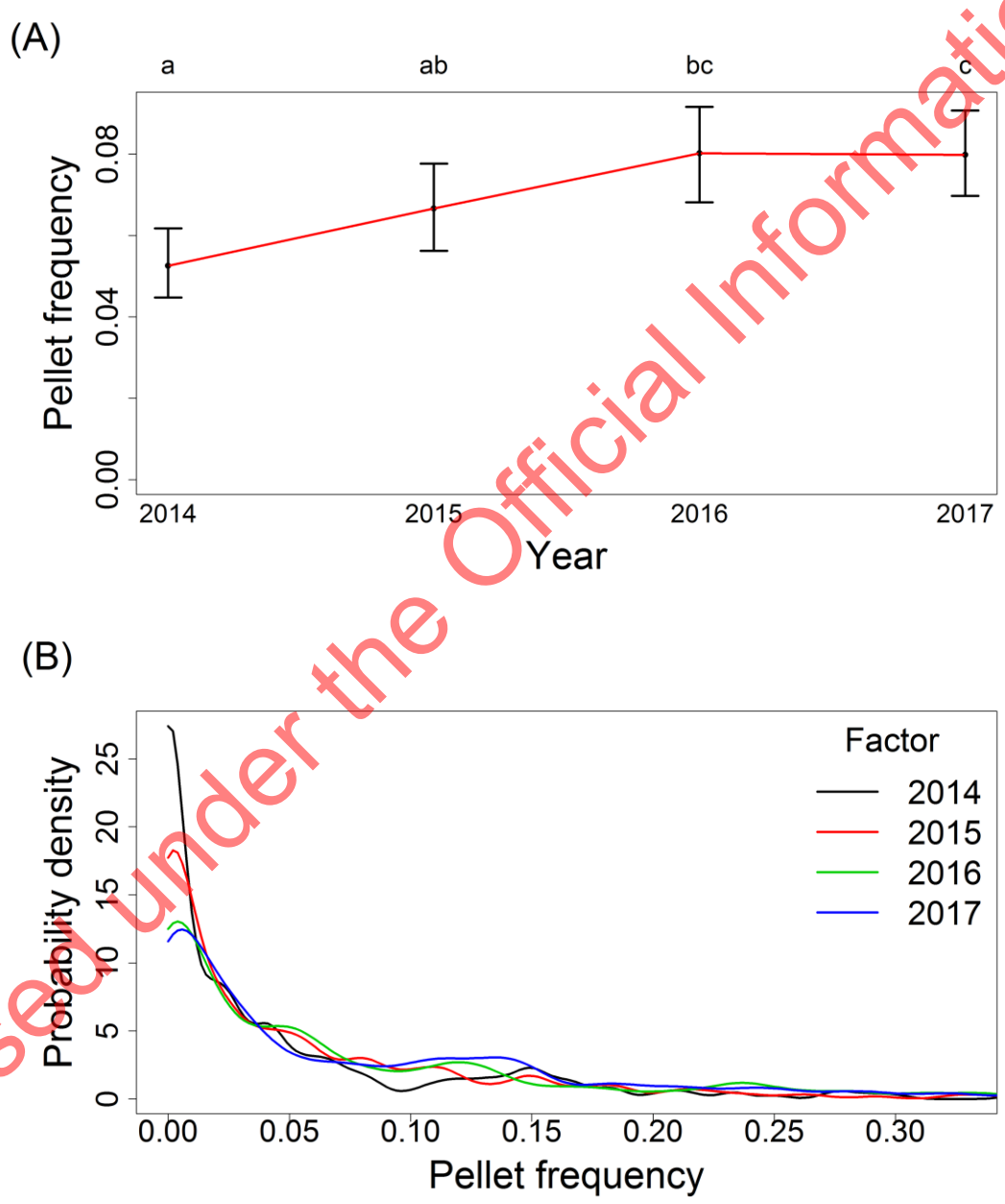


Figure 6: Changes in ungulate pellet frequency determined from the random annual sample points within the first 5-year measurement interval. (A) mean and 95% confidence intervals for each of 4 years' sampling; different letters denote non-overlap of confidence limits with those of other years (B) differences in pellet frequency in plots sampled in each year. Different letters denote significantly less overlap between years than expected by chance ($p < 0.05$).

5.2.2 Changes in possum populations nationally

As with ungulates, the power to detect either increases or decreases in possum frequency populations nationally is almost identical (compare Fig. 7a with 7c, and Fig. 7b with 7d). Again, as with ungulates, the current sampling intensity in Tier 1 (>1000 sample points) is sufficient to detect a 1% change in the frequency of possum occurrence if we assume either even management across all public conservation or no environmental variability (Fig. 7a,b), and is sufficient to detect a ≥2.5% change when Noise is 0.6 (i.e. where only 40% of public conservation land is managed, or analyses incorporate a likely level of environmental variability; Fig. 7c,d).

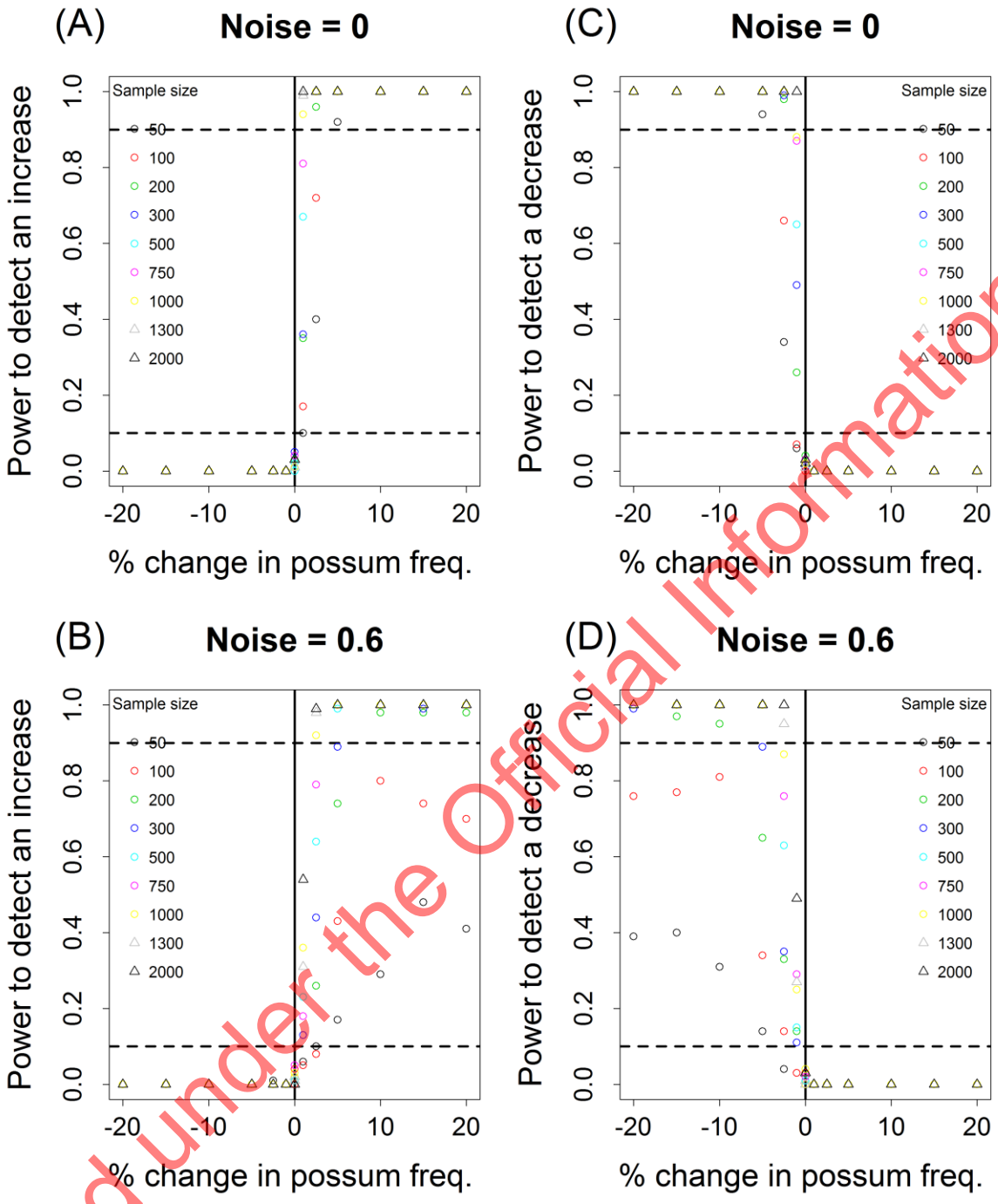


Figure 7: Power to detect an increase (A, C) or decrease (B, D) in possum frequency (based on combined trap-catch and chew-card data over 2011–2016) at two different noise levels. Noise indicates the likelihood of an individual plot experiencing the specified effect size (± measurement error). For noise = 0, there is no variability attending each data point (e.g. management effort is uniform across all points – either all sites are managed or all sites are unmanaged). For noise = 0.6, each plot has a 40% chance of experiencing the effect (e.g. 40% of sample points are managed).

5.2.3 Changes in ungulate populations in North Island Forest Parks

The current sampling intensity of 66 Tier 1 sample points within North Island Forest Parks is sufficient to detect a ≥5% increase or decrease in pellet frequency if we assume either even management across all public conservation or no environmental variability (i.e. Noise = 0; Fig. 8a,b). Doubling the current sampling intensity to 132 sample points within North Island Forest Parks would be sufficient to detect a ≥2.5% increase or decrease at Noise = 0 (Fig. 8a,b). However, when Noise is 0.6 (i.e. where only 40% of the area within North Island Forest Parks is managed, or where analyses incorporate a likely level of environmental variability), then current sampling intensity is sufficient to detect only a ≥15% increase or decrease in pellet frequency, and doubling the current sampling intensity would be sufficient to detect only a ≥10% increase or decrease in pellet frequency (Fig. 8c,d).

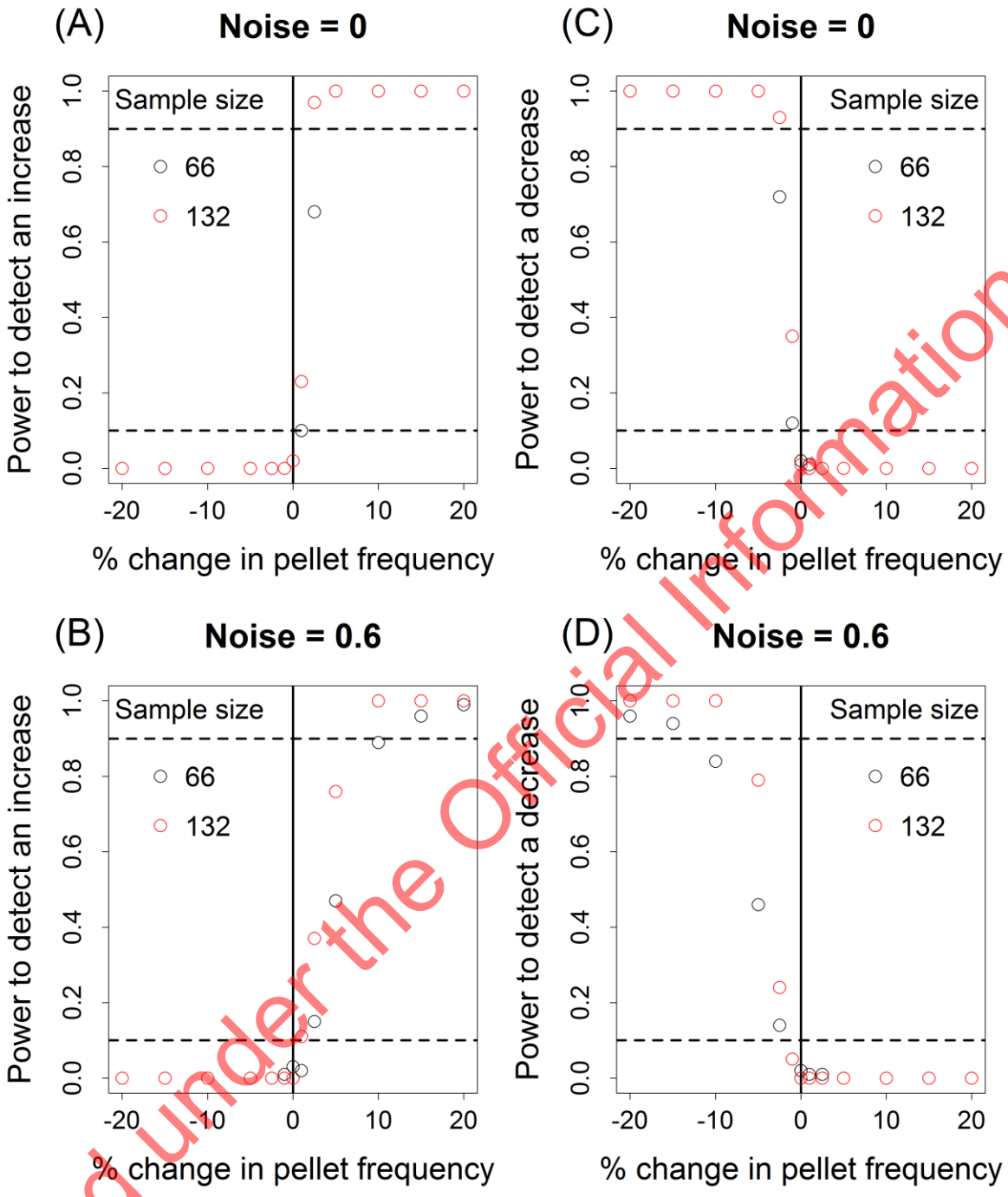


Figure 8: Power to detect an increase (A, C) or decrease (B, D) in ungulate pellet frequency within North Island Forest Parks at two different noise levels. Noise indicates the likelihood of an individual plot experiencing the specified effect size (± measurement error). For noise = 0, there is no variability attending each data point (e.g. management effort is uniform across all points – either all sites are managed or all sites are unmanaged). For noise = 0.6, each plot has a 40% chance of experiencing the effect (e.g. 40% of sample points are managed).

5.2.4 Changes in possum abundance in North Island Forest Parks

The current sampling intensity of 66 Tier 1 sample points within North Island Forest Parks can only detect a ≥10% increase or decrease in the frequency of possum occurrence if we assume either even management across all public conservation land or no environmental variability (i.e. Noise = 0; Fig. 9a,b). Doubling the current sampling intensity to 132 sample points within North Island Forest Parks would be sufficient to detect a ≥5% increase or decrease at Noise = 0 (Fig. 9a,b). However, when Noise is 0.6, the current sampling intensity can only detect a ≥20% increase or decrease in possum frequency, but doubling the current sampling intensity would be sufficient to detect a ≥10% increase or decrease in pellet frequency (Fig. 9c,d).

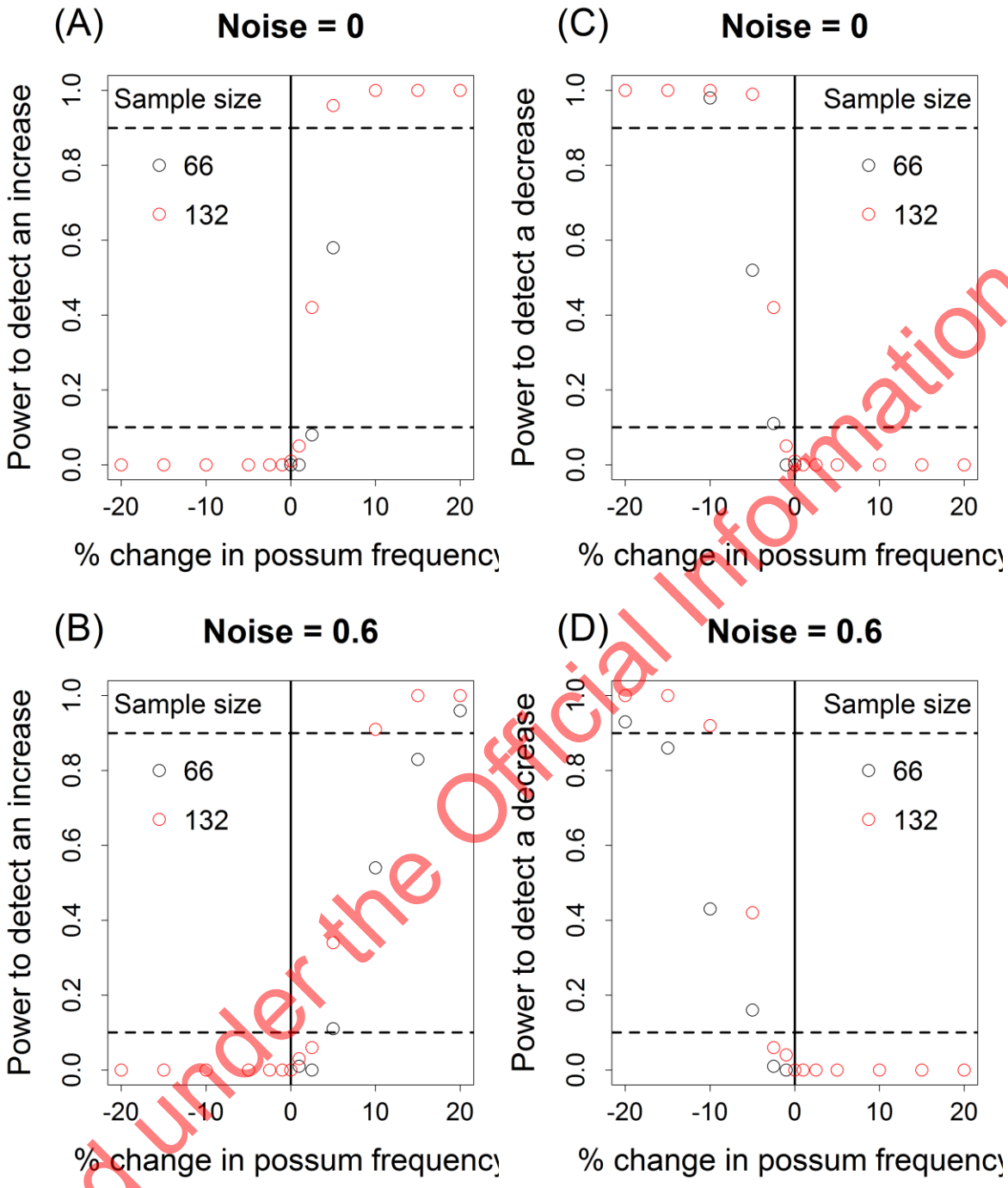


Figure 9: Power to detect an increase (A, C) or decrease (B, D) in possum frequency (based on combined trap-catch and chew-card data over 2011–2016) within North Island Forest Parks at two different noise levels. Noise indicates the likelihood of an individual plot experiencing the specified effect size (± measurement error). For noise = 0, there is no variability attending each data point (e.g. management effort is uniform across all points – either all sites are managed or all sites are unmanaged). For noise = 0.6, each plot has a 40% chance of experiencing the effect (e.g. 40% of sample points are managed).

5.2.5 Bird counts

National scale – general indication of power for different sample sizes

The power to detect either increases or decreases in counts of widespread birds nationally is almost identical (compare Fig. 10a with 10b, and Fig. 10c with 10d). A sampling intensity in Tier 1 of only 500 sample points is sufficient to detect a 5% change between Tier 1 survey periods in mean counts of bellbird – a widespread, common species – when noise = 0.6 (e.g. where only 40% of public conservation land is managed, or analyses incorporate a likely level of environmental variability; Fig. 10a,b). However, 2000 plots are required to detect an increase or decrease in mean counts of <2.5%. For kea – which are present only in the South Island, and then patchily – the current Tier 1 sampling intensity is sufficient to detect a 10% change when noise = 0.6. Even 3,000 plots nationally would have insufficient power to detect an increase or decrease of 5% in kea frequency.

Mean counts of bellbirds from Tier 1 locations surveyed in different years (analysed using the two-sample unpaired overlap significance test) showed no evidence of a trend, although counts in 2015 were significantly greater than those in 2016 and 2017 (Fig. 11a). In contrast, there is clear evidence of a decline in mean counts of kea, with counts in 2016 and 2017 significantly lower than those in 2014 and 2015; indeed, those from sample points in 2017 were 60% lower than those from different sample points in 2014 (Fig. 11b). Repeated measurements will enhance confidence in this trend, but such a rapid decline in counts over four years is a clear early warning signal that could prompt management intervention to boost kea counts. Halving the sampling intensity (i.e. doubling the confidence limits) would mean there would not be statistical confidence in reporting this trend.

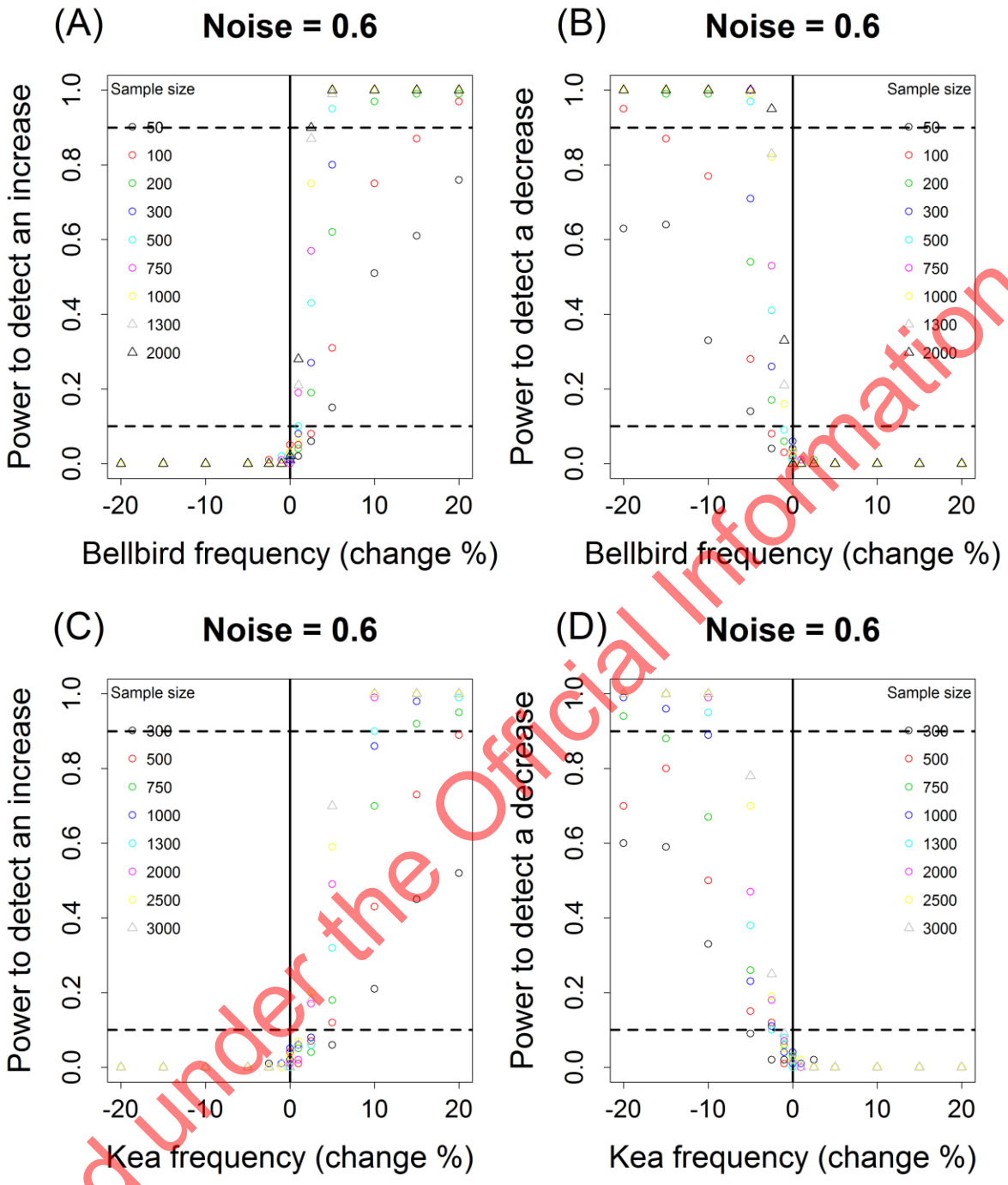


Figure 10: Power to detect an increase or decrease in mean bellbird (A, B) and kea with high noise levels (0.6). Noise indicates the likelihood of an individual plot experiencing the specified effect size (± measurement error). For noise = 0.6, each plot has a 40% chance of experiencing the effect.

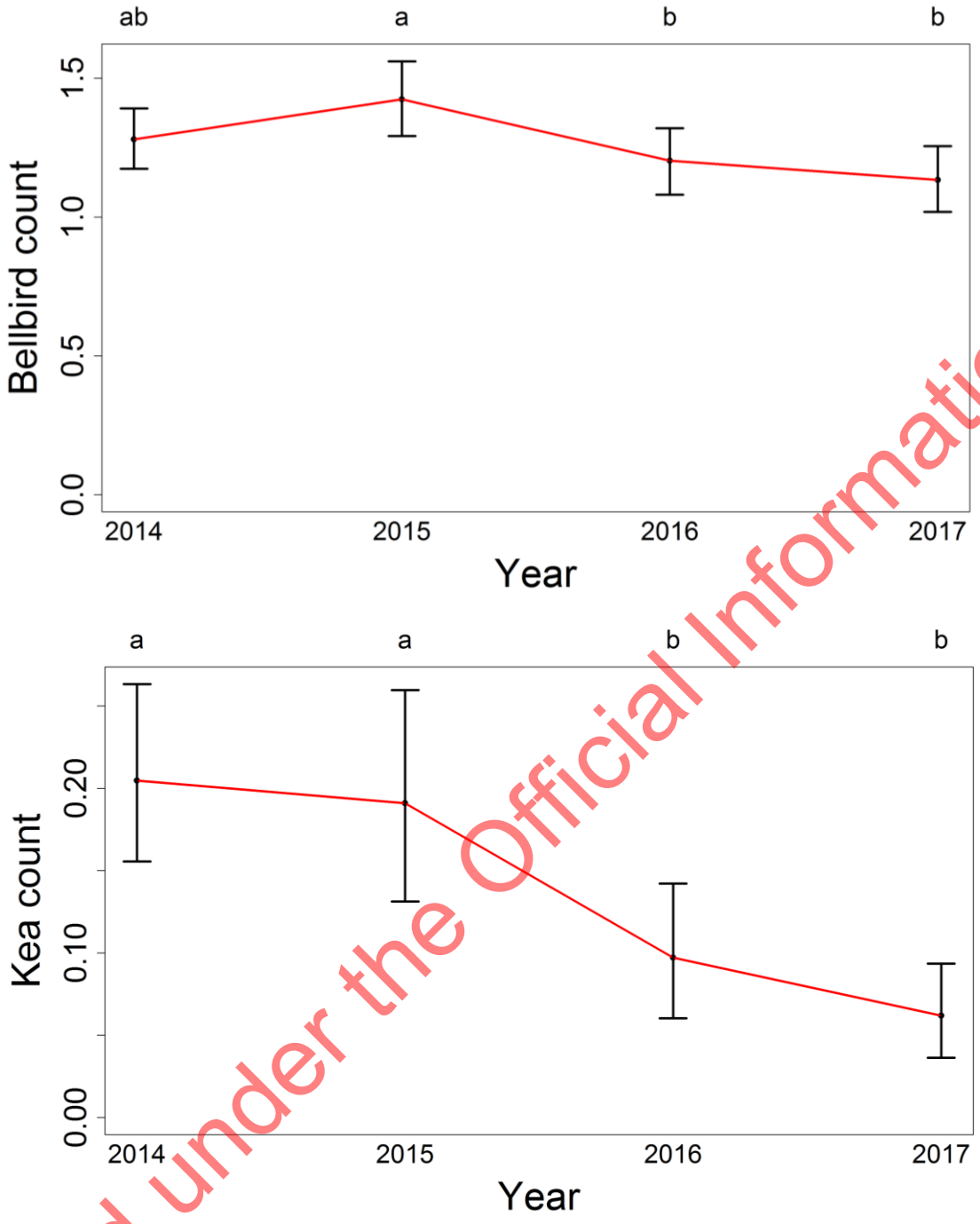


Figure 11: Changes in counts of bellbird and kea determined from the random annual sample points within the first 5-year measurement interval, depicting mean and 95% confidence intervals for each of 4 years' sampling; different letters denote significantly less overlap between years than expected by chance ($p < 0.05$).

Individual conservation areas

In a large National Park (Kahurangi), the current sampling intensity (50 sampling points) is sufficient to detect a ≥5% increase in counts of South Island robins when noise = 0 (i.e. subject to uniform management across the whole National Park, or assuming no environmental variability across sample points; Fig. 12a). However, when noise = 0.6, 50 sampling points in the National Park gives sufficient power to detect only a ≥15%

increase, and doubling sampling (100 sample points) enables detection of only a ≥10% increase (Fig. 12b).

For kākā, a more patchily distributed bird than South Island robin in Kahurangi National Park, 50 sampling points in the National Park gives sufficient power to detect a ≥10% increase in counts when noise = 0 (Fig. 12c) and a ≥15% increase when noise = 0.6 (Fig. 12d). Doubling the current sampling intensity to 100 sample points allows detection of a ≥10% increase in kākā counts when noise = 0.6 (Fig. 12d).

In Arthur's Pass, a small National Park, the current sampling intensity (15 sampling points) is only sufficient to detect a ≥15% increase in rifleman counts when noise = 0, and in this scenario, doubling the sampling intensity (30 sample points) enables detection of a 10% increase (Fig. 13a). However, when noise = 0.6, neither the current sampling intensity nor double it is sufficient to detect any increase under 20% (Fig. 13b).

For kea, a more patchily distributed bird than rifleman in Arthur's Pass National Park, the current sampling intensity is inadequate to detect any increase in kea <20% when noise = 0, and in this scenario, doubling the sampling intensity allows detection of a ≥15% increase (Fig. 13c). However, when noise = 0.6, neither the current sampling intensity nor double it is sufficient to detect any increase under 20% (Fig. 13d).

In summary, the current Tier 1 sampling intensity could detect large increases of some widespread bird species in Kahurangi National Park (a large National Park) but is generally inadequate in most cases for smaller National Parks, like Arthur's Pass National Park, and the power to detect change is poorest for patchily distributed species.

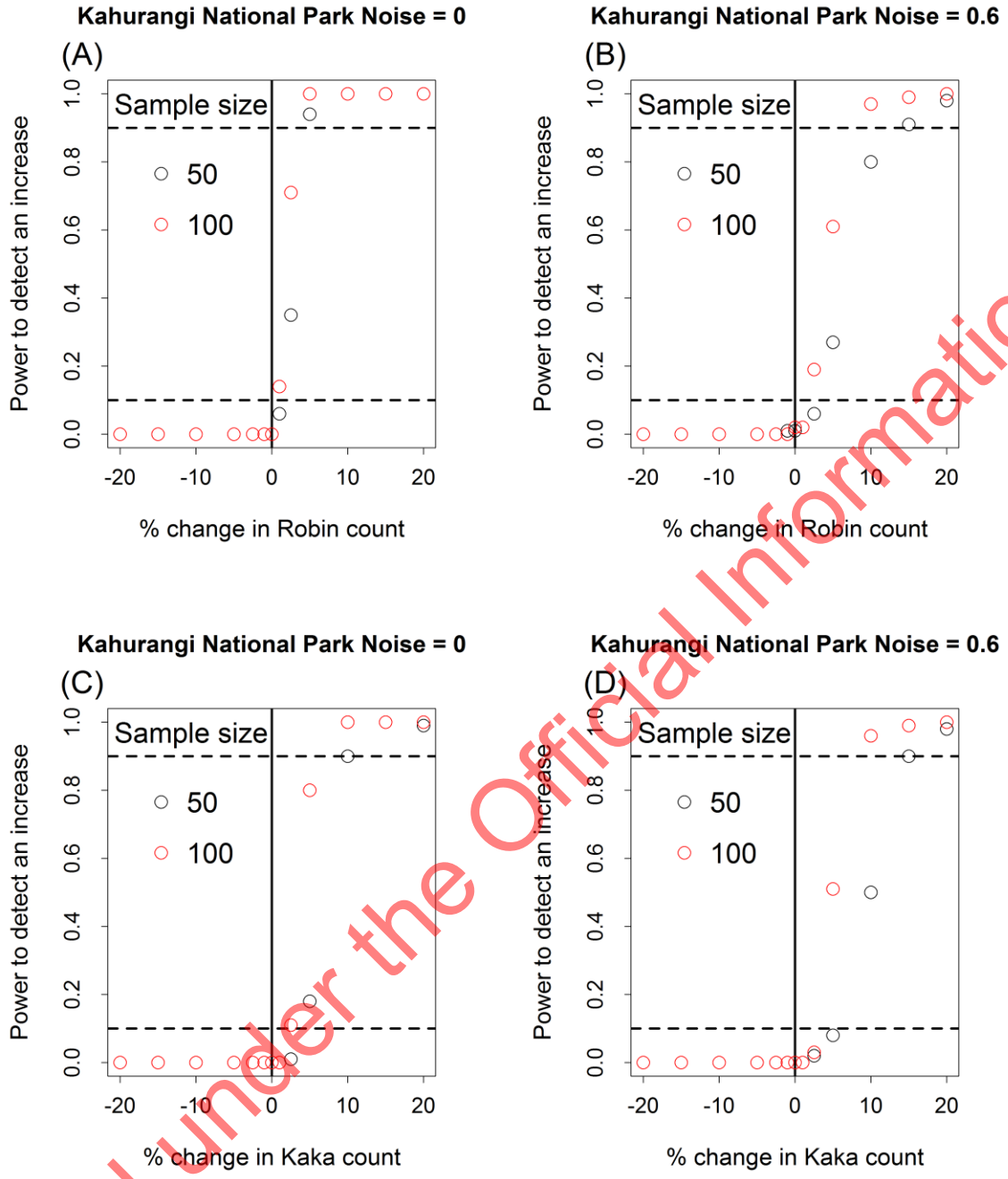


Figure 12: Power to detect increases in counts of South Island robin (A, B) and kākā (C, D) in Kahurangi National Park under scenarios where noise = 0 (A, C) and noise = 0.6 (B, D) for current actual (black circles) or double (red circles) Tier 1 sampling intensity.

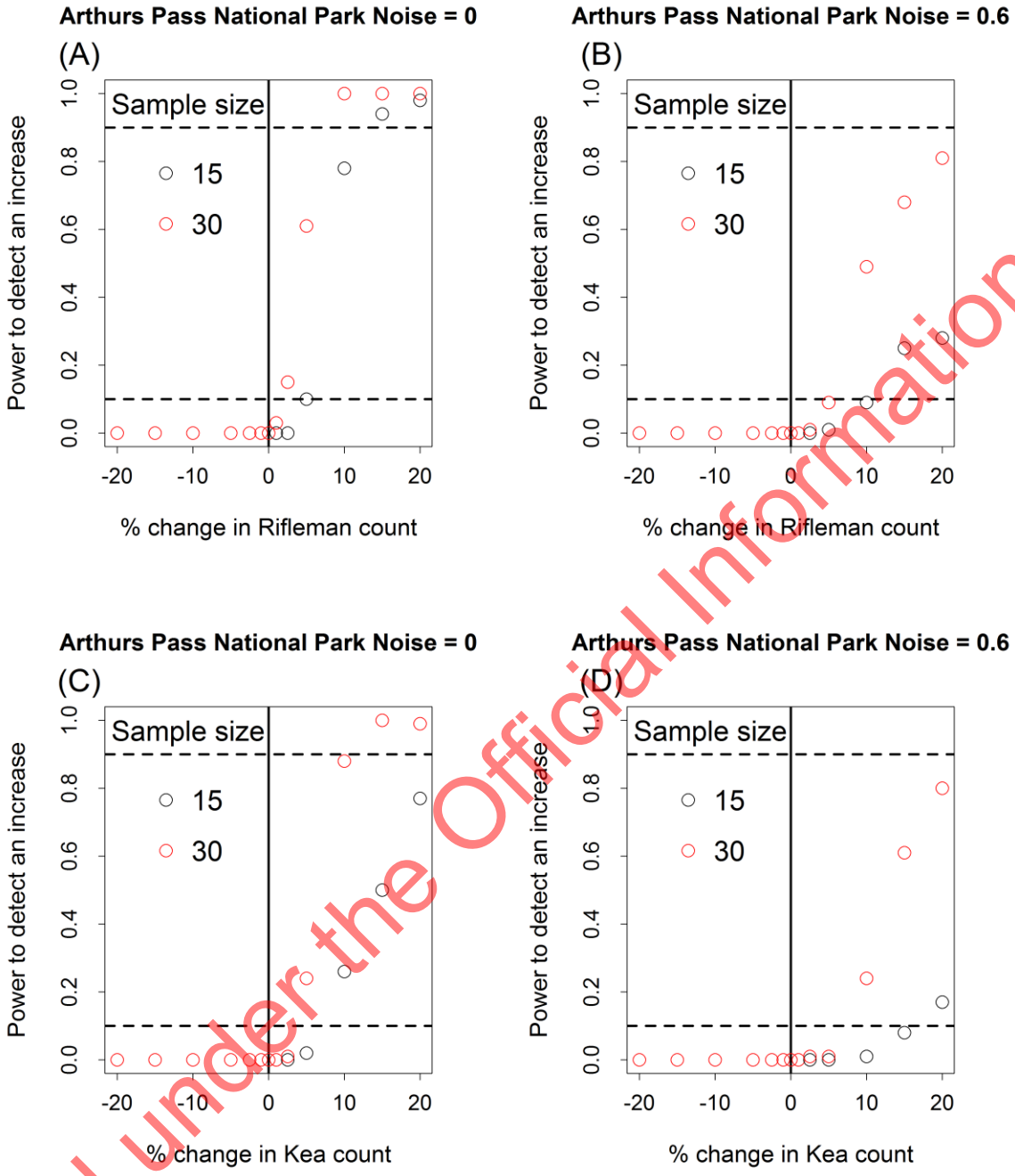


Figure 13: Power to detect increases in counts of rifleman (A, B) and kea (C, D) in Arthur's Pass National Park under scenarios where noise = 0 (A, C) and noise = 0.6 (B, D) for current actual (black circles) or double (red circles) Tier 1 sampling intensity.

6 Conclusions

6.1 Two 5-year vs one 10-year measurement interval for forests and shrublands

Our analyses reveal that there are risks if measurement of sample points in the Tier 1 biodiversity monitoring and reporting programme were altered from two 5-year intervals to a single 10-year interval. A 10-year interval may suffice for reporting change in carbon stocks in New Zealand's natural forests and shrublands (LUCAS programme), but it is less suitable for reporting their biodiversity, or for providing managers with the information that they need to maintain or enhance their ecological integrity. We believe that 5-year intervals are better suited to reporting biodiversity and ecological integrity.

- There is a non-linear relationship between tree dynamism (mortality and recruitment of all tree species combined) measured at 5-year and 10-year intervals across New Zealand's natural forests, and it is difficult to predict which are the most dynamic stands. Further investigations are needed to determine whether more dynamic stands are at lower latitudes or elevations (cf. Bellingham et al. 1999) but given dense stands are represented at all points along the continuum of dynamism, there is no obvious concentration of, for example, mortality in self-thinning stands (cf. Coomes & Allen 2007; Peltzer et al. 2014).
- There are clear benefits of retaining 5-year measurement intervals with respect to frequencies of natural disturbances. For example, forests on public conservation land have been affected by two cyclones within the last 5 years (Cyclone Ita 2014; Cyclone Gita 2018) that are likely to generate pulses of tree recruitment. Disturbance events that reduce canopy biomass can provide opportunities for recruitment of trees that are palatable to introduced mammalian herbivores (Mason et al. 2010). Reducing sampling intensity would give less confidence to refocus management if post-disturbance recruitment was biased towards unpalatable tree species.
- At the level of individual tree species, moving to a 10-year measurement interval doubles the confidence intervals that attend metrics of population level increases or decreases compared with those measured over 5 years. This, in turn, roughly halves the confidence to determine whether management intervention is needed. This is risky with respect to assessing threats to widespread tree species. For example, if myrtle rust, present in New Zealand only since 2017, reduced recruitment rates and/or increased mortality rates of widespread tree species such as southern rātā (*Metrosideros umbellata*), kānuka (*Kunzea ericoides* s.l.) or mānuka (*Leptospermum scoparium*), measuring their populations nationally over a 10-year interval would give insufficient statistical confidence to determine whether the rates were elevated, whereas 5-year intervals would provide such confidence. The same pertains to species such as pāpāuma (*Griselinia littoralis*), which is at risk of reduced recruitment rates if ungulate populations increased sharply. If new biosecurity threats (e.g. rapid ʻōhiʻa death) reached New Zealand, moving to a 10-year measurement interval would compromise capacity to detect and manage their effects.
- Moving to a 10-year measurement interval to report population trends in individual species has potential economic implications. For example, 5-year assessments show some evidence of national population declines in kānuka, which has potential

implications for the honey industry. A 10-year evaluation of changes in their populations would not give managers sufficient statistical confidence to guide decisions about the sustainability of the mānuka and kānuka resource and plan future concessions or management interventions.

- Reporting recruitment and mortality rates for widespread trees such as these is now well established in national reporting (i.e. Environment Aotearoa reports); halving the capacity to report change with confidence, which would result from moving to a 10-year measurement interval, could undermine public confidence in these metrics.
- One of the greatest strengths of the Tier 1 design is the capacity to couple metrics (e.g. of bird abundances and community composition to vegetation, both in terms of habitat diversity and dynamism). A 10-year interval for measuring vegetation decouples vegetation metrics from animal metrics (mammals and birds, measured every 5 years), and thus severely compromises the capacity to link changes in the animal metrics to vegetation. Should ungulate numbers increase significantly nationally over the first 5 years of a 10-year measurement period, the power to determine whether this translated into reduced seedling and sapling numbers for palatable tree species would be compromised because only half as many plots would be measured for vegetation in any given year. If possum numbers showed no change over two 5-year periods and the populations of adult trees that they browse preferentially were measured over 10 years, our analyses show that tree mortality rates evaluated over a 10-year period can exceed those over a 5-year period (Fig. 3b). Rates evaluated over a 10-year period might prompt unnecessary management interventions. The capacity to link changes in bird community composition and abundance to vegetation changes would be similarly weakened (e.g. the consequences of loss of old-growth trees caused by tropical cyclones for bird populations).

6.2 Power to detect change

At a national scale, and in scenarios that are realistic with respect to variable application of management, the current sampling intensity in DOC's Tier 1 programme (i.e. c. 2,000 sample points sampled at 5-year intervals) is adequate to report (with at least 90% confidence):

- A ≥2.5% increase or decrease in the local frequency of ungulates within Tier 1 locations.
- A ≥2.5% increase or decrease in the local frequency of possums within Tier 1 locations.
- A ≥2.5% increase or decrease in the mean counts of bellbirds within Tier 1 locations.
- A ≥10% increase or decrease in the mean counts of kea within Tier 1 locations.

Since a random sample is taken every year, it is possible to determine trends, comparing the different samples each year. These show:

- increasing frequency of occurrence of ungulates nationally, with values in 2016 and 2017 greater than in 2014, and far fewer sample points with zero occurrence.

- a decline in the mean counts of kea, with values in 2017 60% lower than those in 2014.

Had measurements of ungulates and kea been made at sampling intensities suitable for a single 10-year interval rather than at current intensities over a 5-year interval, the lack of power resulting from a smaller sample size would make it impossible to detect these trends. We note, however, that the greatest confidence in these trends will derive from repeated measures, but in the case of rapid declines (e.g. of kea) there is already sufficient basis to plan for management intervention at a national scale.

At the scale of Forest Parks and individual National Parks, and in scenarios that are realistic with respect to variable application of management, the current sampling intensity in DOC's Tier 1 programme is adequate to report:

- a ≥15% increase or decrease in the frequency of occurrence of ungulates and a ≥20% increase or decrease in the frequency of occurrence of possums across North Island Forest Parks.
- a ≥15% increase in the mean counts of South Island robin and kākā in Kahurangi National Park. In the smaller Arthur's Pass National Park the current Tier 1 sampling intensity (or even doubling it) is inadequate to detect a change in mean counts of either rifleman or kea of ≤20%.

7 Recommendations

- Tier 1 has a powerful design to allow measurement of multiple indicators of biodiversity at a national scale and should be maintained in its current form (i.e. sample design and frequency of measurement) at the current level of investment. One of its greatest strengths is the capacity to couple metrics (e.g. of bird abundances and community composition to vegetation, both in terms of habitat diversity and dynamism). Coupling dynamic measures of pest mammals and of bird communities with dynamic measures of plant communities will give even greater interpretive power. The capacity to measure trends in pest mammals, birds, and non-woody vegetation depends currently on interpreting change from a different random sample in each year. This is already yielding useful information to managers (e.g. that ungulate frequency is increasing nationally and that kea counts nationally are in sharp decline). However, the unpaired design used in these analyses is much less powerful than paired design of repeated measures of the same sample points. Managers will have greater confidence that ungulate populations are increasing or that bird abundances are changing when repeated measures are made of the same sample points. We recommend **maintaining repeated measurements of Tier 1 sample points of all metrics (i.e. vegetation, pest mammals, and birds) at 5-year intervals** so that the greatest confidence can be gained of trends in ecological integrity.
- The high levels of dynamism in tree populations show that large mortality and recruitment events can happen even within 5 years. Moving to a 10-year interval is risky because it significantly reduces the ability to adjust management in response to the consequences of natural disturbances, chronic established threats (such as

herbivory) or new biosecurity breaches (i.e. newly arrived pathogens). We therefore recommend **maintaining measurement of all Tier 1 sample points in natural forests at 5-year intervals (as well as non-forested sites at 5-year intervals)**.

- The sampling intensity of Tier 1 nationally is sufficient to determine small (5% or less) changes in pest mammals (ungulates and possums) and of abundances of some bird species. Moving the measurement interval of sample points to 10 years would make it impossible to detect trends from unpaired different random samples in each year. We therefore recommend **maintaining measurements of pest mammals and birds across all Tier 1 sample points at 5-year intervals.**
- The power to detect changes at regional or sub-regional level is much lower. Sampling intensities within larger management areas (e.g. across North Island Forest Parks, or large National Parks such as Kahurangi) would need to be more than double current Tier 1 sampling intensities to detect changes of ≤10% in ungulate frequency or abundances of some bird species. We recommend **using power analyses, such as the approach presented in this report, to determine the number of plots required within Tier 2 plot networks**, with plot locations set using the master sample (van Dam-Bates et al. 2018).
- Better information is needed for each sample point to allow explicit linking of change to management. We recommend **maintaining and improving the systematic collection and collation of data about management history and ongoing operations for each Tier 1 sample point**. Environmental covariates are similarly required for each sample point.

8 Acknowledgements

We appreciate input from Ian Westbrooke, Dong Wang, Helene Thygesen, Amy Hawcroft, Meredith McKay, Elaine Wright, and Kevin Collins, review comments from Andrew Gormley, and technical editing by Anne Austin.

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Appendix 1 –

All supporting files listed in this report have been delivered electronically to the client. For access to them please contact either the person in the client organisation responsible for this work or one of the authors.

Department of Conservation
Te Papa Atawhai

Date: 25 January 2019

To: Martin Kessick

CC: Sharon Alderson

From: Elaine Wright

Subject: The optimum plot measurement cycle - recommendation

Context

The current Tier 1 programme represents a trade-off between level of precision and sampling effort (intensity and frequency) for measuring and reporting temporal changes in occupancy and abundance of common and widespread species. The timing of, and interval between sampling events are key determinants of the quality of the estimates and robustness of the patterns observed. The purpose of the system is to monitor changes in a suite of biodiversity indicators/measures over time not to provide one-off data on status.

Not until the sites are remeasured will we be in a position to know how many sites are required to estimate changes in each indicator and measure within specified confidence limits or whether some form of stratification has benefits on statistical grounds. For example, some vegetation types are more prone to disturbance and have higher rates of turnover than others.

The programme was designed to integrate both vegetation, mammal and bird measures to allow them to be presented in relation spatial and temporal data for each component. For example, bird community and species measures to be presented in relation to spatial and temporal data for both vegetation and mammals.

There are efficiencies from undertaking all measurements at the same locations and at similar or the same time (where timing of specific methods permits). Collection of data for all measures from the same locations strengthens the analyses and interpretation through paired observations. Without paired observations, comparability and interpretation of measures at a site is limited putting at risk the utility of the data for regional, national and international reporting. Changes in bird species richness, occupancy and abundance estimates, for example, could be presented in relation to possum abundance estimates, or abundance of bird food resources (e.g. nectar producing species of the Myrtaceae family), using information from sampling locations where both datasets were collected.

At the end of the 17/18 field season the first 5-year rotation of this programme was completed allowing work to be undertaken to update initial predictions of precision with estimates of precision achieved from the measurement data.

Due to this and the need to look for improvements; efficiencies and cost savings there was a need to evaluate the option of a change in sampling design, (moving from a 5-year to 10-year cycle) for forest plots on the network.

Background

In 2017/2018, *Manaaki Whenua* Landcare Research were contracted to evaluate the optimum frequency of remeasurement of vegetation across the Tier 1 (8*8 km grid) in forests and shrublands.

The objectives were to investigate a change in frequency of remeasurement for forests and shrublands from the current 5-year cycle to a 10-year cycle to

1. evaluate the costs and benefits of altering the frequency of re-measurement and;
2. determine if the change in frequency impacted the power to detect change of pest mammals and birds at varying scales

Key points and recommendations made by Manaaki Whenua

- Tier 1 has a powerful design to allow measurement of multiple indicators of biodiversity at a national scale and should be maintained in its current form (i.e. sample design and frequency of measurement) at the current level of investment.
- One of its grea est strengths is the capacity to couple metrics (e.g. of bird abundances and community composition to vegetation, both in terms of habitat diversity and dynamism). Coupling dynamic measures of pest mammals and of bird communities with dynamic measures of plant communities will give even greater interpretive power.
- The capacity to measure trends in pest mammals, birds, and non-woody vegetation depends currently on interpreting change from a different random sample in each year. This is already yielding useful information to managers (e.g. that ungulate frequency is increasing nationally and that kea counts nationally are in sharp decline).
- However, the unpaired design used in these analyses is much less powerful than paired design of repeated measures of the same sample points. Managers will have greater confidence that ungulate populations are increasing or that bird abundances are changing when repeated measures are made of the same sample points.
- **Recommendation 1 - maintain repeated measurements of Tier 1 sample points of all metrics (i.e. vegetation, pest mammals, and birds) at 5-year**

intervals so that the greatest confidence can be gained of trends in ecological integrity.

- The high levels of dynamism in tree populations show that large mortality and recruitment events can happen even within 5 years. Moving to a 10-year interval is risky because it significantly reduces the ability to adjust management in response to the consequences of natural disturbances, chronic established threats (such as herbivory) or new biosecurity breaches (i.e. newly arrived pathogens).
-
- **Recommendation 2 - maintain measurement of all Tier 1 sample points in natural forests at 5-year intervals (as well as non-forested sites at 5-year intervals)**.
- The sampling intensity of Tier 1 nationally is sufficient to determine small (5% or less) changes in pest mammals (ungulates and possums) and of abundances of some bird species. Moving the measurement interval of sample points to 10 years would make it impossible to detect trends from unpaired different random samples in each year.
-
- **Recommendation 3 - maintain measurements of pest mammals and birds across all Tier 1 sample points at 5-year intervals.**
- The power to detect changes at regional or sub-regional level is much lower. Sampling intensities within larger management areas (e.g. across North Island Forest Parks, or large National Parks such as Kahurangi) would need to be more than double current Tier 1 sampling intensities to detect changes of ≤10% in ungulate frequency or abundances of some bird species.
- **Recommendation 4 -use power analyses, such as the approach presented in this report, to determine the number of plots required within Tier 2 networks**, with plot locations set using the master sample (van Dam-Bates et al. 2018).
- Better information is needed for each sample point to allow explicit linking of change to management.
- **Recommendation 5 - maintain and improve the systematic collection and collation of data about management history and ongoing operations for each Tier 1 sample point**

Additional detail

Two 5-year vs one 10-year measurement interval for forests and shrublands
Analyses revealed there were risks if measurement of sample points in the Tier 1 programme were altered from two 5-year intervals to a single 10-year interval.

A 10-year not suitable for reporting biodiversity, or for providing managers with the information that they need to maintain or enhance ecological integrity of forest vegetation.

Justification for a 5-year cycle:

- There is a non-linear relationship between tree dynamism (mortality and recruitment of all tree species combined) measured at 5-year and 10-year intervals across New Zealand's natural forests
- There are clear benefits of retaining 5-year measurement intervals with respect to frequencies of natural disturbances. Reducing sampling intensity would give less confidence to refocus management if post-disturbance recruitment was biased towards unpalatable tree species.
- At the level of individual tree species, moving to a 10-year measurement interval doubles the confidence intervals compared with those measured over 5 years. This, in turn, roughly halves the confidence to determine whether management intervention is needed. This is risky with respect to assessing threats to widespread tree species. For example, for species such as pāpāuma (Griselinia littoralis), which is at risk of reduced recruitment rates if ungulate populations increased sharply moving to a 10-year measurement interval would compromise capacity to detect change and manage their effects.
- Moving to a 10-year measurement interval to report population trends in individual species has potential economic implications. For example, 5-year assessments show some evidence of national population declines in kānuka, which has potential implications for the honey industry. A 10-year evaluation of changes in their populations would not give managers sufficient statistical confidence to guide decisions about the sustainability of the mānuka and kānuka resource and plan future concessions or management interventions.
- Reporting recruitment and mortality rates for widespread trees such as these is now well established in national reporting (i.e. Environment Aotearoa reports); halving the capacity to report change with confidence, which would result from moving to a 10-year measurement interval, 9(2)(g)(i) [redacted]
- One of the greatest strengths of the Tier 1 design is the capacity to couple metrics (e.g. of bird abundances and community composition to vegetation, both in terms of habitat diversity and dynamism). A 10-year interval for measuring vegetation decouples vegetation metrics from animal metrics (mammals and birds, measured every 5 years), and thus severely compromises the capacity to link changes in the animal metrics to vegetation. Should ungulate numbers increase significantly nationally over the first 5

years of a 10-year measurement period, the power to determine whether this translated into reduced seedling and sapling numbers for palatable tree species would be compromised because only half as many plots would be measured for vegetation in any given year.

Power to detect change

At a national scale the current sampling intensity in the Tier 1 programme is adequate to report (with at least 90% confidence):

- A ≥2.5% increase or decrease in the local frequency of ungulates within Tier 1 locations.
- A ≥2.5% increase or decrease in the local frequency of possums within Tier 1 locations.
- A ≥2.5% increase or decrease in the mean counts of bellbirds within Tier 1 locations.
- A ≥10% increase or decrease in the mean counts of kea within Tier 1 locations.

Since a random sample is taken every year, it is possible to determine trends, comparing the different samples each year. These show:

- increasing frequency of occurrence of ungulates nationally, with values in 2016 and 2017 greater than in 2014, and far fewer sample points with zero occurrence.
- a decline in the mean counts of kea, with values in 2017 60% lower than those in 2014.

Had measurements of ungulates and kea been made at sampling intensities suitable for a single 10-year interval rather than at current intensities over a 5-year interval, the lack of power resulting from a smaller sample size would make it impossible to detect these trends. We note, however, that the greatest confidence in these trends will derive from repeated measures, but in the case of rapid declines (e.g. of kea) there is already sufficient basis to plan for management intervention at a national scale.

Document 25

Daniel Ohs

From: Sharon Alderson
Sent: Thursday, 6 August 2020 8:25 am
To: Elaine Wright; Meredith McKay
Cc: Jo Macpherson
Subject: FW: Monitoring

Importance: High

Kia ora – see below please.

How quickly can we do this, so we can set a clear work programme. (for both us and BMT)
What do we recommend. ?
(do we finish the few plots not delivered due to COVID onset?)

Jo – we may need to discuss reassigning T1 opex, depending on what is being delivered.

Ngā mihi,
Sharon

From: Martin Kessick <mkessick@doc.govt.nz>
Sent: Wednesday, 5 August 2020 5:28 p.m.
To: Sharon Alderson <salderson@doc.govt.nz>
Subject: Monitoring

Hi Sharon,

I finally caught up with Mike. We are now aligned. Essentially, what is the programme that we can now deliver for roughly $4.1m. We know it will be LUCAS plots (and he is recruiting for this) plus animal monitoring plots (we need this work strategically) so what can we reduce from the remaining vegetation plots. He has some programme limitations in any event given how late we are starting.

Regards

Martin Kessick (he/him)
Deputy Director-General, Biodiversity— *Tumuaki Kāhui Kanorau Koiora*
Department of Conservation—*Te Papa Atawhai*
M: s.9(2)(a)

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Conservation leadership for our nature ***Tākina te hī, tiakina te hā, o te ao tūroa***

www.doc.govt.nz

High level Scenarios for 2020-2021 Tier 1 and LUCAS Programme

Key Assumptions:

- Recruitment freeze and ban on temporary staff is lifted
- Requests are approved to (refer to memo):
    - Extend temporary contracts key staff
    - Recruit for permanent vacancies
- Decision on scenarios to proceed with for next year's fields season is made by late May to ensure the necessary time for recruitment and preparation (e.g. Adverts for temp field staff need to out by early June to be able to recircuit by July and to scale up by September)
- Current level of permanent staffing maintained, and enough fixed term staff are recruited to complete the work next season
- Level 4/3 continues until 30 June
- Level 2 allows fieldwork and delivery of a minimum viable programme, but delivery model may need to change where possible/feasible BUT further exploration and testing is not completed yet:
    - Where plots are clustered at a suitable scale to support a "Regional Tier 1 teams" approach (i.e. there are enough plots and work regionally to set up a team) (e.g. Fiordland), the team(s) and supervisors are regionally based (note: unknown if backcountry work will be allowed as yet)
    - Feld delivery could be completed by the "Regional Tier 1 teams" assuming that the local field bases can accommodate these teams and they can be set up in time
    - Where plots are not clustered at suitable scale to support a "Regional Tier 1 teams" approach other options will need to be explored which could include working with Regional Councils, local DOC teams or local contractors to deliver regional work
    - Where options are not available for safe regional delivery, plots could be deferred or dropp d but impacts of this on reporting required for MFE and DOC still need be understood.
- *Agreements made with other land managers may result in working at different places
- Field supervisor model that has been tasked is implemented if OVP scenario proceeds.

Scenarios: For most impacted workstreams of Training and Support and Field Delivery

Scenarios	Minimum Viable Programme (MVP) for MFE only	MVP for MFE and DOC	Optimal Programme (OP) for MFE and DOC	Transform– opportunity to refocus and respond (regional recovery: economic or employment)
Training and Support	Only use returning staff to reduce training required while maintaining data quality standards	Only use returning staff to reduce training required while maintaining data quality standards Refresher Tier 1 Training only implemented as online and/or regionally with essential support from C&D team	Implementation of new Field supervisor m del (tasked by Mike Slater) & parallel model review/refine to support this by PSU Recruit as normal using returning and new staff Tier 1 Training implemented as online and/or regionally with essential support from C&D team	See SLU proposals Scale up recruit and use existing staff Training and Development framework developed and implemented Tier 1 Training implemented as online and/or regionally with essential support from C&D team and external contractors (e.g. NMIT)
Field delivery	LUCAS vegetation plots only (including unfinished 19/20 plots) fulfilling MfE MOU with options for: - LUCAS Front county plots only Implementation of EDC	LUCAS vegetation plots (including unfinished 19/20 plots) fulfilling MfE MOU Implementation of EDC PLUS, Reduced T1 with options for: - Tier 1 and LUCAS Front county plots only - Tier 1 Animals on PCL LUCAS plots only - Sample size dependant on number of returning temp staff	Normal field season OR Normal field season + unfinished 19/20 plots Tier 1 audit project implemented regionally until Level 1 implemented	See SLU proposals LUCAS + Tier 1 plots plus expansion into Regional Council land* with options for: - Front county plots only - Animals or Vege methods only - Sample size dependant on number of skilled staff/teams available

		- Sample size dependant on maximum staff under current Supervisors in monitoring unit structure Tier 1 audit project deferred until Level 1 implemented		

Document 27

PO Box 10362, Wellington 6143
Website: www.mfe.govt.nz
Freephone: 0800 499 700

20 May 2021

Sharon Alderson
Department of Conservation
PO Box 10420
Wellington 6143

Dear Sharon Alderson

Letter of support for the Natural Forest Plot Measurement Programme

I would like to reaffirm the Ministry for the Environment's (MfE) ongoing support of, and commitment to, the Land Use Carbon Analysis System (LUCAS) natural forest plot measurement programme (NFPMP) and the ongoing implementation of an electronic data capture solution. Both of these commitments fall within the Memorandum of Understanding (MOU) between MfE and the Department of Conservation (DOC). This was signed in 2018 for a six-year term.[1]

LiDAR proposal

I have been made aware of an initiative to explore the feasibility of using LiDAR to deliver data requirements under the MOU. I would like to emphasize the importance of any change in methodology being calibrated against the existing approach to ensure the integrity of the time series of data is maintained. The Climate Change Commission's (CCC) recent draft advice highlights the important role our natural forests can play in meeting our climate change targets. To enable this we need to ensure that any methodological change does not result in a change in trend within our estimates for greenhouse gas reporting. We also want to ensure that the joint requirements for biodiversity data between agencies are not compromised with a proposed change in approach, the importance of which is outlined below.

Reduction in funding for the Tier 1 Monitoring Programme

I have also been made aware that DOC is likely to reduce the Tier 1 programme budget and that the full programme will no longer be delivered. We would like to ensure that the agreed deliverables under the MOU could still be met in full including continued data quality assurance. Given the complex nature of natural forests, small changes in data quality can impact our ability to detect trends. The sector level impacts of any such changes would also need to be considered given the wide ranging use of these data.

R

[1] The MOU defines the relationship between the LUCAS Measurement Programme and DOC's Tier One Programme. It involves DOC's measurement of the Year's 5-10 plots of the LUCAS pre-1990 measurement programme and the plots in the LUCAS post 1989 measurement programme. This measurement is taking place over the 2018/19, 2019/20, 2020/21, 2021/22, 2022/23 and 2023/24 field measurement seasons

Ministry for the Environment
Manatū Mō Te Taiao

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Importance of the MOU and the NFPMP

The NFPMP allows New Zealand to meet its mandatory international and domestic climate change reporting requirements. Measurement of forests is required to obtain accurate estimates of carbon stock and stock change as the natural forest estate changes through time. The CCC's draft advice for consultation is looking to shift New Zealand's forestry focus towards native forests to help New Zealand meet its climate change targets. The NFPMP will be essential in detecting removals from native forests and is fundamental to successfully implement the CCC's draft advice.

Integrating the Tier One and LUCAS programmes is a joined-up approach that provides optimal efficiency and recognises the interconnected nature of our ecosystems and environment. This relationship is especially important in light of the Parliamentary Commissioner for the Environment's (PCE) report on New Zealand's environmental reporting system. This report highlighted how 'huge' gaps in data and knowledge undermine our stewardship of the environment and called for concerted action to improve the system. The NFPMP is a clear example of addressing this data gap for one of New Zealand's most extensive land-use types – natural forests.

The PCE's subsequent review on funding and prioritisation of environmental research in New Zealand highlighted Tier One monitoring as a 'ground-breaking, systematic sampling programme that provides an important link between New Zealand's environmental reporting system and the science system. This report further highlighted New Zealand's lack of consistent, authoritative time-series data and comprehensive spatial coverage. The NFPMP is a rare and valuable example of a programme that addresses these deficiencies in that it is nationwide and has been ongoing since 2002.

The data collected in the NFPMP are also used widely across government including MfE's environmental reporting programme fulfilling our obligations under the Environmental Reporting Act (2015). The data are used to meet the requirements of international treaties including the Montreal Process, the United Nations Forest Resource Assessment and the Convention on Biological Diversity. Data collected within this programme are also used in the environmental-economic accounts that are compiled and published by Statistics New Zealand. They are used by your own Department to report on status and trends in biodiversity and the impacts of selected pressures (e.g. ungulate browse). These data form part of a highly valuable, publically available dataset which is used by scientists in New Zealand and abroad for biodiversity and climate-related science.

Kind regards,

s.9(2)(a)

Sean Poff
Director, Joint Evidence Data and Insights
Ministry for the Environment

Document 28

Greater Wellington
Te Pane Matua Taiao

By email

20 December 2021

100 Cuba Street
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T 04 384 5708
F 04 385 6960

Marie Long
Deputy Director General – Biodiversity
Department of Conservation

Email: mlong@doc.govt.nz

Tēnā Koe Marie

Request for monitoring of 8 x 8km grid sampling points

Greater Wellington Regional Council (GWRC) wishes to request that the Department of Conservation (DOC) complete the Tier 1 Biodiversity and Monitoring Reporting System (BMRS) programme in the Wellington region as originally planned. We have been working collaboratively with DOC and the Ministry for the Environment (MFE) for the past seven years to undertake biodiversity monitoring of sampling points on the national 8 x 8km grid across the region (see Background in Attachment 1). It is understood that recent funding cuts to the DOC field programme will mean that five sites that were originally to be monitored in the region this season will no longer be measured by DOC. GWRC does not have the capacity to complete that work and this change poses a threat to data integrity for the Wellington region. Please note our urgent request for the situation to be rectified.

As detailed by Peter Bellingham of Landcare Research in a paper published in May 2020 (Attachment 2), there is a global need for observation systems that deliver regular, timely data on state and trends in biodiversity. Halting biodiversity decline across New Zealand requires robust and timely data to inform conservation activities. The data collected in the Wellington region is not only essential for regional reporting. The entire value of a national sampling proposition hinges on the power to detect environmental changes that are relevant to regional councils. While DOC has been able to conduct statistical power analyses on its sampling of public conservation land, this view is skewed to managed, natural forest environments. Regional councils need to be able to be able to detect changes not only across unmanaged natural forests but also across the wider landscape. It is important therefore that the Wellington region is able to complete a full second cycle of monitoring to provide a balanced view of the value such a programme would deliver to the nation.

We strongly urge you, as a partner and stakeholder, to reconsider the Department's decision to drop five more sampling points within the Wellington region this season and encourage you to continue to fund sites in the Wellington region through until 2023/2024 to allow for the completion of our second cycle. We would also strongly urge the department to invest in and maintain the full programme and engage with Regional Councils actively when making choices for the National Monitoring and Reporting Systems (NMRS) Programmes. We would welcome a meeting with you if you wish to discuss this further and look forward to your early reply.

Ngā mihi

Nigel Corry
Te Tumu Whakarae | Chief Executive
Greater Wellington Te Pane Matua Taiao
s.9(2)(a)

Attachment 1: Background to GWRC's State of the Environment terrestrial ecology monitoring programme

Greater Wellington Regional Council (GWRC) initiated a regional state and trend monitoring programme for terrestrial ecology in 2014/2015. This programme is built on the 8 x 8km national grid of points established to inform the national Land Use and Carbon Accounting System (LUCAS), led by the Ministry for the Environment (MfE) and both used and expanded on used by the Department of Conservation (DOC) for their Tier 1 Biodiversity Monitoring and Reporting System (BMRS). Vegetation, birds and pest animals are monitored at each of these sample points. There are 126 points in the Wellington region and the ability to maximize a collaborative approach with the national MfE and DOC monitoring programmes was one of the reasons why GWRC's terrestrial ecology programme was undertaken. MFE and DOC monitor 50 of the 126 potential monitoring sites, with GWRC monitoring the remaining 76 sites. Birds and pest animals are also monitored by GWRC at LUCAS sites that are not located on DOC land as MfE only records the vegetation at those sites. Monitoring is conducted on a five-year-long cycle and GWRC is about to initiate the third season of our second cycle, building on seven years of continuous monitoring since summer 2014/2015.

The collective planning and measurement of all sites and the data sharing partnership GWRC has enjoyed with DOC and MfE has been key to initiating and delivering results from the regional state and trend monitoring programmes. Based on this success, DOC, EMAR and Regional Councils via the Regional Cluster Bid are currently seeking for funding to expand this sampling to all of the other regional councils to deliver on the National Biodiversity Strategy (Te Mana o te Taiao). It is unfortunate that DOC has cut the programme at the very time councils other than GWRC are finally making moves to report widely across private land. It is understood however that funding cuts to DOC's monitoring programme for the last two years means that timely sampling at sites within the Wellington region is now longer able to be completed. Five sites in the Wellington region will not be monitored as originally programmed this year (with one site not completed last year), further eroding the utility of existing data. This comes on top of earlier cuts to the MfE- LUCAS funded programme funding sites were halved with were moved to a 10-year-long cycle, requiring GRWC to pick up the plots that were dropped from our sampling cycle. This loss of support will have a major impact on GWRC's ability to complete the state and trend monitoring for the region, as we do not have the capacity to add extra sampling points that fall on Public Conservation Land to our programme.

Attachment 2:

Bellingham PJ, Richardson SJ, Gormley AM, Allen RB, Cook A, Crisp PN, Forsyth DM, McGlone MS McKay M, MacLeod CJ, van Dam-Bates and Wright EF, 2020. Implementing integrated measurements of Essential Biodiversity Variables at a national scale. Ecol Solut. Evid. 1: e12025 Implementing integrated measurements of Essential Biodiversity Variables at a national scale (wiley.com)

Department of Conservation
Te Papa Atawhai

Date: 08 February 2022

To: Sharon Alderson

CC: Elaine Wright, Morgan Mclean, Ben Reddiex

From: Meredith Mckay

Subject: Response to request from GWRC regarding investment and measurement of Tier 1 monitoring sites

Context

On 20 December 2021 Greater Wellington Regional Council (GWRC) Chief Executive, Nigel Corry,
requested that DOC (DOC-5693163).

1. Reconsider the decision to drop scheduled measurement of five Tier 1 sampling points within the Wellington region this season (and in effect shift to a 10-year cycle for measurement),
2. Continue to fund the Tier 1 programme and sites in the Wellington region through until 2023/2024 to allow for the completion of GWRC second plot measurement cycle,
3. Invest in and maintain the full Tier 1 programme,
4. Engage with Regional Councils actively when making choices for the National Monitoring and Reporting Systems (NMRS) Programmes.

The Tier 1 Programme team were asked by Sharon Alderson (SRO) to evaluate if DOC should measure the five sites dropped and if so, could these be delivered at what cost or impact on the seasons planned programme.

Background

The Tier 1 programme is designed to integrate both vegetation, mammal, and bird measures allowing DOC to monitor and report status and trend of a selection of native species and pests on all Public Conservation Lands (PCL).

Sites on the 8km grid network are measured over a 5-year cycle and the timing of, and interval between sampling events are key determinants of the quality of the estimates and robustness of the patterns observed. In 2019 an independent review of the length of the measurement cycle confirmed the need to retain coupling of measures and the current 5-year cycle. Moving to a 10-year interval significantly reduced the ability to adjust management in response to the consequences of natural disturbances, chronic established threats (such as herbivory) or new biosecurity breaches (i.e. newly arrived pathogens). These findings were presented to Martin Kessick, DDG and there was agreement that 5-year cycle would be retained DOC-5693163.

Since then budget constraints have impacted the programme caused by reduced funding (budget cut of $500K), increased costs of delivery and overheads forcing the programme to scale back monitoring. The risks and impacts of this on DOC and other stakeholders have been reported to the SRO and DDG.

In March 2021, during business planning we highlighted again that Regional Council reporting commitments would be impacted by this decision. For example, Greater Wellington have an integrated programme that parallels DOC's and that we share data and outputs for reporting on performance at regional and national scales (DOC-6607843).

Despite this, DOC's investment in 2021-2022 was not sufficient to deliver the full programme. As a result, the programme was scaled back for another season and 100 vegetation measures dropped. Since 2019-2020 season approx. 260 vegetation measures at Tier 1 plots have been dropped from the 5-year cycle (DOC-6740587).

In September, DOC advised Phillipa Crisp at GWRC of these changes during the collective planning process we complete each season. The final list of DOC's planned sites was supplied GWRC flagged that they did not have the capacity to complete these additional sites dropped by DOC and that this would impact on data integrity for the Wellington region reporting.

Evaluation

The Principal Science Advisor for the Tier 1 Programme has reviewed this request and recommended DOC complete vegetation measures these sites. This will ensure the integrity of the GWRC network and regional reporting and reduce DOC's reputational risk.

The monitoring team investigated options and advised that DOC can measure these sites if.

1. To complete these vegetation measures within the current allocated budget, we would need to drop up to six Tier 1 vegetation measure from the planned programme There are options to overspend the budget, but these were not considered at this stage.
2. We have approval for one South Island team to travel to the North Island to complete this*.
3. If travel is not approved, external contractors in the North Island could be contracted (if available and skilled) to complete these sites if the Tier 1 budget currently allocated can be redeployed to pay for this.
4. The data for EDC devices, plotsheets and maps will need to be prepared for the field teams. To achieve this, we may need to delay some Tier 1 tasks in the MIS team.

*Due to the recent Omicron outbreak we have already redeployed field teams to complete MFE LUCAS plots as a priority. The bulk of these sites are in the NI and these teams are fully deployed to meet this commitment. To complete additional sites, a team from the South Island will need to be redeployed.

Recommendation

1. DOC reconfigure field programme plans to complete the measurement of the requested GWRC sites.
2. DDG grants approval for South Island teams to travel to North Island.

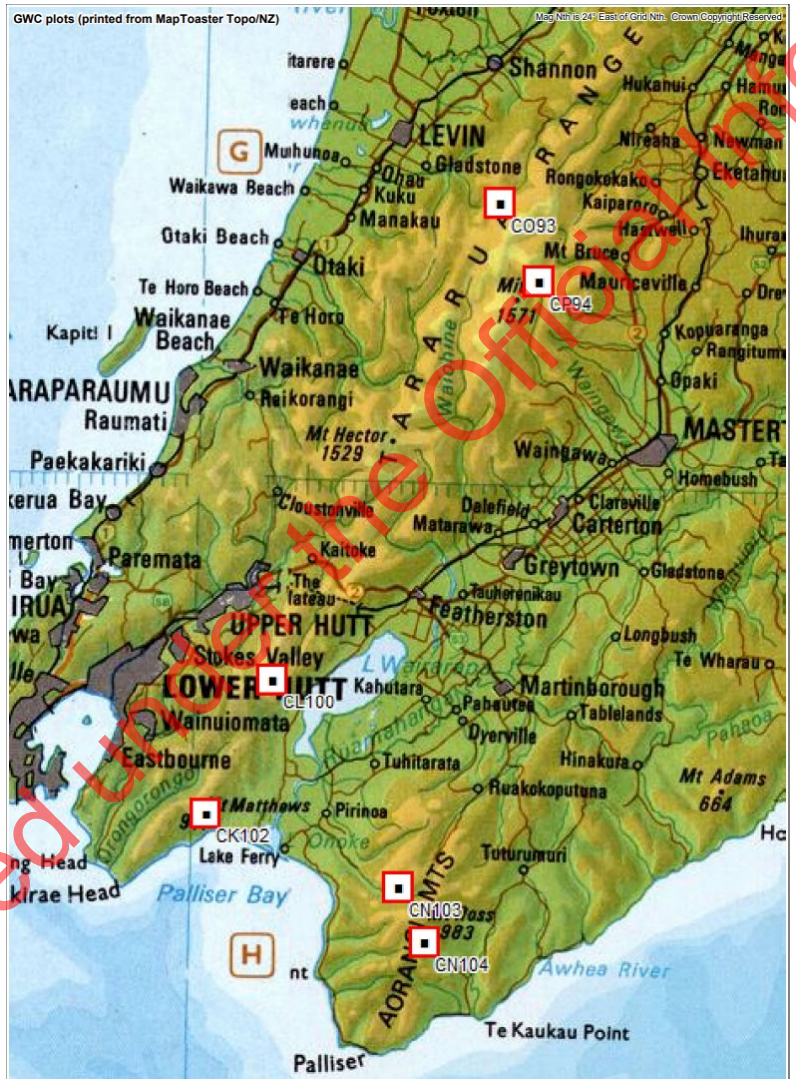
Decision:

	Name, Role	
	Date	
	Signature	

References

1. NBMRS Tier 1 Monitoring Programme Business planning preparation Memo DOC-6607843
2. 2021-2021 Tier 1 and LUCAS Tier 1 programme costs and options for confirmation of programme DOC-6740587
3. The optimum plot measurement cycle - Memo for DDG - DOC-5693163
4. Bellingham PJ, Richardson SJ, Gormley AM, Allen RB, Cook A, Crisp PN, Forsyth DM, McGlone MS, McKay M, MacLeod CJ, van Dam-Bates and Wright EF, 2020. Implementing integrated measurements of Essential Biodiversity Variables at a national scale. Ecol Solut. Evid. 1: e12025 Implementing integrated measurements of Essential Biodiversity Variables at a national scale (wiley.com)

Figure 1



Department of Conservation
Te Papa Atawhai

Date: 06 April 2022

To: Sharon Alderson

CC: Morgan McLean, Elaine Wright and Ben Reddiex

From: Meredith Mckay

Subject: Updated - Response to request from GWRC regarding investment and measurement of Tier 1 monitoring sites

Context

Update to DOC-6909224 Memo.

In response to our first recommendations (see below), we attempted to reconfigure the Tier 1 field programme plans to enable BMT to complete the measur ment of the requested GWRC sites.

Attempts were made but as of April, the capacity for BMT to complete these is limited as approval to send teams to the North Island was denied and the North Island team have at least 11 LUCAS plots still to complete. The earliest they could attempt to measure these would be mid to late May which is very late in the season. Short day length and weather in May are a risk and we are unable to guarantee th s would be completed.

After discussion with Morgan McLean, to mitigate the risk above, we tested options to redeploy the Tier 1 Programme audit team and convert the last audit trip to complete these sites.

This is possible and impact to the audit and reporting this year are manageable. The costs are estimated at maximum of $50K and as low as $30K depending on weather. This was tested with Morgan and s very reasonable and close to or equivalent to the cost of using our own field teams

We have confirmed that we could afford the measurement of the GWRC plots by the audit team within the current budget but recommend we split costs between BMT and MIST at $15K min – $25K max per team.

Next steps

1. The Tier 1 Programme audit team are contracted to complete these plots in April
2. The costs are split in half between BMT and MIST

D

ORIGNAL Response to request from GWRC regarding investment and measurement of Tier 1 monitoring sites – Feb 2022

On 20 December 2021 Greater Wellington Regional Council (GWRC) Chief Executive, Nigel Corry,
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1. Reconsider the decision to drop scheduled measurement of five Tier 1 sampling points within the Wellington region this season (and in effect shift to a 10-year cycle for measurement),
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Recommendation

3. DOC reconfigure field programme plans to complete the measurement of the requested GWRC sites.
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Decision:

	Name, Role	
	Date	
	Signature	

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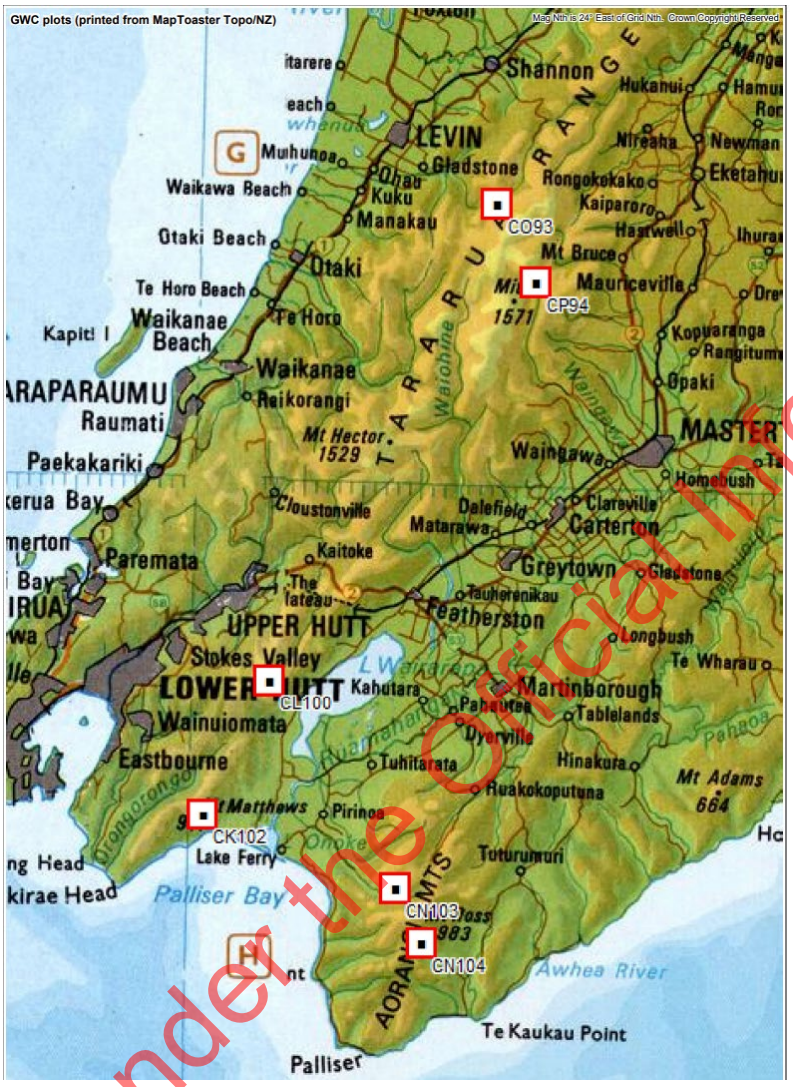

Department of Conservation
Te Papa Atawhai

Document 31

File Ref DOC- 6622424

Date: 12 April 2021

To: Nigel Searles and Asher Cook

From: Meredith McKay and Elaine Wright

Subject: Department of Conservation reduction in funding for Tier 1 Monitoring Programme

Summary

1. The Department of Conservation (DOC) is likely to reduce the Tier 1 programme budget by $0.5 M from $4.6M to $4.1M per year. The full programme will no longer able to be delivered. Changes in response to the budget cut will be required. These change impact MFE and commitments made by DOC as part of the MOU. A summary of the changes and impact are provided for MFE internal use and discussion. As yet, no sector level discussion about changes and impacts for MFE, Stats NZ and others has occurred. Renegotiation of the MOU may be required.

Programme funding

2. DOC funds the Tier 1 programme at $4.6 M per year.
3. MfE contributes $0.9 M - $1 M per year for DOC to complete MfE LUCAS plots on and off PCL. This covers 80% of the actual cost and the remaining 20% is covered by DOC due to share/overlapping data on PCL sites.
4. MFE funding offsets the overall cost of the department's own investment in the Tier 1 monitoring programme.

Changes to DOC Tier 1 programme funding in 2020-2021

5. In July 2020 DOC's DG, Lou Sanson requested a budget decrease of $0.5 M be made to the Tier 1 programme. Reducing the Tier 1 budget to $4.1M
6. PSU Design and Evaluation Manager, Elaine Wright was asked to consider the request and advise on the programme changes to accommodate the shortfall in resourcing.
7. The request to downsize the progarmme took account of the following:
    a. **Reduction in budget is a singular event**. The full budget of $4.6 M would be reinstated in 2021/22
    b. **MFE LUCAS programme commitments.** The LUCAS field programme and EDC implementation for 2021/22
    c. **Maintain the random selection** of sites each year
    d. **History of sampling investment** by DOC in non-woody sites on PCL is limited. There is an inadequate time series for estimating expected rates of change in vegetation and interpreting animal occupancy and abundance. There are fewer sites on PCL compared with woody impacting precision if the sampling effort is reduced. Change over time is critical for assessing impact of climate change.
    e. **Quality of outputs** impossible to maintain with a reduction in sampling effort. This is particularly important subsets of the data, whether geographic or environmental.

Changes to Tier 1 and LUCAS programme with budget reduction of $0.5 M for 2020-2021

8. Programme changes made for the 2020-2021 season were discussed with MFE and are summarised in Table 1. Risks to data quality due to the change or pause of quality assurance processes was assessed and considered acceptable for a single season.

Table 1. Summary of change 2020-2021

Tier 1 only adjustments	Tier 1 & LUCAS adjustments
Complete a) Tier 1 **vegetation** and **animal** measures at <u>non-woody sites</u> on PCL* b) Tier 1 **animal** measures at <u>woody sites</u> on PCL **Pause** c) Tier 1 **vegetation** measures at non LUCAS woody sites on PCL d) Carbon Monitoring methods at Tier 1 only sites a. Coarse Woody Debris b. Tree Heights e) Tier 1 specific data collection a. Soils collections b. Non Vascular collections **Note that due to further budget pressures mid-season caused by COVID and EDC, Vegetation measures on a subset of Tier 1 non woody sites were also dropped*	**Complete** a) All LUCAS plots (includes private land and subset of Tier 1 sites) b) Implementation of Electronic Data Capture **Pause** f) Development of a common data standard with MFE and other stakeholders g) Quality Assurance; Tier 1 field audit and report to MFE h) Quality Assurance Tier 1 and LUCAS Refresher Training i) Quality Assurance Tier 1 and LUCAS Data and Information management training

Permanent changes to funding to be implemented 2021-2022

9. In March 2021 we were informed that the budget decrease of $0.5 M is likely to be permanent and a further 10% reduction in funding is being considered.

10. DOC LUCAS project manager (Meredith Mckay) and PSU Design and Evaluation Manager (Elaine Wright) were asked to provide information on options and impacts for delivery of the Tier 1 programme with DOC's reduced investment..

Permanent changes to programme to be implemented 2021-2022

11. With a $0.5 M cut to DOC's baseline funding the full Tier 1 terrestrial monitoring programme cannot be delivered.

12. This will impact MFE as some key quality assurance deliverables that DOC committed to and offset as part of the collective action initiative can no longer be met.

13. The main programme changes and impact on deliverables in the MOU are summarised below. Specific details are listed in Appendix 1.

Direct Impacts and MOU deliverables no longer possible

14. **Discontinuation of field audits** - Absence of a quality assurance programme means data captured are of unknown quality. This is a reputational risk in organisations experiencing high rates of turnover of skilled staff

15. **Cessation of training** (Tier 1 and LUCAS Refresher; Data and Information Management). Absence of a quality assurance programme means data captured by teams are of unknown quality. This is a reputational risk in organisations where staff are not trained to ensure consistency in interpretation and implementation of methods.

Other Impacts – MFE and Sector

16. DOC contributes data to support park level reporting for internal decision making and to support external engagement (e.g. Ministerial briefing on Ungulate pressure in NI Forests and successful budget bid for fund for management). A reduced programme has significant implications for contributions to reporting and decision making.

17. DOC and MFE plans to report on Carbon Stock and Change for PCL to inform DOC's Carbon Accounting and Sustainably plans will be impacted.

18. DOC contributes data to support requests and commitments for National and International Reporting. A reduced programme has significant implications for future comprehensive and timely contributions (e.g. MfE Land Domain and Environment Aotearoa Reports, CBD, Montreal Process, Stats NZ Data Investment Plan focused on essential data assets for NZ;

19. DOC faces a reputational risk as the Tier 1 and LUCAS programmes are foundational for implementation of the ANZBS and EMRS to monitor and report on the state of New Zealand's biodiversity. Tier 1 and LUCAS programmes provide underpinning data and the core skills and capability to support implementation of both programmes.

    DOC also faces wider reputational risks. In light of the Parliamentary Commissioner for the Environment's (PCE) report on New Zealand's environmental reporting system and funding. This report highlighted how 'huge' gaps in data and knowledge undermine our stewardship of the environment and called for concerted action to improve the system. The NFPMP is a clear example of addressing this data gap for one of New Zealand's most extensive land-use types – natural forests. The PCE's subsequent review on funding and prioritisation of environmental research in New Zealand highlighted Tier One monitoring as a 'ground-breaking, systematic sampling programme' and provides an important link between New Zealand's environmental reporting system and the science system

Next steps

20. DOC's funding for Tier 1 Programme impacts MFE
21. To our knowledge, DOC have not engaged with others in the sector who have dependencies on the data or quality assurance of these data.
22. Impacts are wider than MFE LUCAS programme and could MFE Land Domain reporting, MFE EMRS programme and other central government initiatives (e.g. Stats NZ DIP). We encourage MFE LUCAS programme team to raise this with relevant teams and management within MFE.
23. We recommend these changes are reported internally and discussion regarding these changes and impacts on MFE are raised with DOC.
24. Depending on the outcome of discussion, DOC and MFE may need to re-negotiate MOU deliverables.

Appendix 1. Summary of MOU commitments and impacts by DOC funding changes

Phase	Deliverable	Continuation	Impact
PLANNING AND PREPARATION	Assign a Project Manager with experience in LUCAS plot measurement, and that will provide support to field teams to assist with the delivery of quality control systems in the field and the office	Yes	None
	Assign Operations Logistics Personnel with experience in LUCAS plot measurement, and that will provide support to field teams to assist with the delivery of quality control systems in the field and the office	Yes	None
	Plan and recruit for field teams to include experienced vegetation monitoring staff with a comprehensive understanding of all aspects of LUCAS programme data collection standards	Yes	Loss of skills staff is possible with cut to Tier 1 programme as current levels of staff retention over winter no longer affordable.
	Plan and recruit for sufficient number of well-trained teams to deliver the planned field programme	Yes	None
	Prepare and provide Field measurement itinerary	Yes	None
	Plan and ensure all necessary consents and permissions are obtained for access to the selected plots	Yes	None
COMMUNICATION	Communications plan updated annually that provides mechanisms and support for information and feedback on quality of work or any issues (e.g., health and safety) to be relayed in a timely manner;	Yes	None
DATA MANAGEMENT	A Data management plan updated annually that support the collection and management of data to ensure the requirements of the LUCAS programme are met.	Yes	Budget cuts will lead to further reduction in support data and information management. While LUCAS data management will be a priority there is a dependency on DOC systems and lack of investment may mean a lot of more manual transactions for the programme team.
	DOC will work with MFE and other stakeholders to establish a common data standard for operational data via the 8-km grid	No	Essential metadata and operation data from the 8km grid will not be available for MFE or the

Phase	Deliverable	Continuation	Impact
	stakeholder group, the Environmental Monitoring and Reporting project (**http://www.mfe.govt.nz/more/environmental-reporting/data-improvement/data-improvement-initiatives**) and other working groups. DOC to develop a fit for purpose data quality assurance protocols, the aggregation of historic and current operational data, and the sharing of this data amongst stakeholders		sector. This will limit DOC and MFE programme management. Broader impact on the sector as this will impact agencies implementation of monitoring 8-km grid and MFE's EMRS programme, DOC's ANZBS implementation planning and Regional Council implementation of Tier 1 and Tier 2 programmes
	Upgrades to systems/process for data and information management	No	Budget cuts cause a stop to upgrade of the programme systems/process for data and information management (e.g. Migration to AWS and federated systems). While we expect no impact on the LUCAS data management the opportunity for improved data sharing and efficiencies will be lost.
	Upgrades to reporting products and making data available to others	No	Budget cuts cause a stop to upgrade reporting products and making data available to others (e.g. Publication of metrics to web portals). While we expect no impact on the LUCAS programme as we can supply data manually, there is a lot opportunity for improved data sharing and reduction in manual transactions.
QUALITY ASSURANCE	A Quality Control and Quality Assurance plan updated annually that support the collection and quality assurance of data to ensure the requirements of the LUCAS programme are met.	Yes	Plan will be delivered but modified to account for quality assurance components dropped due to funding
	Field Team composition standards met; DOC field teams will normally be comprised of five people and each team will have a skill set that includes at least the following: Fitness and back country experience, including 4 wheel drive (4WD), helicopter and boat travel experience; Botanical knowledge of New Zealand's	Maybe	Loss of skills staff is possible with cut to Tier 1 programme as current levels of staff retention over winter no longer affordable. This may affect recruitment in outyears and DOC's ability to meet existing team composition standards.

Phase	Deliverable	Continuation	Impact
	indigenous flora; Natural forest plot monitoring experience; and Leadership		
	Field Team composition standards met; All DOC field staff will have the following backcountry skills: High level of fitness, Experience walking off track, River safety skills. At least one member of each team will also have: High level of backcountry navigation skills; Four wheel drive ("4WD") training and experience (if needed); Competency in backcountry communications; Field emergency management competency	Yes	None
	DOC to undertake internal field audits of plots on a regular basis to the end of the season. An internal audit summary report will be produced, and results communicated to teams and MfE in a timely manner. Extra training/changes to teams/upgrades in support or equipment will be made as identified by internal audit.	No	While MFE audit programme will continue it is focussed only on Carbon data. Tier 1 Field audit will be discontinued due to budget cuts. This will impact biodiversity elements. Absence of a quality assurance programme means biodiversity data captured are of unknown quality. This is a reputational risk in organisations experiencing high rates of turnover of skilled staff
	A summary report of all internal audit results ("Internal Audit Summary Report") will be provided to MfE by 31 July each year;	No	Discontinuation of Field audit will mean this report cannot be delivered and biodiversity data captured are of unknown quality and MFE will have no evidence of DOC performance
	Field teams to perform QC/QA checks on plot sheets or EDC data before leaving plots using standardised checklists (Stage 1 checks);	Yes	None
	Field teams to conduct a final QC/QA check on plot sheets or EDC data before the end of each fieldtrip or block of work prior to sending original plot sheets back to DOC base (Stage 2 checks);	Yes	None
	Perform QC/QA checks on 10% of the plot sheets or EDC data to ensure compliance with DQS set in the LUCAS Manual (Stage 3	No	This level of checking will not be able to continue with budget cuts. Dropping means no

Phase	Deliverable	Continuation	Impact
	checks). Provide MFE a report detailing any issues or corrections will be collated and sent to team leaders who will be responsible for the quality of the on-plot data collection programme		auditing and reporting on quality of biodiversity data will occur. Confidence in the data reduce
TRAINING	Design, develop and implement annually a training programme that covers methods, design and quality assurance and control processes required for the LUCAS Measurement Programme	Yes	None
	Deliver a pre-season comprehensive field training course for all field staff before measuring any plots in the field	No	Cessation of this training due to budget cuts. While all new staff will be received training, existing staff will no longer receive Tier 1 and LUCAS Refresher Training or training with the auditor. As training field staff ensures consistency in interpretation and implementation of LUCAS methods and calibration between w teams the expected outcome is likely to be a reduction in data quality and failure to meet MFE LUCAS data quality standards.
	Complete Health and safety training for all field staff before measuring any plots in the field. Including; Outdoor first aid (where required); River safety; Four wheel drive ("4WD") training (where required); Communications and field emergency management; Helicopter safety; GPS and navigation; Driving behaviour and expectations; Boat safety skills (where required); Health and safety hazard and risk awareness training; Health and safety procedures training; Specialised field equipment training	Yes	None
	Complete data and information management training for all field staff before measuring any plots in the field.	No	Cessation of this training due to budget cuts. While all existing staff will know most of the

Phase	Deliverable	Continuation	Impact
			processes, new staff will not receive Tier 1 and LUCAS data and information management training, As training field staff ensures consistency in data and information management practices and processes the expected outcome is likely to be a reduction in data quality and failure to meet MFE LUCAS data quality standards.
FIELD PROGRAMME	Deliver the LUCAS Measurement Programme	Yes	None
ELECTRONIC DATA CAPTURE	Develop, trial and implement an EDC system	Yes	None
RISK MANAGEMENT	DOC to develop, implement and risk mitigation plan and provide to MFE each year. Plan must account for (but not be limited to) the following: Health and safety; Loss of skilled staff or contractors; Data loss through loss or damage; Audit failure, and Reduced quality of work over field season due to shorter winter days or poor weather conditions.	Yes	Plan will be delivered but modified to account for quality assurance components dropped due to funding
	To avoid or reduce the loss of skilled staff or contractors DOC to develop capability and succession plans that focus on a core staff of 50% with complementary skill sets.	No	Loss of skills staff is possible with cut to Tier 1 programme as current levels of staff retention over winter no longer affordable.
	To mitigate risk of data loss DOC will protect and back up information collected in the field ensure quality scanners are available at each DOC Base Office; Ensure each field base to have fireproof safe for temporary storage of plotsheets and these are used	Yes	None
	To avoid audit failure, DOC conduct internal plot-based and office-based audits, and ensure the result of these audits are communicated and acted upon	No	No longer able to manage this risk due to budget cuts. MFE audit programme will continue but is focussed only on Carbon data. Dropping of the Tier 1 Field audit means no

Phase	Deliverable	Continuation	Impact
			auditing and reporting on quality of biodiversity data will occur. Confidence in the data reduce.
	A detailed health and safety plan will be delivered annually, and DOC promptly notify MfE of any health and safety incidents that require a DOC investigation	Yes	None
LOGISITICS	DOC will organise and implement the logistical requirements for the project ensuring field teams are given logistical support to ensure safe and efficient field measurements in often potentially hazardous environments.	Yes	None
	DOC will ensure appropriate vehicles are used and are set up for this type of work, with the following where required: a full set of off-road recovery gear; and off-road mud terrain type tyres.	Yes	None
	DOC will supply equipment to field crews as specified in the LUCAS Manual	Yes	None

Appendix 2. Supplementary Information

About the programme

25. The Department of Conservation (DOC) implemented a national scale (Tier 1) programme to monitor and report on state and trends in New Zealand's terrestrial biodiversity in 2011[1]. The Tier 1 8-km-grid programme is designed to provide timely, unbiased information for reporting on status and trends in biodiversity across Public Conservation Land (PCL).

26. The Tier 1 network builds on the Ministry for Environment (MfE) Land-use Carbon Analysis System (LUCAS) natural forest plot measurement programme (NFPMP), in place since 2002 for reporting on carbon stock and change in NZ forests and shrublands.

27. The Tier 1 network expanded cover to include forests, shrublands and non-forested areas across PCL; and increased scope to include animal as well as vegetation measures.

28. DOC and MfE have worked together since 2011 as part of a central government collective initiative to complete the monitoring at approximately 1400 spread over a five and ten-year cycle.

29. As part of this collective action agreement DOC is funded by MFE to complete the LUCAS field programme for natural forests and shrublands. This funding offsets the overall cost of the department's own investment in the Tier 1 monitoring programme.

30. The commitments for the NFPMP programme and required deliverables are covered by a Memorandum of Understanding (MOU) and include the delivery of the NFPMP as well as implementation and ongoing delivery of an electronic data capture solution plus a range of other quality assurance components (Full detail in Appendix 1). The most recent MOU was signed in 2018 for a six-year term

Collective action benefits

31. Together DOC and MFE deliver monitoring and reporting on the state and trends in New Zealand's terrestrial biodiversity and carbon stock and change in NZ forests and shrublands for the sector.

32. Data and information from these two programme ensure New Zealand meet its mandatory national and international reporting commitments including; MfE/StatsNZ led production of Environment Aotearoa and Land Domain Reports; Convention on Biological Diversity Reports and New Zealand international climate change reporting requirements.

33. This work lead by DOC and MfE demonstrates that a system based on a national framework and design delivers significant benefits and far greater return on investment than separate or fragmented programmes.

[1] Approved business cases DOC-603738 and DOC-788375

Document 32

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22 April 2020

Sharon Alderson
Department of Conservation
salderson@doc.govt.nz
PO Box 10420
Wellington 6143

Dear Sharon,

Letter of support for the natural forest plot measurement programme

This letter reaffirms the Ministry for the Environment's (MfE) ongoing support of, and commitment to, the Land Use Carbon Analysis System (LUCAS) natural forest plot measurement programme (NFPMP) and the development and implementation of an electronic data capture solution. Both of these commitments fall within the Memorandum of Understanding between MfE and the Department of Conservation (DOC). This was signed in 2018 for a six year term.[1]

Current status of the 2019-2020 measurement programme

In response to the COVID-19 outbreak and the alert level 4 four national lockdown, all fieldwork has ceased for the current season. At the time fieldwork was halted 103 of the 113 plots scheduled for measurement had been completed. DOC and MfE are currently considering how best to redistribute measurement of the remaining plots in future seasons. Other parts of the work programme, such as data entry and quality assurance procedures should continue as set out in the MOU. Fieldwork for the 2020 – 2021 period is expected to resume next field season, providing there is a lowering of the alert status.

[1] The MOU defines the relationship between the LUCAS Measurement Programme and DOC's Tier One Programme. It involves DOC's measurement of the Year's 5-10 plots of the LUCAS pre-1990 measurement programme and the plots in the LUCAS post-1989 measurement programme. This measurement is taking place over the 2018/19, 2019/20, 2020/21, 2021/22, 2022/23 and 2023/24 field measurement seasons.

Ministry for the Environment
Manatū Mō Te Taiao

[redacted]

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Importance of the MOU and the associated measurement programme

The NFPMP allows New Zealand to meet its mandatory international climate change reporting requirements. Measurement of forests is required to obtain accurate estimates of carbon stock and stock change as the natural forest estate changes through time. This information allows us to track progress against our international climate change targets under the Kyoto Protocol, and its successor, the Paris Agreement.

Collaborating with DOC is a mutually beneficial relationship and contributes to your ongoing commitment to monitoring the status and trend in terrestrial biodiversity across conservation land with the Tier One Programme. This relationship is especially important in light of the Parliamentary Commissioner for the Environment's (PCE) report on New Zealand's environmental reporting system. This report highlighted how 'huge' gaps in data and knowledge undermine our stewardship of the environment and called for concerted action to improve the system. The NFPMP is a clear example of addressing this data gap for one of New Zealand's most extensive land-use types – natural forests.

The PCE's report further highlighted New Zealand's lack of consistent, authoritative time-series data and comprehensive spatial coverage. The NFPMP is a rare and valuable example of a programme that fulfils these deficiencies in that it is an unbiased systematic random sample of New Zealand's natural forests and has been ongoing since 2002. Such programmes are vitally important in their ability to detect real trends over appropriate timescales and need ongoing support.

Integrating the Tier One and LUCAS programmes is a joined-up approach that provides optimal efficiency and recognises the interconnected nature of our ecosystems and environment. Collecting information on both carbon and biodiversity (including vegetation, birds and pest mammals) increases the value and use of the data and ultimately provides a more comprehensive understanding of how our natural environment is changing through time.

The data collected in the NFPMP are also used widely across government including within our own Division in informing policy development for the Zero Carbon Act and the 2050 target. MfE's environmental reporting programme utilises the data collected under this programme and helps us to fulfil our important obligations under the Environmental Reporting Act (2015). The Ministry for Primary Industries (MPI) uses the data in its international and domestic forestry policy work. The data are also used for meeting the requirements of other international treaties including the Montreal Process, the United Nations Forest Resource Assessment and the Convention on Biological Diversity. Data collected within this programme are also used in the environmental-economic accounts that are compiled and published by Statistics New Zealand. The data forms part of a highly valuable, publically available dataset which is used by scientists in New Zealand and abroad for biodiversity and climate-related science.

Ministry for the Environment
Manatū Mō Te Taiao

[redacted]

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An important shift to electronic data capture

Currently data collected in the field is recorded on paper sheets and then transcribed into an electronic database at a later date. The plan for phased implementation of an in-field electronic data capture (EDC) starting 2020-2021 season is a significant innovation that is highly desirable to MfE and is a commitment stipulated within the MOU. EDC provides increased data quality, faster data delivery, and significant cost efficiencies. MfE continues to strongly support this innovative aspect of the MOU and views it as vital in our collective drive for operational efficiency and the highest standards of data quality.

Kind regards,

s.9(2)(a)

Roger Lincoln
Director Climate Change
Ministry for the Environment

Daniel Ohs

From: Martin Kessick
Sent: Sunday, 19 July 2020 5:37 pm
To: Lou Sanson
Cc: Michael Slater; Ken Hughey
Subject: Monitoring Meeting
Attachments: Tier 1 Monitoring Programme - DOC-6364412.pptx

Kia ora Lou,

Set out below is a frame for us to have the Monitoring discussion tomorrow at 1pm (there is too much to expect you to read this in advance but I can readily take you through it. Mike & Ken have had some exposure to the attachments).

As we discussed at my MOR last week (and your additional email questions), I've tried to set out the following:

1. Our investment & strategy for each of T1, T2 & T3 monitoring.
2. Our pathway to make all of those programmes more sustainable (less carbon intensive).
3. How we are aligning ourselves with MfE (strategy, funding & implementation).

1. Tier 1, 2 & 3

There is a set of three slides in the attachment to this email.

Slide 1 (the bar graph) shows; **Black bars** - the level of investment requested in the original business case to deliver the Tier 1 monitoring programme as part of the wider National Biodiversity Monitoring System (NBMS) & **Green bars** – the actual investment made. Both bars show total Opex combined across Biodiversity & Operations Groups. The gap between expected and actual investment has meant that some of the supporting infrastructure has not been developed and that manual processes are still needed for elements of data management, training, reporting etc. The recent maturity assessment conducted to support a task in the Budget 2018 business case also confirms this remains a gap for the programme as well as highlighting the absence of investment for the marine and freshwater domains.

You'll see that over the past three years we have been able to reduce our Monitoring costs by approx. $400k – 500k on average per year.

Slide 2 (the A3 scenarios page) presents the three options we have been working on for the Tier 1 programme for delivery in the 2020/21 FY. We can discuss these scenarios at our meeting including an assessment of the critical issues in all.

In relation to costs across all monitoring the team have been able to extract the following (*Noting that not all monitoring is nationally managed and readily identified through BPRS).*

Monitoring type	Definition	Actual cost
Tier 1	*Assuming preferred scenario*	$4.6m
Tier 2	Tiakina Nga Manu Save Our Iconic Kiwi	$1.9m $0.5m
Tier 3	Waitutu, Eglinton, Arawai Kakariki, Marine Sentinel	$1.03 m
TOTAL		$8.03

The NBMS articulates Tier 3 monitoring as providing the research, methodological development and long-term monitoring of biodiversity at key reference sites representative of the ecological diversity of New Zealand. The following long term projects are considered to be Tier 3 monitoring :

Project	Description/purpose	Lead Scientist	Publications/knowledge transfer
Eglinton	Long-term investigation of impacts of pest control within beech forest on suit of species and habitats.	Colin O'Donnell and Terry Greene.	Lengthy list of peer reviewed external publications and presentations with a long list of potential publications
Waitutu	Long-term investigation of pest control within mixed beech podocarp forest and the effects on forest processes, pest populations and bird species.	Terry Greene, Elaine Wright with significant contributions from LCR, Cambridge University and Institute of Ecosystem Studies science staff.	Published external publications (particularly on forest dynamics work), impacts of aerial 1080 application, quarterly summary reports, presentations to stakeholders including significant investment from NHF and SILNA. Further publications in draft.
Waipapa EA	Long term monitoring of pest control impacts on specific keystone species (NI kaka and kereru) within virgin podocarp forest.	Terry Greene	Publications over many years relating to bird populations (robins, tomtits, kaka, kokako, etc.), forest dynamics relative to logging regimes. Associated presentations, media articles
Seed Rain	Nationally significant monitoring programme quantifying significant system drivers within mast dominated forest and grassland systems.	Elaine Wright with significant contributions from LCR and NIWA science staff	Key covariate within predictive models to explain pest dynamics and consequent impacts on native species. Expansion of programme into indirect measures using remote sensing
Nelson Lakes	Long-term monitoring programme of pest control impacts within a honeydew beech forest.	Graeme Elliott & Kerry B own	External publications on efficacy impact of pest control regimes on bird populations and particularly kaka populations.
Murchison Mountains	Long term monitoring of an Alpine system for endangered takahe and more latterly kea, rock wren and lizards	Andrew Digby, Kerry Weston, Jo Monks	Long list of publications on ecology of takahe and pest management within this system. Publications of rock wren and lizards. Many presentations to stakeholders, sponsors, etc.
Arawai Kakariki	Significant national freshwater monitoring programme establishing baselines for water quality, effectiveness of pest control (weeds, fish, mammals, etc.) and species population dynamics.	Hugh Robertson (Nelson)	13 years of data and increasing number of publications, presentations both within and external to DOC.

2. <u>A More Sustainable Monitoring Programme</u>

Slide 3 (list of improvement work): outlines work in progress at various stages.

- Exploring and designing – early stages of scoping research or work tasks
- Developing – moving to detailed design
- Implementing – including supporting business process documentation and SPA agreed

ICT Strategy alignment will be reviewed during 20/21 for existing work and as four-year plans are developed. This will primarily be through the workstreams:

- Remote sensing and monitoring
- Data and Insights
- Sharon has initiated further discussion of eDNA with Mike Bunce, Chief Scientist at EPA
- Drones will be specifically addressed in the early work of the remote sensing and monitoring workstream under ICT Strategy. This workstream will also consider carbon reduction potential.
- I also met with Qrious, an AI/Machine Learning company who have designed an automated Kokako & Kiwi call system which has processed thirty years of manually recorded data.

In relation to your question about all monitoring under one Director:

- Currently the DOC National Biodiversity Monitoring System is led from PSU (Sharon).
- The work is delivered as an end-to-end process involving MIS, D&E and BM teams. The field delivery component of the National Monitoring Programme (Tier 1) and Results Monitoring (Tier 2) for TNM are delivered by the Biodiversity Monitoring Team (BMT) currently reporting to Jo MacPherson, National Operations.
- BMT also delivers the field component of other local monitoring work when requested by Regional Operations, as capacity permits.

3. Alignment with MfE

- I am meeting fortnightly with Natasha Lewis at MfE to discuss joint monitoring system design (most recently last Friday where we discussed common measures for J4N outcomes as well as resurrecting our trip to Chch to engage Environment Canterbury in our process. *Note* – 9(2)(g)(i) [redacted]
- Sharon is meeting with MfE Director Neil Hurley the 17 July to discuss how to collaborate on the Environmental Monitoring & Reporting System **(EMRS) led by MfE**. The latest update from MfE is "*While the proposal is on-hold, we are working through how to progress based on existing baseline funding and partnerships between agencies."* Biodiversity monitoring in terrestrial, freshwater and marine domains is expected to be a component of the EMRS
- DOC continues to actively work with MfE on contributions to the Environmental Domain Reports. Our current focus is on providing data and information for the **"Our Land 2021" Report** (an Environmental Monitoring output). Consistent with previous years, this includes supplying a range of DOC datasets from the Tier 1 programme, rare ecosystems and protected area spatial data, NZ threat classification, booking system, concessions, activity counter programme, social surveys e.g. Great walks, Short Walks etc.
- Sharon and Elaine are also working with StatsNZ and all other government agencies on the **Data Investment Plan (DIP).** This plan is focused on essential data assets of strategic importance. The DIP aims to identify where investment in essential data assets is needed to yield the greatest value for New Zealand. The plan will develop a stocktake of New Zealand's essential data assets positioned within a framework of enduring information needs covering New Zealand society, economy and environment as well as consideration of NZ in a global context, underlying infrastructure and analysis undertaken to develop insights.
- Sharon will also meet with LINZ next week to ensure alignment on monitoring work across agencies.

Both Mike & I (Mike in particular) need to move forward with recruitment. It would be good if we could identify next steps tomorrow so that we get started with improving this year's Tier 1 monitoring programme.

Regards

Martin Kessick (he/him)
Deputy Director-General, Biodiversity— *Tumuaki Kāhui Kanorau Koiora*
Department of Conservation—*Te Papa Atawhai*
M: s.9(2)(a) [redacted]

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Scenarios for T1 monitoring programme for the next 12 months

Scenarios Considered	Utility of Data rating to meet DOC ,MFE, AOG Requirements	Value/Benefit Proposition	Opportunities this provides	Total Cost for Delivery + Investment Required	Context / Key Critical Issues
Full Programme: T1 and LUCAS **PLOTS** **ANI=330 (100%)** **VEG=290 (100%)**	DOC ★★★ AOG ★★★	DOC Annual Report Annual Report Dashboard AOG commitments International reporting (CBD, IPCC) MFE Land Domain Report DOC Biodiversity WĀNANGA Pathway Biodiversity Strategy NPS on Biodiversity	Systems improvement Capability and Development Framework Better programme management EDC investment now to secure savings in outyears	**TOTAL** **$5.8M** **COST PRESSURE/ ADDITIONAL INVESTMENT** **$1.2M**	**CONTEXT** • COVID lockdown and potential constraints on programme delivery required a rethink about what is possible for the delivery of the 2020-2021 Tier 1 and LUCAS Programme • Created opportunity to reassess and align the Tier 1 annual plan with DOC Biodiversity WĀNANGA Pathway • Drove consideration of the requirements Operations have for the delivery of the programme • Analysis of constraints, requirements, risk and benefits completed • Response=3 potential scenarios selected for consideration post covid • For each the change, benefits, opportunities, resources required, and critical issues are detailed **CRITICAL ISSUES - Delivery** • Recruitment freeze & delays in approvals causing significant challenge for implementation. 9(2)(g)(i) [redacted] • Reduced time for programme of work for BMT will require some outsourcing to complete delivery. 9(2)(g)(i) [redacted] **CRITICAL ISSUES – Data Utility** • Implications of a change in sample size and cycle of remeasurement has long-term implications for programme • Reduce sample size to meet current constraints limit utility of data for DOC and AOG • Redesign of plot cycle would require agreement from stakeholders **CRITICAL ISSUES– Operating /Structure/Systems** • Programme faced pressure prior to COVID-19 with 30% of core team roles vacant • Programme delays prior to lockdown due to extreme weather conditions in 19/20. • Field operating model heavily reliant on temporary staff and contractors • High turnover of staff, loss of core capacity and skills and increased health and safety risks • COVID-19 lockdown resulted in early termination of the summer field season • COVID-19 situation has reduced productivity and caused delays. • Programme end of season BAU work 1 to 2 months behind schedule • Core capacity insufficient to complete the end of season BAU work **and** begin pre-season preparation for 20/21 **and** implement EDC , Database and systems improvements and the Capability and Development Framework
Full Programme: T1 and LUCAS *with* Delayed Start *and* Modified Delivery Model **PLOTS** **ANI=330 (100%)** **VEG=290 (100%)**	DOC ★★★ AOG ★★★	DOC Annual Report Annual Report Dashboard AOG commitments International reporting (CBD, IPCC) MFE Land Domain Report DOC Biodiversity WĀNANGA Pathway Biodiversity Strategy NPS on Biodiversity	Systems improvement (reduced due to time) Capability and Development Framework Better programme management EDC investment now to secure savings in outyears Testing alternate models (Outsourcing/working with others)	**CURRENT** **$4.6M** **COST PRESSURE/ ADDITIONAL INVESTMENT** **$0**	
Minimal Viable Product: LUCAS Programme only **PLOTS** **ANI=0 (0%)** **VEG=130 (45%)**	DOC ★ AOG ★★	~~DOC Annual Report~~ ~~AOG commitments~~ ~~Annual Report Dashboard~~ ~~MFE Land Domain Report~~ International reporting ~~(CBD,~~ IPCC) ~~DOC Biodiversity WĀNANGA Pathway Biodiversity Strategy NPS on Biodiversity~~	~~Systems improvement Capability and Development Framework~~ ~~Better programme management~~ EDC investment now to secure savings in outyears	**TOTAL** **$2.5M** **CURRENT** **$4.6M** **COST PRESSURE/ ADDITIONAL INVESTMENT =** **$-2.1M**	






Monitoring Improvement Work - New Tools and maintenance of existing investment

Exploring and Designing

Improving engagement through understanding human impacts

- Signage
- Anthropogenic noise pollution
- Anthropogenic light pollution
- Wildlife interaction - Marine mammal tourism app
- Human waste contamination tool

Visitor Safety

- Tracking of individual GW customers (Whanganui Journey)

Supporting Innovation using remote sensing tools

- National beech flowering layer
- Dominant canopy species composition/canopy health
- Tahr monitoring
- Seabird monitoring
- Surveillance cameras
- GNSS tracking of concessionaires' aircraft, jetboats, watertaxis, snowmobiles, etcRecruiting visitor feedback respondents

Calibration and validation of monitoring methods

- Bird counts
- Possums indices
- eDNA
- Human waste contamination
- Anthropogenic light pollution
- Tranquillity Mapping

Increasing Trust Transparency & Collaboration

- Proactive engagement with external organisations e.g. AUT, LCR, University of Otago, University of Canterbury, PennState University, US National Parks Service, Herbarium Networks etc.

Improving Understanding

- Statistical exploration to support policy & work programmes

Integrated Biodiversity Data and Information Management System

- Master Data
- Planning and Reporting
- Data and Sample Management
- Biodiversity Monitoring Databases
- Web Interfaces
- Biodiversity Data Services
- Biodiversity Electronic Data Capture
- Reporting and Visualisation
- Published standards

Developing

Ecosystem Performance

- Designing scalable ecological monitoring and evaluation programmes
- Selection of indicators and monitoring methods to report on ecological integrity

Improving Engagement

- Designing scalable social/visitor monitoring and evaluation programmes
- Enhanced visitor feedback system for safety & experience quality

Growing capability for monitoring programmes

- Capability and Development framework
- Recruitment strategy
- Learning/training framework
- Develop/refine curriculum design
- Database system

Development and improvement of frameworks tools methods and spatial data se

- Rare ecosystems
- Climate change adaptation modelling
- Outcomes Monitoring Framework
- Monitoring toolbox

Statistical capability and capacity

- Teaching and advice

Tools to assess human impacts

- Soundscape/tranquillity
- Marine and FW vessel impacts
- Carbon footprint
- Nightscape quality

Supporting innovation using remote sensing tools

- National beech flowering layer
- Dominant canopy species co position/canopy health
- Tahr monitoring
- Seabird monitoring
- Weather sensit y of visitation (activity counter & NIWA data)

Supporting innovation using acoustic Tools

- Automated processing (VUW)
- Density estimation
- App cat o for landscape-scale monitoring (TNM, EMU/SMU)
- Noise propagation (AEDT, NMSim)

ncre sing trust and transparency and utility of data and information

- Develop composite indicators
- Contribute to MfE/StatsNZ Domain reporting – Land
- Data Investment Plan StatsNZ
- Streamline access to vegetation data – NVS
- Peer review publications
- National vegetation reports
- Expanding suite of technical fact sheets

Integrated Biodiversity Data and Information Management System

- Master Data system for Tier 1
- Web Interfaces for TNM and Tier 1
- Biodiversity Data Services – Data available online or download/automated data request process
- Published standards – Information management plans available online
- Migration of historic data to secure information
- Data Management – processing and storage system for Tier 1 acoustic data

Implementing

Ecosystem Performance

- Implementing/maintaining scalable ecological monitoring and evaluation programmes

Improving Engagement

- Implement g/ or maintaining scalable social/visitor monitoring and evaluati n rogrammes

Evaluat on and reporting on

- S fety messaging
- Visitor product portfolios
- Interpretation Rangers programme
- Marine mammal/reserve compliance training programme
- Status and trends in ecological indicators
- Long-term data sets – Eglinton, Waitutu, Waipapa kaka, Seed rain

Innovative remote sensing tools

- Wilding conifers

Increasing profile and value of existing investment through

Maintenance of

- National spatial data sets
- Technical fact sheets – Annual report
- Plot Level Reports
- Annual report indictor dashboard

Integrated Biodiversity Data and Information Management System

- LUCAS Electronic Data Capture
- Migration of to SQL

Department of Conservation
Te Papa Atawhai

Document 35

File Ref DOC-6607843

Date: 24 March 2021

To: Michelle Crowell

CC: Sharon Alderson, Ben Reddiex, Mike Perry

From: Meredith Mckay and Elaine Wright

Subject: National Biodiversity Monitoring System –*Business planning preparation for Tier 1 Terrestrial Monitoring programme 2021-2022*

Contents

Purpose

1. To provide information on costs, options and impacts for delivery of the LUCAS and Tier 1 terrestrial monitoring programme in anticipation of reduced financial planning levels for the 2021-2022 season.

Task Assignment

2. Task assignment - Task assignment - Pre- Business planning Tier 1 terrestrial DOC-6607794
3. Business planning for 2021/2022 is due to start this month, once financial planning levels have been confirmed by SLT.
4. The current year's programme was reduced in scope and scale due to a 10% reduction in the programmes operating budget than in previous years. In early 2021, both business groups forecast significant overspends and adjusted planned actions for the remainder of the year to balance the programme budget.
5. Sharon's expectation is that for 2021/2022 we clearly document and agree how the DOC allocation and MFE revenue are split between Planning & Support and the Biodiversity Monitoring team, and how many plots of different types will be delivered for the agreed expenditure
6. High level work now on the cost to deliver various options for the Tier 1 terrestrial monitoring programme will be valuable for both business groups as business planning discussions are ramping up.
7. Advise the number of Tier 1 terrestrial plots (LUCAS, Tier 1 Veg & LUCAS, Animal) that would be delivered under 3 hypothetical scenarios. Describe the impact on the department and other sector users (e.g. MfE State of Environment) for each scenario.
8. Include a new Scenario 1a whereby the MFE MOU commitments are met by adjust MfE revenue split.

Context

9. Reinstatement of the $500K for the 2021-2022 is unlikely
10. This represents a sustained change to resourcing rather than a one off. A change of resourcing to this extent in a designed programme is significant as the frequency and intensity of sampling effort is implicated.
11. In 2019 advice was provided to DDG Biodiversity, Chief Science Advisor and DG recommending no change to the frequency and intensity of sampling on the basis of research commissioned from MWLCR using the data generated from the programme to date

Task 1 –Current state of NMRS Tier 1 Programme finances

Current state of investment

12. In 2020-2021 the FPL received was $4.55M but after BP, the Director General reduced this by $500K to $4.05M. See Table 1.
13. This reduction was communicated as a one-off for the 2020-2021 season.
14. Programme delivery was reduced in response to this – see DOC-6294441.
15. LUCAS revenue of $0.9 M is received for delivery of LUCAS plots and a new expectation of EDC implementation. Delays in the EDC project start up and the need to deliver on agreed MOU milestones more of the revenue in 2020-2021 was diverted to offset costs of EDC than planned.
16. Total resourcing for LUCAS and Tier 1 programmes for 2020-2021 including implementation of EDC are provided in Table 2

Table 1. FPL pre and post budget reduction 2020-2021 (including Salaries)

Group	Operations	Bio group		TOTAL
Team	BMT	MIST	D&E	
DOC FPL	$3.2M	$1.1	$0.25	$4.55M
DOC CUT FPL	$2.8M	$1.0	$0.25	$4.05M

Table 2. Revised DOC FPL and LUCAS revenue 2020-2021 (including Salaries)

Group	Operations	Bio group		TOTAL
Team	BMT	MIST	D&E	
DOC CUT FPL	$2.8M	$1.0M	$0.25M	$4.05M
MFE LUCAS REV	$0.25M	$0.65M	$0	$0.9M
TOTAL $	$3.05M	$1.65M	$0.25M	$4.95M

Task 2 – Options for 2021-2022 NMRS Tier 1 Programme

Context

17. We have reviewed costs versus funding and provided options for delivery of Tier 1 terrestrial monitoring programme for next year under three hypothetical scenarios:

Scenario 1	The new reduced $500K baseline FPL	2021-2022 DOC budget allocation stays the same, MFE revenue is as expected
Scenario 1b	The new reduced $500K baseline FPL	2021-2022 DOC budget allocation stays the same, MFE revenue is as expected but the split of revenue between Biodiversity Group and Operations is modified from $390K and $590K to $440K and $540K respectively so the MFE MOU commitments can be delivered
Scenario 2	A further 10% reduction of FPL	2021-2022 DOC budget allocation is reduced by 10%, MFE revenue is as expected
Scenario 3	10% increase on 2020-2021 FPL	2020-2021 DOC budget allocation increased by 10% noting that this is not back to 2019-2020 levels, MFE revenue is as expected

18. See Table 7 for Number of Tier 1 terrestrial plots (LUCAS, Tier 1 Veg and Tier 1 Animal) that would be delivered under each scenario
19. See table 8 for Summary of DOC FPL and LUCAS revenue for each scenario.
20. See table 9 for Programme Deliverables and Impacts Summary for each scenario
21. Detailed summary of scenarios 1-3 are below.
22. These are estimates as detailed bottom up costings and exact plot numbers are still in progress.

Scenario 1: Reduced $500K baseline FPL plus MFE revenue

23. With the reduction in $500K to the baseline FPL the full Tier 1 terrestrial monitoring programme cannot be delivered.
24. With Scenario 1 levels of investment we can;

COMPLETE

1) LUCAS programme
    a. measurement of LUCAS **vegetation** plots at woody sites (includes private land and subset of Tier 1 sites)
    b. continue with implementation of EDC
2) The full suite of Tier 1 **vegetation** and **animal** measures at non-woody sites on PCL
3) Only the Tier 1 **animal** measures at woody sites on PCL
4) All processing of data, samples and acoustic records

STOP or DROP;

5) DROP Tier 1 **vegetation** at woody sites on PCL

6) DROP elements of the Carbon Monitoring methods on Tier 1 only sites (e.g. Tree Heights and Coarse Woody Debris).
7) STOP Quality Assurance elements of the programme (e.g. Refresher Training, Field audits)
8) STOP upgrades to systems/process for data and information management
9) DROP upgrades to reporting products and making data available to others

Table 3. Number of Tier 1 terrestrial plots (LUCAS, Tier 1 Veg & Animal) that would be delivered under scenario 1

LUCAS & Tier 1 Terrestrial Monitoring Programme 2021-2022#			
Scenario 1	**MFE LUCAS**	**DOC Tier 1**	
	Vegetation (Private & PCL)	**Tier 1Vegetation**	**Tier 1 Animal**
Full Programme	120	290	290
Reduced 500K FPL	120	210	290
Difference	0	-80	0

#Plot numbers are estimated as final plot lists for Tier 1 and LUCAS are not available yet.

Scenario 1: Impacts

Impact on internal and external commitments and risks for DOC with this scenario are;

25. **DOC**

- The loss of **vegetation** measures on another 80 Forest plots this year and failure to systematically measure the sites pushes the cost burden into out years.
- Reduction in the number of sites measured introduces bias and impacts estimates in areas of under sampling; quality of outputs affected by loss of precision, inference, and timely access to data for reporting on trends in vegetation impacts across relevant NZ-wide scale.
- Dropping of the quality assurance components of the programme such as Field audits erodes internal and external confidence in the data and opportunities to shape future training based on observation of staff practices. Absence of a quality assurance programme means biodiversity data captured are of unknown quality.
- 9(2)(g)(i) [redacted]
- Data to support park level reporting for internal decision making and to support external engagement (e.g. Ministerial briefing on Ungulate pressure in NI Forests and successful budget bid for fund for management) no longer possible. A reduced programme has significant implications for contributions to reporting and decision making.

26. **MFE**

- Commitments to quality assurance of data collected under MOU with MFE will not be met; Field Audit, Training and adequate data and information management.
- Reputational risks for DOC as reduced investment counter to sector needs and commitments

27. **MFE/Stats NZ**; DOC is responsible for the production of a number of the national Tier 1 statistics agreed by Cabinet in 2016 which the programme deliver for DOC. There are significant implications for future MfE Land Domain Report and periodic Biodiversity Reports; Stats NZ Data Investment Plan focused on essential data assets for NZ;

28. **ANZBS and EMRS**; Reputational risk for DOC as Tier 1 terrestrial programme is the foundational programme for ANZBS and EMRS to monitor and report on the state of New Zealand's biodiversity. Tier 1 provides underpinning data and the core skills and capability to support implementation of both programmes.

29. **PCE**; Reputational risks for DOC as reduced investment counter to PCE support for the programme "a ground-breaking, systematic sampling programme for all public conservation land" and without this network of sites and associated datasets, management of the risk of forest dieback would be nearly impossible

30. **NZCA;** Last year the NZCA requested that the DG invest in and grow this programme in a letter to Lou Sanson. The reduced investment is a reputational risk with the NZCA.

31. **Regional Councils:** Auckland and Greater Wellington have integrated programmes that parallel DOC and share data and outputs for reporting on performance at regional and national scales. Both councils reporting commitments would be impacted if DOC stop or scale back this programme.

32. **State Services Commission; Performance Improvement Framework (PIF);** Design and implementation of the programme was completed to address key performance issues raised by the SSC PiF programme In follow up report in 2010 DOC reported on the implementation of Tier 1; "the department is undergoing transformational change. Our extensive programme includes internationally ground-breaking work in the monitoring and assessment of the health of New Zealand's unique plants and wildlife". This was noted by SSC with further advice that "DOC were required to be an active participant in providing impact data to contribute to improved environmental reporting. This has been achieved by the implementation and ongoing investment in the programme and as a result the 2016 follow up review found that "DOC has established capability in this regard but further work and capacity is required to make this a reality". Stopping or scaling back is a risk that DOC will fail to meet SCC expectations and sector commitments.

Scenario 1b: Reduced $500K baseline FPL and MFE revenue but split of revenue modified

33. Same as scenario 1 but the split of revenue between Biodiversity Group and Operations is modified from $390K and $590K to $440K and $540K respectively so the MFE MOU commitments can be delivered.

34. With Scenario 1b levels of investment and revenue split we can;

COMPLETE

1) Same as Scenario 1 BUT Drop 10-20 Tier 1- ANI woody sites on PCL OR find other savings in BMT to account for $150K less funding
2) RESTART Quality Assurance elements of the programme (e.g. Refresher Training, Field audits)

STOP or DROP;

1) DROP Tier 1 **animal** at 10-20 woody sites on PCL
2) DROP Tier 1 **vegetation** at woody sites on PCL
3) DROP elements of the Carbon Monitoring methods on Tier 1 only sites (e.g. Tree Heights and Coarse Woody Debris).
4) STOP upgrades to systems/process for data and information management
5) DROP upgrades to reporting products and making data available to others

Table 4. Number of Tier 1 terrestrial plots (LUCAS, Tier 1 Veg & Animal) that would be delivered under scenario 1b

LUCAS & Tier 1 Terrestrial Monitoring Programme 2021-2022#			
Scenario 1	**MFE LUCAS**	**DOC Tier 1**	
	Vegetation (Private & PCL)	**Tier 1Vegetation**	**Tier 1 Animal**
Full Programme	120	290	290
Reduced 500K FPL	120	210	~270
Difference	0	-80	-20

#Plot numbers are estimated as final plot lists for Tier 1 and LUCAS are not available yet.

Scenario 1b: Impacts

35. The same impacts outlined in scenario 1 but in this scenario, we have mitigated some risk as the MFE MOU commitments are made; Quality assurance of data collected under MOU with MFE via Field Audit and Training and adequate data and information management.

Scenario 2: A further 10% reduction of FPL and MFE revenue

36. With the previous reduction of 500K and an additional 10% reduction, the full Tier 1 terrestrial monitoring programme cannot be delivered.

37. With Scenario 2 levels of investment we can

COMPLETE

3) 1 & 2 as per Scenario 1 but DROP 3 and REDUCE 4

STOP or DROP;

1) STOP or DROP all elements in Scenario 1 PLUS
2) DROP Tier 1 **vegetation** & **animal** measures at all woody sites on PCL
3) STOP all processing of acoustic records and national reporting of nocturnal birds

Table 5. Number of Tier 1 terrestrial plots (LUCAS, Tier 1 Veg & Animal) that would be delivered under scenario 2

LUCAS & Tier 1 Terrestrial Monitoring Programme 2021-2022#			
Scenario 2	**MFE LUCAS**	**DOC Tier 1**	
	Vegetation (Private & PCL)	**Tier 1Vegetation**	**Tier 1 Animal**
Full Programme	120	290	290
Further 10% reduction of FPL	120	210	210
Difference	0	-80	-80

#Plot numbers are estimated as final plot lists for Tier 1 and LUCAS are not available yet.

Scenario 2: Impacts

In addition to the impacts outlined in scenario 1, the impact on internal and external commitments and risks for DOC with this scenario are;

38. **DOC**

- The loss of both **vegetation and animal** measures on Forest plots impacts the department's ability to report on status and trends in occupancy and relative abundance of ungulates in woody ecosystems and cost burden into out years is further increased.
- This programme will no longer able to process acoustic records and provide independent information on Kiwi distribution to SOIK and other programmes w th DOC.
- Reduced programme of this scale will lead to a significant loss of skills sta f from the programme (BMT most impacted). Other core programme in DOC depend on these stills including Tiakina Ngā Manu, Save our Iconic Kiwi and Tier 2 Monitoring programme.
- While redundancies are not expected, at this reduced level of investment, redeployment of some permanent staff may be needed.
- Stopping investment and support for the underpinning system will impact others in DOC including TNM who are dependent on this for data capture maintenance to support decision making.

39. **Research sector**

- DOC have agreed to support at a minimum of two MBIE endeavour bids specifying a dependency on access and use of data collected as part of the Tier 1 terrestrial monitoring programme.

Scenario 3: 10% increase on 2020-2021 FPL and MFE revenue

40. A 10% increase in FPL from last year; 4.45M, does not return the programme investment back to 2020-2021 level of 4.55M and the full Tier 1 terrestrial monitoring programme cannot be delivered.

41. With Scenario 3 levels of investment we can deliver;

COMPLETE

1) 1-4 as per Scenario 1 BUT bring back in the Quality Assurance and some upgrade elements back into the programme;
2) RESTART Quality Assurance elements of the programme (e.g. Refresher Training, Field audits)
3) RESTART upgrades to systems/process for data and information management
4) START upgrades to reporting products and making data available to others

STOP or DROP -

1) STILL DROP some measurements and elements of the methods
2) DROP Tier 1 vegetation at woody sites on PCL
3) DROP components of methods (e.g. Tree Heights and Coarse Woody Debris).

Table 6. Number of Tier 1 terrestrial plots (LUCAS, Tier 1 Veg & Animal) that would be delivered under scenario 3

LUCAS & Tier 1 Terrestrial Monitoring Programme 2021-2022#		
Scenario 3	**MFE LUCAS**	**DOC Tier 1**

	Vegetation (Private & PCL)	Tier 1Vegetation	Tier 1 Animal
Full Programme	120	290	290
10% increase on 20-21 FPL	120	210	290
Difference	0	-80	0

#Plot numbers are estimated as final plot lists for Tier 1 and LUCAS are not available yet.

Scenario 3: Impacts

DOC/MFE; Impact on internal departmental commitments and dependencies as well as other sector users are the same as in Scenario 1 but the risks to data quality and commitments to MFE are mitigated.

Opportunities

42. Strategic alignment with other programmes and organisation objectives is critical for the success of the programme.

43. We see an opportunity within Scenarios 1 and 3 to align our current research with the Remote Monitoring and Technology workstream and Sustainability Strategy and Action Plan. We believe there is an excellent opportunity for the programme to lead the work to investigate software solutions to improve logistics and heli operating that would reduce our carbon footprint.

44. Early scoping of other sector solutions (e.g. forestry, oil, fire) show route optimization algorithms can aid planning and testing of heli routes to minimize time/costs and drones can be used for advance assessment to plan more efficient routes.

Appendix

Deliverables Summary table

Table 7. Number of Tier 1 terrestrial plots (LUCAS, Tier 1 Veg and Tier 1 Animal) that would be delivered under each scenario and rapid assessment and quality score for what each scenario could.

LUCAS & Tier 1 Terrestrial Monitoring Programme 2021-2022				
Scenarios	Plots/Deliverables			Quality*
	MFE LUCAS	DOC Tier 1		
	Vegetation	Tier 1 Vegetation	Tier 1 Animal	LUCAS and Tier 1
Scenario 1	120	210	290	Medium
Scenario 1b	120	210	~270	Medium+
Scenario 2	120	210	210	Low
Scenario 3	120	210	290	High

*A rapid assessment and ranking (low to high) of the relative quality of programme delivery for the full suite of components and elements including Number of plots, Capability and Capacity Retention, Quality Assurance Framework, Data & Information Management, Analysis and Reporting objectives.

Financial Summary table

Table 8. Summary of DOC FPL and LUCAS revenue for each scenario (including Salaries)

Scenarios	BMT		MIST		D&E		Total
	FPL	MFE LUCAS REVENUE*	FPL	MFE LUCAS REVENUE *	FPL	MFE LUCAS REVENUE	
Scenario 1	$2,800,000	$ 590,000	$1,000,000	$390,000	$250,000	$0	$5,030,000
Scenario 1b	$2,800,000	$ 440,000	$1,000,000	$540,000	$250,000	$0	$5,030,000
Scenario 2	$2,545,455	$590,000	$909,091	$390,000	$227,273	$0	$4,661,818
Scenario 3	$3,080,000	$590,000	$1,100,000	$390,000	$275,000	$0	$5,435,000

*$200K of LUCAS revenue is dedicated to EDC and remainder shared between BMT and MIST

Scenarios Summary table

Table 9. Summary of costs, deliverables, impacts and benefits of each scenario

Programme Component	Elements			Scenario 2 10% reduction + MFE revenue			Scenario 1 New reduced $500K baseline + MFE revenue			Scenario 1b Scenario 1 but MFE revenue but split vary to meet MOU QA commitment			Scenario 3 10% increase + MFE revenue		
DOC Funding	BMT	MIST	D&E	$2,54M	$900K	$227K	$2,80M	$1,0M	$250K	$2,80M	$1,0M	$250K	$3,08M	$1,1M	$275K
Revenue				$590K	$390K	0	$590K	$390K	0	$440K	$540K	0	$590K	$390K	0
Total	Funding Totals			**$4,661,818**			**$5,030,000**			**$5,030,000**			**$5,435,000**		
Fieldwork	LUCAS plots		120	✓			✓			✓			✓		
Fieldwork	LUCAS Implementation of EDC			✓			✓			✓			✓		
Fieldwork	Tier 1- **ANI** non-woody sites on PCL		130	✓			✓			✓			✓		
Fieldwork	Tier 1- **VEGE** non-woody sites on PCL		130	✓			✓			✓			✓		
Fieldwork	Tier 1- **ANI** woody sites on PCL		160	✗			✓			**~140 plots** ✓			✓		
Fieldwork	Tier 1- **VEGE** Non LUCAS woody sites on PCL		80	✗			✗			✗			✗		
Methods	Carbon Monitoring methods on T1 only plots			✗			✗			✗			✗		
Quality Assurance	QA/QC elements - Training, Auditing, QA processes			✗			✗			✓			✓		
Data and Information	Upgrades - Data and information management			✗			✗			✗			✓		
Data and Information	Upgrades - Reporting products			✗			✗			✗			✓		
Data and Information	Processing of data & samples			✓			✓			✓			✓		
Data and Information	Processing of acoustic records			✗			✓			✓			✓		
Impacts And rapid assessment and ranking (low to high) of the relative impacts for each scenario															

9(2)(g)(i)

Department of Conservation
Te Papa Atawhai

Document 36

File Ref DOC-6294441

Date: 13 August 2020

To: Martin Kessick

CC: Sharon Alderson, Jo MacPherson, Meredith McKay, Mike Perry

From: Elaine Wright

Subject: National Biodiversity Monitoring System –Reduction in sample locations in Tier 1 Monitoring Programme for 2020-2021

Executive Summary

About the programme

1. The Department of Conservation implemented a national scale (Tier 1) programme to monitor and report on state and trends in New Zealand's terrestrial biodiversity in 2011. The Tier 1 8-km-grid programme is designed to provide timely, unbiased information for reporting on status and trends in biodiversity across Public Conservation Land (PCL).
2. The Tier 1 network builds on the Ministry for Environment (MfE) Land-use Carbon Analysis System (LUCAS), in place since 2002 for reporting on carbon stock and change in NZ forests and shrublands. DOC is funded to complete the LUCAS field programme for natural forests and shrublands. The work is covered by MOU's which have been in place since 2011.
3. The Tier 1 network was expanded in scale to cover forests, shrublands and non-forested areas across PCL, and scope to include animal as well as vegetation measures. Monitoring occurs at approximately 1400 sites across PCL, with each site visited once every five years.
4. This programme is delivered jointly by Operations (fieldwork) and the Biodiversity Group (pre and post season supporting activities; audit, information management; analysis and reporting, design and research). The budget was originally secured as a programme but distributed between Operations and Biodiversity Group Cost-Centres.
5. This work has demonstrated that a system based on a national framework and design delivers significant benefits and far greater return on investment than one that is fragmented and uncoordinated.
6. Data and information derived from the programme on presence/absence, occupancy and abundance for a suite of measures and indicators are updated on an annual basis and reported to a range of internal and external stakeholders via the DOC website (e.g. plot level reports and technical fact sheets, annual report)
7. Data and information are reported in NZCA updates; Ministerial requests; OIA's; Budget bids (e.g. trends in occupancy of ungulates across PCL; Tahr Population abundance); MfE/StatsNZ led production of Environment Aotearoa and Land Domain Reports; Convention on Biological Diversity Report; Stocktake report supporting the NZ Biodiversity Strategy; Published articles in peer reviewed journals.
8. Data are supplied on request to the research community and other interested parties and have been included in a range of peer review publications

Design considerations

9. The current Tier 1 programme represents a trade-off between levels of precision and sampling effort (intensity and frequency) for measuring and reporting temporal changes in occupancy and abundance of common and widespread species. The timing and interval between sampling events; continuity of measures and method standards are key determinants of the quality of the estimates and robustness of the patterns observed.

10. The programme was designed to integrate both vegetation, mammal and bird measures to allow them to be presented spatially and temporally. Without paired observations, comparability and interpretation of measures at a site is limited putting at risk the utility of the data for regional, national and international reporting

11. At the end of the first 5-year rotation of this programme (2017/18) Manaaki Whenua Landcare Research (MWLCR) was contracted to evaluate the optimum frequency of remeasurement across the Tier 1 programme (e.g. implications of a change in sampling design from a 5-year to a 10-year cycle).

12. Key findings in the contract report are as follows:

    a. The sampling intensity of Tier 1 nationally is sufficient to determine small (5% or less) changes in pest mammals (ungulates and possums) and abundances of some bird species. Moving the measurement interval of sample points to 10 years would make it impossible to detect trends from unpaired different random samples in each year.

    b. The high levels of dynamism in tree populations show that large mortality and recruitment events can happen even within 5 years. Moving to a 10-year interval significantly reduces the ability to adjust management in response to the consequences of disturbances (e.g. chronic established threats such as herbivory by ungulate).

    c. The capacity to measure trends in pest mammals, birds, and non-woody vegetation depends currently on interpreting change from a different random sample in each year. This is already yielding useful information for managers but paired observations through repeated measurements at a site will strengthen that.

13. Based on the MWLCR report the current Tier 1 programme has continued with a five-year remeasurement cycle.

Change request

14. In July 2020 Lou Sanson requested a budget decrease of $0.5 M be made to the Tier 1 programme. For the remaining budget Biodiversity and Operations team were instructed to deliver the LUCAS programme and all Tier 1 animal measures for the 2020/21 summer season.

15. PSU Design and Evaluation Manager, supported by Monitoring and Information Systems and Biodiversity Monitoring Team managers was asked to consider the request and advise on the balance of the programme for this year given the remaining funds.

16. On average the current programme costs DOC $4.6 M per year. MfE contributes $1 M per year as part of the MOU with DOC to complete MfE LUCAS plots on and off PCL.

17. The request to downsize the progamme took account of the following:

d. **Reduction in budget is a singular event**. The full budget of $4.6 M would be reinstated in 2021/22

e. **Maintain the random selection** of sites each year

f. **Essential work confirmed** with input from science community prior to identification of opportunities for additional sampling under a temporary reduction in budget

g. **Unbalanced data** through failure to remeasure selected sites (e.g. Fiordland) (introduces bias impacting estimates of trend in measures and indicators in areas of under sampling) can be accommodated if this is a singular event but not if the change in funding becomes a multi-year problem

h. **History of sampling investment** by DOC in non-woody sites on PCL is limited. There is an inadequate time series for estimating expected rates of change in vegetation and interpreting animal occupancy and abundance. There are fewer sites on PCL compared with woody impacting precision if the sampling effort is reduced. Change over time is critical for assessing impact of climate change.

i. **Opportunity costs** through using combined animal and vegetation teams to sample non-woody sites. Timing of measurements in critical periods more closely aligned and fewer people required to measure vegetation through absence of stems.

j. **Quality of outputs** impossible to maintain with a reduction in sampling effort. This is particularly important subsets of the data, whether geographic or environmental.

Programme adjustments with budget reduction of $0.5 M for 2020/21

a) Complete LUCAS programme
b) Complete full suite of Tier 1 animal measures at woody sites on PCL
c) Complete full suite of Tier 1 vegetation and animal measures at non-woody sites on PCL
d) Simplify which components of methods are essential to remeasure this year to reduce the time taken at each site by the respective teams in a) through c).

See Appendix 2 for an assessment of risk

	Tier 1 Programme 2020/21			
	LUCAS Vegetation (Private & PCL)	**Tier 1 Vegetation**	**Tier 1 Animal**	**Comment**
Current Programme	129	286	286	Note 84 LUCAS plots overlap with Tier 1 forest plots
Revised Programme with 0.5 M budget reduction	129	177	286	Note 84 LUCAS plots overlap with Tier 1 forest plots on PCL; 93 non-forest Tier 1 sites
Difference	0	109	0	Tier 1 forest plots

Approval

It is recommended that the Director-General:

a) **Approve the revised programme** by signing the attached, noting that this is for 1-year only**:**

b) **Prepare memo for key external stakeholders** informing them of the Departments decision. These include NZCA, MfE (LUCAS and Environmental Reporting Programmes; MPI International Reporting team for IPCC; Regional Council Chief Executives; Minister; PCE; StatsNZ (DIP and Environmental Reporting teams)

c) Instruct the finance team to reinstate the full budget for 2021/22

Background

18. In 2007 the Natural Heritage Management System (NHMS) co-ordinating committee endorsed a suite of Measures and Indicators from the Biodiversity Assessment Framework for use within DOC. This included data currently collected at national scale (e.g. Land Cover Data Base) and those requiring integrated development (e.g. sampling design) for reporting at a range of scales. Following development, a multi-year field-based work programme was proposed. A business case was approved in 2010, and the financial and human resources to deliver on this secured in 2011.

19. The Biodiversity Monitoring and Reporting System (BMRS) to deliver these measures and indicators was designed by DOC in association with Manaaki Whenua Landcare Research to overcome past shortfalls in biodiversity monitoring in DOC. The BMRS aims to meet four key goals:

    a. National and regional reporting of status and trends in biodiversity

    b. Informing prioritisation for resource allocation

    c. Evaluating the effectiveness of conservation management and policy

    d. Early warning system for emerging threats

20. Programme requirements included:

    a. Make valid statistical inferences across a range of scales

    b. Address multiple management initiatives

    c. Collect data on a wide range of variables to report on outcomes; and

    d. Be flexible, to address a wide range of uses and adapt to changing circumstances

21. DOC uses a three-tiered approach to meet these goals. The three tiers are of different scale and scope which are complementary to each other. Fully implemented, this integrated system will allow reporting on components of ecological integrity at a range of scales and enable an assessment of progress towards defined outcomes.

22. The Department of Conservation implemented a national-scale (Tier 1) programme to monitor and report on state and trends in New Zealand's terrestrial biodiversity in 2011. Tier 1 is monitoring for national context with coverage across all public conservation land.

What is it?

23. The Tier 1 8-km-grid programme is designed to provide timely, unbiased information for reporting on status and trends in biodiversity across Public Conservation Land (PCL). The Tier 1 network builds on Ministry for Environment (MfE) Land-use Carbon Analysis System (LUCAS), in place since 2002 for reporting on carbon stock and change in NZ forests and shrublands. DOC and MfE, as part of a central government collective programme, monitor a selection of sites each year. This work is covered by MOU's which have been in place since 2011. MfE funds DOC to complete the LUCAS component of the vegetation work, offsetting the overall cost of DOCs Tier 1 programme. There is considerable overlap in the sites visited, methods and data required by each organisation, and the grid-based design supports evidence-based reporting with known levels of precision by both DOC and MfE.

24. The Tier 1 network was expanded in scale to cover forests, shrublands and non-forested areas across PCL; and scope to include animal as well as vegetation measures. Monitoring occurs at approximately 1400 sites across PCL, with each site visited once every five years. Approximately 278 sites are

visited each season by the field teams. Data are collected on structure and composition of vegetation communities and animals that can be sampled the scale of the programme using standard monitoring approaches including birds (day and night), deer, goats, and other ungulates, rabbits and hares, and possums. Acoustic recorders are also used to capture data on birds and bats. The Tier 1 programme contributed to a pilot of Environmental DNA methods at a subset of sites. Aerial surveys have been conducted to provide estimates of Tahr population abundance across the Tahr management zones.

25. The National Programme is delivered jointly by Operations (fieldwork) and the Biodiversity Group (pre and post season supporting activities; audit, information management; analysis and reporting, design and research). Each team has different roles and functions. The budget was originally secured as a programme but distributed between Operations and Biodiversity Group cost-centres.

What does it deliver?

26. The sample design has a national focus, though measures and indicators can be compiled at a range of scales with less precision for regions or populations with smaller sample sizes. Across all PCL, sampling intensities typically allow measures or indicators to be estimated with known levels of precision, usually within 5% of the mean at the 90% confidence interval. The design will detect major changes at local scales, e.g. new taxa that appear on over 0.5% of PCL or existing taxa that disappear from down to 0.5% of PCL. The design also allows estimation of differences between levels of management, for example results have shown that across PCL, the possum abundance is lowest in areas subject to sustained aerial control.

27. Information on presence/absence occupancy and abundance for a suite of measures and indicators are routinely reported to a range of internal and external stakeholders via the DOC website (plot level reports and technical fact sheets), Annual production of technical fact sheets; evidence cited in the Annual Report; Ministerial requests; OIA's and information on trends to support budget bids (e.g. Trends in increasing occupancy of ungulates across PCL; Tahr Population abundance etc). Data are supplied on request to the research community and other interested parties and have been included in a range of peer review publications. Information derived from the programme has been routinely reported in MfE/StatsNZ led production of Environment Aotearoa Reports (current and previous Land Domain reports); 3rd Montreal Process Report led by MPI; most recent Convention on Biological Diversity Report; Stocktake report supporting the NZ Biodiversity Strategy.

Change Context

Is it value for money?

28. On average the current programme costs $4.6 M per year. $1M of this is offset by MfE as part of the MOU with DOC to complete MfE LUCAS plots.

29. The BMRS Tier 1 programme follows best practices that include an extensive and ongoing process of review and refinement. The scope, scale and frequency of review varies across components of the programme. The types of review cover management, data quality and assurance, methods, risk management, systems and design requirements, scientific peer review etc. Several of these reviews are conducted annually or at key points in the programme, now in its first remeasurement phase. A practice of ongoing review for efficiencies have held costs to the same budget annually despite inflation.

30. In addition to the initiatives taken by the teams managing this programme several reviews were undertaken at the request of Senior managers in DOC through 2014 to 2017. Numerous options were considered to streamline or reduce costs. These included:

    a. Field workforce design and programme delivery,

    b. Commercial models,

    c. Programme design, methods and indicators,

    d. Programme quality,

    e. Types of technology,

    f. Business processes for internal data use;

    g. Training;

    h. Database and tools.

Can we do it differently/better?

31. The current Tier 1 programme represents a trade-off between levels of precision and sampling effort (intensity and frequency) for measuring and reporting temporal changes in occupancy and abundance of common and widespread species. The timing and interval between sampling events; continuity of measures and method standards are key determinants of the quality of the estimates and robustness of the patterns observed.

32. The programme was designed to integrate both vegetation, mammal and bird measures to allow them to be presented spatially and temporally. For example, bird community and species measures to be presented in relation to spatial and temporal data for both vegetation, mammals and other aspects of the environment.

33. There are efficiencies from undertaking all measurements at the same locations and at similar or the same time (where timing of specific methods permits). Collection of data for all measures from the same locations strengthens the analyses and interpretation through paired observations. Without paired observations, comparability and interpretation of measures at a site is limited putting at risk the utility of the data for regional, national and international reporting

34. At the end of the 2017/18 field season the first 5-year rotation of this programme was completed, allowing work to be undertaken to update initial predictions of precision with estimates of precision achieved from the measurement data and seek opportunities to reduce costs.

35. Manaaki Whenua Landcare Research (MWLCR) was contracted to do this work which included an evaluation of the optimum frequency of remeasurement across the Tier 1 programme (e.g. implications of a change in sampling design from a 5-year to a 10-year cycle).

36. Key points/recommendations in the contract report of relevance to this request for a reduced programme for the 2020/21 season are as follows:

    k. The sampling intensity of Tier 1 nationally is sufficient to determine small (5% or less) changes in pest mammals (ungulates and possums) and abundances of some bird species. Moving the measurement interval of sample points to 10 years would make it impossible to detect trends from unpaired different random samples in each year.

    l. The high levels of dynamism in tree populations show that large mortality and recruitment events can happen even within 5 years. Moving to a 10-

year interval is risky because it significantly reduces the ability to adjust management in response to the consequences of natural disturbances, chronic established threats (such as herbivory by ungulates) or new biosecurity breaches (i.e. newly arrived pathogens).

m. The capacity to measure trends in pest mammals, birds, and non-woody vegetation depends currently on interpreting change from a different random sample in each year. This is already yielding useful information to managers (e.g. that ungulate occupancy is increasing nationally; kea counts nationally are in sharp decline).

37. Based on the MWLCR report the current Tier 1 programme has continued with a five-year remeasurement cycle.

Recent Stakeholder Engagement

38. In March 2020 NZCA sent a letter to Lou Sanson following provision of a memo and presentation on the Tier 1 programme in February 2020 (Appendix 1.1 and 1.2) endorsing the need for sustained and uninterrupted permanent funding to ensure success (Appendix 1.3)

39. DOC issued a memo at the Regional Council Chief Executives Group in May 2018 reaffirming the organisations commitment to long term monitoring of NZ biodiversity at the National Level ('Tier 1'); using a scientifically robust, unbiased and statistically valid scalable programme, and use of these data to help report on the state of NZ environment at a range of scales (with MfE, StatsNZ and Regional Councils) (Appendix 1.4).

40. Letter of support for programme from MfE in 2020 (Appendix 1.5)

41. MfE Environmental Reporting Programme Manager request for Tier 1 data and information for the "Our Land 2021" Report (an Environmental Monitoring output) scheduled for release in April 2021 Data and information from the Tier 1 programme also featured in previous MfE/StatsNZ reports.

42. Collaboration on the Environmental Monitoring & Reporting System (EMRS) led by MfE. Biodiversity monitoring in terrestrial, freshwater and marine domains is expected to be a component of the EMRS.

43. Member of the StatsNZ led working group developing and all of government Data Investment Plan (DIP). This plan is focused on essential data assets of strategic importance for NZ. The plan includes a stocktake of New Zealand's essential data assets positioned within a framework of enduring information needs covering New Zealand society, economy and environment as well as consideration of NZ in a global context, underlying infrastructure and analysis undertaken to develop insights.

New Developments

44. We have a 6-year commitment with MfE to continue to deliver their field programme aimed at quantifying carbon sequestration. The MOU includes a commitment to electronic data capture (EDC) in the field, for vegetation data, aimed at reducing costs and processing time for managing this data. We are on track to implement EDC by late 2020.

45. Research focused on remote sensing, software for processing, tools for data capture and systems for management and sharing are essential and some preliminary work is under way in this area led by members of the Design and Evaluation Team.

Operating constraints

46. The gap between expected and actual investment has meant that some of the infrastructure and systems support at an organisational level have not been developed and manual processes are still being used for elements of data management, training, reporting etc.
47. The recent maturity assessment conducted to support a task in the Budget 2018 business case (Appendix 1.4) also confirms this remains a gap for the programme as well as highlighting the absence of investment for the marine and freshwater domains.
48. While DOC is committed to enabling easy access to, and open sharing of programme data, it has not been able to fund the systems and associated tools to support this yet.
49. To further reduce costs, significant sustained investment is required in systems and technological solutions.

Change request due to decrease in funding

50. In July 2020 Lou Sanson requested a budget decrease of $0.5 M be made to the Tier 1 programme. For the remaining budget Biodiversity and Operations team were instructed to deliver the LUCAS programme and all Tier 1 animal measures for the 2020/21 summer season.
51. PSU Design and Evaluation Manager, supported by Monitoring and Information Systems and Biodiversity Monitoring Team managers was asked to consider the request and advise on the balance of the programme for this year given the remaining funds.

Considerations underpinning the programme with a reduction of 0.5 M

a) **Reduction in budget is a singular event**. The full budget of $4.6 M would be reinstated in 2021/22
b) **Maintain the random selection** of sites each year
c) **Essential work confirmed** with input from science community prior to identification of opportunities for additional sampling under a temporary reduction in budget
d) **Unbalanced data** through failure to remeasure selected sites (e.g. Fiordland) (introduces bias impacting estimates of trend in measures and indicators in areas of under sampling) can be accommodated if this is a singular event but not if the change in funding becomes a multi-year problem
e) **History of sampling investment** by DOC in non-woody sites on PCL is limited. There is an inadequate time series for estimating expected rates of change in vegetation and interpreting animal occupancy and abundance. There are fewer sites on PCL compared with woody impacting precision if the sampling effort is reduced. Change over time is critical for assessing impact of climate change.
f) **Opportunity costs** through using combined animal and vegetation teams to sample non-woody sites. Timing of measurements in critical periods more closely aligned and fewer people required to measure vegetation through absence of stems.
g) **Quality of outputs** impossible to maintain with a reduction in sampling effort. This is particularly important subsets of the data, whether geographic or environmental.

Programme adjustments with budget reduction of $0.5 M

	Tier 1 Programme 2020/21			
	LUCAS Vegetation (Private & PCL)	**Tier 1 Vegetation**	**Tier 1 Animal**	**Comment**
Current Programme	129	286	286	Note 84 LUCAS plots overlap with Tier 1 forest plots
Revised Programme with 0.5 M budget reduction	129	177	286	Note 84 LUCAS plots overlap with Tier 1 forest plots on PCL; 93 non-forest Tier 1 sites
Difference	0	109	0	Tier 1 forest plots

e) Complete LUCAS programme
f) Complete full suite of Tier 1 animal measures at woody sites on PCL
g) Complete full suite of Tier 1 vegetation and animal measures at non-woody sites on PCL
h) Simplify which components of methods are essential to remeasure this year to reduce the time taken at each site by the respective teams in a) through c).

Appendix 1 – References

1. NZCA Request - Memo and presentation for February 2020 - NZCA Agenda Papers Tier 2020 DOC-6202140
2. Letter from NZCA to Lou March 2020 DOC-6401168
3. Review of Biodiversity Monitoring – Budget 2018 task DOC-6253857
4. Memo to CEEF – link to be provided
5. Letter to DOC regarding MfE support of MOU DOC-6362057
6. The optimum plot measurement cycle - Memo for DDG DOC-5693163

Appendix 2 – Impact Analysis

Impact of Implementing Proposed Change

Type of Impact	Description of Impact
Cost Impact	Failure to systematically measure the sites pushes the cost burden into out years
Time Impact	Delays in recruitment and budget confirmation have affected lead in time to recruit and prepare for the season
Scope Impact	Changing scope for woody and non-woody sites to streamline data to be captured has no impact on spatial coverage across and the immediate utility of the data but it will affect quality
Benefits Impact	Reduction in the number of sites measured introduces bias and impacts estimates in areas of undersampling; quality of outputs affected by loss of precision and timely access to data for reporting on status and trend across relevant NZ-wide scale
Risk Impact	Reputational risk MFE, Stats NZ, NZCA and the Minster, in context of MfE Land Domain Report; Stats NZ Data Investment Plan; PCE report on gaps in environmental reporting; NZBS; NZCA endorsement of programme; support expressed by Minister
Quality Impact	High if reduction in quality control and assurance of data through need to consider other reductions.

Document 37

Daniel Ohs

From: Sharon Alderson
Sent: Wednesday, 13 May 2020 4:53 pm
To: Meredith McKay
Cc: Elaine Wright; Mike Perry; Emma Percy; Jo Macpherson
Subject: RE: Scenarios for implementation of Tier 1 and LUCAS 2020-2021

Kia ora Meredith – thank you for this.
I will give this the attention it deserves and aim to get any questions to you in next 2 days – You will know from previous experience that I am likely to have MANY questions…. Not sure if Jo will have as many, but its possible.

Go ahead and set a time for briefing next week – I'm sure that will be time well spent.

Ngā mihi,
Sharon

From: Meredith McKay <mmckay@doc.govt.nz>
Sent: Wednesday, 13 May 2020 12:20 p.m.
To: Sharon Alderson <salderson@doc.govt.nz>
Cc: Elaine Wright <ewright@doc.govt.nz>; Mike Perry <mperry@doc.govt nz>; Emma Percy <epercy@doc.govt.nz>; Jo Macpherson <jmacpherson@doc.govt.nz>
Subject: Scenarios for implementation of Tier 1 and LUCAS 2020-2021
Importance: High

Hello Sharon

Please find attached the Scenarios for implementation of Tier 1 and LUCAS programme for 2020-2021 - DOC-6289314

This is a high level summary and does not capture all the details about what we would do and when which we would work on once we decide how to proceed.

1. On page one you will find the Context for the scenarios including:
   - Summary of existing pressures prior to Covid-19
   - Current state of programme with added pressures of Covid-19
   - The core assumptions we made when developing scenarios for implementation
   - A statement on the preferred scenario for the programme
   - What we need to proceed
   - A matrix of the known operating constraints (Team size, Travel Restrictions, Post Season Prep, Pre-Season Prep) with varying scenarios for these and the resulting implementation model that would work with these constraints.

2. Pages 2-3 are seven scenarios that we tested with some key information by theme;
   - The sample size/number of plots
   - The utility of the data in each scenario
   - The result – what we would be delivering
   - Recruitment needs/expectations
   - Some advantages and disadvantages we have considered for each scenario
   - Last but importantly, the critical dates for key decisions/actions that we believe are critical for each scenario to proceed/be implemented.

3. On the last page is a key explaining what the Foundational Projects are and the some of the potential new work/approaches we may need to develop/deliver under Covid 19 restrictions

I think you will need some time to digest this and come back to us with any questions.

One suggestion we have is to meet with you next week and to walk you through/provide a briefing on the scenarios. If you had questions in advance of this you could send though for us to prepare for and address?

Could you consider this suggestion and if this works for you I can arrange this. If you have a different approach you would like to take let me know.

Thanks
Meredith

Meredith Mckay
Monitoring & Information Systems Team Manager
Planning and Support Unit
Biodiversity Group
Department of Conservation | Te Papa Atawhai
https://www.doc.govt.nz/
_____
Ōtautahi / Christchurch Office
Level 3, Grand Central
161 Cashel Street, Christchurch 8011
PO Box 4715, Christchurch Mail Centre, Christchurch 8140
s.9(2)(a)

-----Original Appointment-----
From: Sharon Alderson <salderson@doc.govt.nz>
Sent: Tuesday, 21 April 2020 12:01 p.m.
To: Sharon Alderson; Mike Perry; Emma Percy; Meredith McKay; Elaine Wright
Subject: UPDATE Scenarios for implementation of Tier 1 and LUCAS 2020-2021
When: Tuesday, 28 April 2020 12:00 p.m.-1:00 p.m. (UTC+12:00) Auckland, Wellington.
Where: Microsoft Teams Meeting
Importance: High

Kia ora koutou

Finding a time in your calendars without scheduled meetings, 'no meetings to be booked at this time' or 'sanity breaks' is proving impossible. I have found this half hour and am hoping that you will be willing to extend it into half an hour of the above already scheduled, if that makes sense!

Thanks,
Kerryanne

Join Microsoft Teams Meeting

Learn more about Teams | Meeting options

Document 38

BUSINESS PLANNING FOR LUCAS AND TIER ONE PROGRAMME 20/21 (OPS, MIST and D&E)

OVERVIEW

The National Biodiversity Monitoring Programme is challenged with trying to deliver a nationally significant programme of work in a constrained timeframe, with a declining budget and absence of funding for foundational work to deliver efficiencies over the last 5 years. The programme requires some urgent decisions to be made around recruitment and financial investment to meet the work delivery deadlines.

The purpose of this paper is to create awareness of the current state of the programme and a solution to support and allow for full project delivery in 20/21. We understand that we are in a fluid state right now under COVID_19 so we have included an alternative scenario and captured implications of how each one will impact the programme in both the short and long-term.

ASSUMPTIONS and KEY CRITERIA EVALUATED

This paper is working on an assumption that commitment to a programme delivery option for 20/21 and key recruitment decisions will be made by 1st June 2020.

The key criteria considered; end to end components of programme preparation and delivery, investment required, sustainability, impact on other programmes and health, safety and wellbeing of staff.

CURRENT STATE

Delays in completion of 58 (47 Tier 1, 11 LUCAS) Vegetation and 15 Tier 1 Animal plots were experienced this year due to extreme weather conditions. The Covid19 lockdown resulted in the early termination of the summer field season and any mitigation options to complete this work as planned.

MIST: Faced increased pressure prior to lockdown to deliver BAU work with \ **5 out of 18 permanent/long term roles vacant** (30% of or core team vacant) (Figure 1). COVID-19 lockdown caused delays in shipping and **reduced productivity** (increased number of transactions due to WFH). The MIST team are an estimated 1 to 2 months behind schedule (Figure 2). Currently there is **not enough capacity and resourcing** in MIST to complete the end of season BAU work, begin pre-season preparation for 20/21 **and** complete essential foundational work (**EDC , Database and systems improvements and the Capability and Development Framework) in the time required to start next season (Aug 2020). In additional, **programme delivery costs have increased over time, and FPL have remained static**.

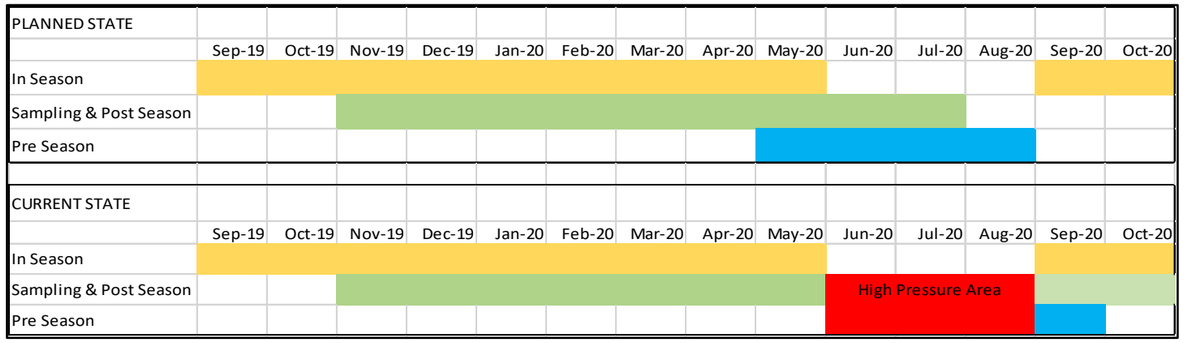
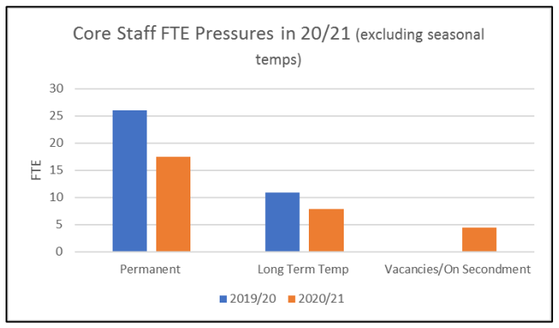


Figure 1



BMT: Faced pressure prior to COVID-19 with **7 out of 24 in permanent/long term roles vacant** (30% of core team vacant) (Figure 1. While not the operating model recommended at the outset of this programme operational delivery of the Tier 1 programme has been heavily reliant on temporary staff and contractors. This has resulted in a high turnover of staff with a loss of skill, return on investment in their development and increased health and safety risks. The operating model was in review at time of lockdown and proposed changes to mitigate risks included improved staff supervision and change in ratios of permanent to temp staff that more closely align with the original proposal. Due to COVID-19 the review and improvements work to invest in a **sustainable team structure was stalled**. In addition, **programme delivery costs have increased, and FPL has remained static (**Tier One Monitoring Cost Pressures - DOC-5523595).

*Figure **2***

BACKGROUND

In 2016 there was a full review on the Status of DOCs National Monitoring and Reporting Systems. The recommendations proposed, if implemented would have improved sustainability of the programme and provided a pathway for long-term development. None of the recommendations were funded or implemented. With a change in the MfE MOU some of the foundational projects had to be progressed and are referred to in this paper - DOC-2711406. During the 2016 review an assessment of planned vs actual investment highlighted that the actual investment was significantly lower (between 37% and 53%) than originally approved in 2012. This has had a significant impact on the efficiency and sustainability of the programme to date. Further details on this can be found in the section 11-73 (Page 246).

KEY MESSAGES

1. The programme is not appropriately resourced given the increase in costs and reallocation of initial funding experienced since 2012.
2. LUCAS Revenue used to offset changes in programme costs in previous years is not available in 2020-2021 as deployed to deliver EDC for MFE in accordance with the MOU
3. Actual costs to field delivery were projected (Pre-Covid) to exceed current FPL by approximately 358k in 19/20.
4. The current level of internal resourcing (Vote Conservation funding) is insufficient to implement a full programme next year.
5. The COVID-19 situation has compounded this by reducing productivity and causing delays.
6. The current FTE capacity caused by delays in agreement to previous recruitment requests, is insufficient to deliver the programme.
7. Mike Slater requires BMT to implement restructure and add new roles to support effective delivery of programme (DOC-5956884 & DOC-5947379).
8. To deliver a full programme next season, the requirements for staff, additional funding and critical dates for approvals are provided below.
9. Recent logistics planning suggests that implementation of a full programme next season is significant challenge and an alternative scenario is provided.

COMPONENTS	FEATURES	**Full 20/21 Programme excl deferred 19/20 plots** *(recent planning shows this scenario may no longer be an option)*	**Full LUCAS Programme + Reduced but optimised Tier 1 Programme**
PROGRAMME	**WHAT IS DELIVERED**	• All LUCAS plots including deferred LUCAS from 19/20 • All Tier 1 20/21 plots	• All LUCAS plots including deferred LUCAS from 19/20 • Tier 1 measures on approx. 85% of the Tier 1 network of sites
	HOW MANY PLOTS **VEGE PLOTS N=** **ANI PLOTS N=**	**N= 330 (100%[1])** **N= 290 (100%)**	**N=280 (85%)** **N= 210 (72%)**
	REQUIREMENTS	• **Recruitment decisions made by 1st June** • Level 1 by 30 June • Season Start date as normal - 1 September 2020 • Investment in proposed BMT restructure and additional roles is made for capacity to deliver • No regional Travel restrictions • EDC is delivered as planned	• Sample Design capable of being reconfigured to mitigate change in investment whilst minimising impact on utility of data for all stakeholders • Recruitment decisions made by 1st June • Level 1 by 30 July • Implement proposed BMT restructure within current Operations budget • Investment in additional MIST roles is made for capacity to deliver • Season Start date delayed by 1 month - 1 October 2020 • No regional Travel restricted • EDC is delivered as planned
	UTILITY OF DATA	• MfE - Inclusion of all available re-measured vegetation plots in international report • DOC – Reporting on status and trends in all vegetation and animal measures	• MfE -Inclusion of all available re-measured vegetation plots in international report • DOC – Some limits to immediate utility of data for DOC due to fewer sites. Impact on realising benefits from re-measurement on precision of estimates. • National Status and Trend reporting with reduced precision and absence of regional summaries.
	RISK	• High risk that recruitment would not be completed by normal season start date therefore delaying programme delivery • Current volume of work is greater than existing FTE • Increased pressure on current staff to deliver to current workload and support training of new FTE's • Dependent on an immediate approval of all requested recruitment	• Medium risk that recruitment would not be completed in time for start of field season but can be mitigated if recruitment decision made quickly • MIST current volume of work is still greater than existing FTE (could be managed if we work with D&E to redeploy some BAU or Foundational Projects and accept risk some won't be completed in 20/21) • This assumes D&E can redesign, gain agreement from stakeholders and confidently reduce sample size to meet current constraints of programme • High risk that a failure to fully consider the implications of a change in sample size and cycle of remeasurement (3rd year of the first repeated cycle of a 5-year programme) has long-term implications for the continuation of this programme. • Limits data for 20/21 reporting **Key message: Delay of recruitment decision impacts the number of plots that can be delivered within the field season (October – May). This may require redeployment of current funds and investment in external contractors to deliver components of this work.**
CRITICAL INVESTMENT REQUIRED – *What is needed to deliver*	**CAPACITY**	• Recruitment of all vacant permanent/long term temp FTE's and summer staff (Table 2) • Approval to implement proposed BMT restructure to deliver on programme as approved by Mike Slater (DOC-5956884 & DOC-5947379) and add new MIST role to support effective delivery for 20/21.	• Recruitment of all vacant permanent/long term temp FTE's and summer staff (Table 2) • Approval to implement proposed BMT restructure to deliver on programme as approved by Mike Slater (DOC-5956884 & DOC-5947379)) and add new MIST role to support effective delivery for 20/21.

	TIME	• Previous seasonal recruitment took 13 weeks.
		• With the proposed restructure, the recruitment process will need to be stage which results in the process taking 18 weeks (Table 3)
		• Critical task dependencies
		  ○ Season start date – 10th August (BMT Meeting)
		  ○ Actual time to needed to from advertise until season start – 15 wks.
		  ○ Time available – **10 weeks**
			• Previous seasonal recruitment took 13 weeks.
			• With the proposed restructure, the recruitment process will need to be stage which results in the process taking 18 weeks (Table 3)
			• Critical task dependencies
			  ○ Season start date – 14th September (BMT Meeting)
			  ○ Actual time to needed to recruit – 15weeks
			  ○ Time available – **15 weeks**

	FUNDING	• Costs to deliver scenario $5,824,800 • Current funding = $5,044,440, Additional funding requirements = $780,360 (Table 1) **Key message: Current DOC funding does not support implementation due to decreasing baseline from reallocation by DDGs over duration of programme and increase in programme delivery costs (Memo - Biodiversity Monitoring Costs - DOC-6202482)** **.**	• Costs to deliver scenario $5,343,800 • Current funding = $5,044,440, Additional funding requirements = $299,360 (Table 1) **Key messages:** **•Current DOC funding does not support implementation due to decreasing baseline from reallocation by DDGs over duration of programme and increase in programme delivery costs (Memo - Biodiversity Monitoring Costs - DOC-6202482)** **•Proposed BMT restructure continues but less plots able to be completed.** 9(2)(g)(i) [redacted]
FOUNDATIONAL INVESTMENTS	**FOUNDATIONAL WORK****	• Delivers EDC, C&D Framework, DB and Systems improvements, Programme management systems documentation (e.g. SOP's)	• Delivers EDC, • Reduced or delayed delivery of C&D Framework, DB and Systems improvements, Programme management systems documentation (e.g. SOP's) as time and capacity of skilled staff is limited and focussed on support field programme BAU work

[1] **% of Programme**

TABLE 1 - COST SUMMARY TABLE

Group	Items	Scenario One				Scenario 2			
		#	Current Funding	Additional Funding	Total	#	Current Funding	Additional Funding	Total
BMT	Salaries	24	$820,000	$-	$820,000	24	$820,000	$-	$820,000
BMT	Wages - Seasonal Workers	47	$1,600,000	$251,000	$1,851,000	47	$1,600,000	-$126,000 (reduced programme)	$1,474,000
BMT	Salaries – Transfer seasonal to perm	20	*Most of budget sits in existing funding under wages – seasonal workers*			20	*Most of budget sits in existing funding under wages – seasonal workers*		
BMT	Wages - New FTEs (as per proposal) **	3	$-	$126,000	$126,000	3	0	$126,000 (reduced programme)	$126,000
BMT	**Opex**	-	$920,000	$104,000	$1,024,000	-	$920,000	$0 (reduced programme)	$920,000
BMT TOTAL		94	$3,340,000	$481,000	$3,821,000	94	$3,340,000	0	$3,340,000
MIST	Salaries	13	$1,162,700	$-	$1,162,700	13	$1,162,700	$-	$1,162,700
MIST	Wages	4	$121,900	$184,700	$226,600	4	$121,900	$184,700	$226,600
MIST	New FTEs Wages (as per proposal) **	1	$-	$80,000	$80,000	1	$-	$80,000	$80,000
MIST	Opex	-	$419,840	$114,660	$534,500	-	$419,840	$114,660	$534,500
MIST TOTAL		18	$1,704,440	$299,360	$2,003,800	18	$1,704,440	$299,360	$2,003,800
GRAND Total		**112**	**$5,044,440**	**$780,360**	**$5,824,800**	**112**	**$5,044,440**	**$299,360**	**$5,343,800**

TABLE 2 - RECRUITMENT DETAILS

Recruitment Details	Role	Scenario 1 FTE	Scenario 2	Details
BMT	Current Team	17	17	
BMT	FTE Vacancies	7	7	This is includes moving some 3-year contracts to perm
BMT	Perm Team	23	23	This is including the seasonal roles that are now requested to be permanent
BMT	Seasonal Team	47	47	
MIST	Current Team	12	12	Core team of staff (Salaried and Waged)
MIST	FTE Vacancies	3	3	Replacing roles of Meredith, Chris and Benno
MIST	Temp Vacancies	2	2	Sample processing and Data Entry staff
MIST	Additional Support	1	1	Programme Coordinator

Table 3 - OPERATIONS RECRUITMENT TIMELINE

	No.	1-Jun	8-Jun	15-Jun	22-Jun	29-Jun	6-Jul	13-Jul	20-Jul	27-Jul	3-Aug	10-Aug	17-Aug	24-Aug	31-Aug	7-Sep	14-Sep	21-Sep	28-Sep	5-Oct	12-Oct	19-Oct	26-Oct	2-Nov	9-Nov	16-Nov
Previous season dates (1 lot of recruitment)																										
Temp Field Staff	67	Approval	Advertise			Shortlist	Interview	Interview	Interview	Interview	Prep	BMT meeting	Calibration	Mentoring		Induction	Training		Local plots	Trip 1				Trip 2			
Season Start											Prep	BMT meeting	Calibration	Mentoring		Induction	Training		Local plots	Trip 1				Trip 2			
20/21 season dates with Restructure											*Season Start*															
Supervisors	3	Approval	Advertise		Shortlist	Interview																				
Logistics permanent Support	2		Advertise		Shortlist	Interview																				
Existing permanent vacanies	7			Advertise		Shortlist	Interview																			
Permanent field staff	20			Advertise		Shortlist	Interview																			
Temp Field Staff	47						Advertise				Shortlist	Interview														
Season Start																Prep	BMT Meeting	Calibration	Mentoring		Induction	Training		Local plots	Trip 1	

Season Start

****Table 4 - FOUNDATIONAL WORK AND PROJECTS: *Costs provided are estimates***

Foundational Projects	Output	Details and Current State	Cost	Long-term benefits	Consequence of not Investing
Capacity & Capability Development Strategy	Project due to be phased in 20/21 and fully implemented 21/22.	Team are looking to Predator Free and TNM for support from some tools, SOIK for any bird tools PLUS C&D support.	200k plus Opex **(Covered by LUCAS Revenue)**	Framework benefits: DOC to develop workforce's capabilities, skills and competencies to ensure a sustainable and enduring programme. Sets out skills and capabilities required for the Tier 1 and LUCAS programme field team roles and the development steps/path required for these. Integrates with recruitment, role descriptions, training courses & tools, deployment standard, information systems, reporting, review and improvement process well as performance management and succession planning.	MIST unable to transition training to provider, not set up for FW or Tier 2 programmes, dependency of staff in programme to deliver training, unable to be strategic about when/how build capacity in DOC
Database Systems and Improvement	Database and web interface improvements are due to phased in 20/21 and fully implemented 21/22.	We are making some progress on this currently but will need a dedicated person to lead.	100k **(Not Funded yet – TBA)**	Maintain the value and integrity of the Tier 1 dataset into the future.	Loss of data integrity, increased labour cost (manual handling), limited interoperability within and external to DOC, reputational risk
Programme Management Structure and Development	Overarching programme management plan and programme and systems documentation (e.g. SOP's) completed and fully implemented 21/22	We are making some progress on this with recruitment and support from Programme Advisor. The programme management artefacts and standards will be put in place formally and this role has been requested a coordinator to run the BAU. The two roles will work to set up programme management, governance and roles/responsibilities of each team that work on the programme delivery	80k **(DOC Funding – MIST 20/21 Bus Plan)**	Improved coordination and communication of projects within and between the teams that contribute to programme delivery. Professional standards and approaches of programme management. Projects completed on time and within budget. Visibility of all work, timeline, schedules, budgets, reporting. Free up technical advisors to focus on foundational work. Clarification of team functions and roles. Sets up model for new programmes.	
Existing Projects	**Output**	**Details and Current State**	**Cost**		
Electronic Data Capture (EDC)	Project is in progress with initial trial in 20/21 and full implementation by 21/22.	This project will incur some extra work from MIST during its implementation phase (approx. 6 months) in 20/21 but with recruitment of 3 core roles as fast as possible, the extra capacity in the team via investment above the core team can be freed up to complete this work. To mitigate risk, a dedicated project team has been put place.	**$5**00K **(Covered by LUCAS Revenue)**	Reduced cost over time, Improved data quality and data efficiency, Remote and faster access, Automation and integration with other systems. Model for ISS to test for wider implementation.	Failure to meet MOU commitments, reputational risk, loss investment to date, no opportunity to save money longer term

		Funding; There is no DOC baseline funding required for the solution. All funding is covered by the MFE revenue we receive over the life of the 6-year programme. The EDC will be cost neutral at the conclusion of the 6-year MOU. DOC will absorb the initial costs and then realise the benefits over this period subject to agreement to the risk mitigation steps			
BMT Review	Review and restructure of BMT Ops	The BMT Operating model is under review. However, this is not currently formalised as a TA and may need will need to be addressed urgently to meeting programme deadlines in preferred scenario. It is also worth considering putting this review programme wide if it would not hold up the essential recruitment required. BMT have experienced operating pressures with overspend from 19/20 prior to lockdown.	New structure Yr. 1 = $126k Y2 2 = $227K Tier 1 BAU Cost pressure = $355k Need to address winter salary risk	A stable structure that will improve span of control, increase experience in the team which will improve H&S, increase operating efficiency and retain technical skills	Inability to continue to operate as have been instructed to implement the new structure

References

BMT structure improvements DOC-5956884

BMT team structure presentation - DOC-5947379

Tier One Monitoring Cost Pressures -DOC-5523595

Memo - Biodiversity Monitoring Costs - DOC-6202482

Scenarios FAQ – *In Progress*

Daniel Ohs

From: Meredith McKay
Sent: Tuesday, 16 June 2020 10:41 pm
To: Sharon Alderson
Subject: TESTING Simplified scenarios (3 options and supplementary info)
Attachments: Simplified Scenarios_DRAFT - DOC-6325539.pptx

Hi Sharon

Testing if this is near what you wanted. Read below and provide me feedback if possible and I will modify if time.

You Requested – A Simplified scenarios outline (3 options and supplementary info) MEREDITH – by next Wed PM for meeting MK/MS etc

A copy is attached and link is Simplified scenarios made - Simplified Scenarios DOC-6325539.

Martin feedback asks for

1. What we need in terms of resource and support to deliver the triple A monitoring programme in line with our Biodiversity Pathway and AOG commitments and opportunities
2. The current programme, but including the cost pressures that have to be accommodated as a result of the changes in Ops structure (perhaps with a 2b of adding in the completion of this years cancelled work)
3. The bare minimum to comply with our contracted commitments i.e. the LUCAS plots, nothing to contribute to the wider NZ environmental monitoring system/measures

We were not able to achieve this exactly as requested but have provided a good assessment of what was possible to deliver as a work programme over the coming year and presented the 3 scenarios that came out on top.

1. Full programme as normal (it is assumed here we will pick up 11 MFE plots from last year but did not add that in as may confuse and low impact)
2. Full programme as normal but contract some work out as BMT wont have capacity to deliver it all
3. LUCAS only programme – no Tier 1 animal measures at all as Martin wanted to see this and it needed to be tested

In this simplified version will find 2 pages.

- Page 1 is summary of scenarios with simplified summary of the data use, benefits, resources required for each scenario. Its high level. More detailed info is provided in FULL Scenario document SCENARIO PLANNING FOR TIER ONE PROGRAMME 2020 DOC-6289314
- Page 2 are the supplementary details and is more of an explainer for Martin (and possibly Lou) to provide more detail about what it will take to deliver programme with evaluation of
    a. UTILTY OF DATA – assessment of programme changes on the data use and reiteration of how tested already and still not optimal
    b. BENEFITS and links to pathways, strategy etc and examples that may help you explain on the day
    c. OPPORTUNITIES full range of these available with full programme
    d. RESOURCES REQUIRED – more detail about what it will take
    e. CHANGES WE WILL NEED TO MAKE – more detail on changes detailed on page 1
    f. FULL LIST OF CRITICAL ISSUES WE EXPLORED

Note for your meeting you will need

- Simplified Scenarios DOC-6325539
- SCENARIO PLANNING FOR TIER ONE PROGRAMME 2020 DOC-6289314
- BMT structure improvements DOC-5956884 – suggest you pre read if not had time yet
- BMT team structure presentation - DOC-5947379 – suggest you pre read if not had time yet

- Tier One Monitoring Cost Pressures -DOC-5523595 – suggest you pre read if not had time yet
- Memo - Biodiversity Monitoring Costs - DOC-6202482 – suggest you pre read if not had time yet

Righto. Apologies in advance if does not get us there yet. Brokering lots of views not always as simple as hoped.
Thanks
Meredith

From: Meredith McKay
Sent: Tuesday, 16 June 2020 1:57 p.m.
To: Elaine Wright <ewright@doc.govt.nz>
Subject: URGENT Simplified scenarios (3 options and supplementary info)

Hi there
Context

- Request - Simplified scenarios outline (3 options and supplementary info) MEREDITH – by next Wed PM for meeting MK/MS etc

    1. What we need in terms of resource and support to deliver the triple A monitoring programme in line with our Biodiversity Pathway and AOG commitments and opportunities [FULL PROGRAMME]
    2. The current programme, but including the cost pressures that have to be accommodated as a result of the changes in Ops structure (perhaps with a 2b of adding in the completion of this years cancelled work). [CURRENT PROGRAMME]
    3. The bare minimum to comply with our contracted commitments i.e. the LUCAS plots, nothing to contribute to the wider NZ environmental monitoring system/measures. [LUCAS ONLY PROGRAMME]

- Additional context for what wanting – See email attached and extract below.

Resources

- SCENARIO PLANNING FOR TIER ONE PROGRAMME 2020 https://doccm.doc.govt.nz:443/wcc/faces/wccdoc?dDocName=DOC-6289314
- PPT re Biodiversity pathway https://doccm.doc.govt.nz:443/wcc/faces/wccdoc?dDocName=DOC-6322635 (PPT to NZCA)
- New version of Simplified scenarios made - Simplified Scenarios_DRAFT https://doccm.doc.govt.nz:443/wcc/faces/wccdoc?dDocName=DOC-6325539

Comment before you start

- I could not really deliver on Number 2 scenario above as we deliver full programme but just have lots of cost pressures.
- I changed to reduced programme to get across the issues around delay
- If you think you can make a S2 like Martin wants can you tell me how and I will mock this up
- Added details in supplementary from original document

Task

- See page 2 where I tried to add more value and benefits of full programme
- Used pathway (attached) and first draft
- Missing your strategic stuff and needs rework
- Can you rework for me by end of day?
- PLUS General comment and feedback & if really hate stop work and call me but going for walk to destress so after 3.

Timeframe.

- Sorry to ask this but by end of today
- As copy would be easier for me

Thanks in advance

Headed out for an hour. Will call when back.
Meredith

Hi Sharon,

I think we need a decent sit down session together to clarify the task.

How I have been thinking about this is 3 scenarios/options to define our T1 monitoring programme for the next 12 months. The prompt was the COVID lockdown and the assumption that the alert levels would have been more restrictive for longer and would have forced a rethink about what was possible to deliver as a work programme over the coming year. I wanted to be able to show Lou what the various levels of risk and return were for three different approaches to defining the programme. Essentially:

1. What we need in terms of resource and support to deliver the triple A monitoring programme in line with our Biodiversity Pathway and AOG commitments and opportunities.
2. The current programme, but including the cost pressures that have to be accommodated as a result of the changes in Ops structure (perhaps with a 2b of adding in the completion of this years cancelled work).
3. The bare minimum to comply with our contracted commitments i.e. the LUCAS plots, nothing to contribute to the wider NZ environmental monitoring system/measures

This would include an assessment of cost, opportunities & CIs for each.

I acknowledge that BP decisions have already been made but I need to show Lou that we have taken the opportunity to use COVID to reassess the monitoring programme (rather than just 'cut it' in AL4 lockdown), align it with or pathway work as much as possible and consider the decisions that Ops has made around supporting the delivery of the programme.

Let's get Judy to find us some time and work through this.

Scenarios for T1 monitoring programme for the next 12 months

Scenarios Considered	Utility of Data rating to meet DOC ,MFE, AOG Requirements	Value/Benefit Proposition	Opportunities this provides	Total Cost for Delivery + Investment Required	Context / Key Critical Issues
Full Programme: T1 and LUCAS **PLOTS** **ANI=330 (100%)** **VEG=290 (100%)**	DOC ★★★ AOG ★★★	DOC Annual Report Annual Report Dashboard AOG commitments International reporting (CBD, IPCC) MFE Land Domain Report DOC Biodiversity WĀNANGA Pathway Biodiversity Strategy NPS on Biodiversity	Systems improvement Capability and Development Framework Better programme management EDC investment now to secure savings in outyears	**TOTAL** **$5.8M** **COST PRESSURE/ ADDITIONAL INVESTMENT** **$1.2M**	**CONTEXT** • COVID lockdown and potential constraints on programme delivery required a rethink about what is possible for the delivery of the 2020-2021 Tier 1 and LUCAS Programme • Created opportunity to reassess and align the Tier 1 annual plan with DOC B odiversity WĀNANGA Pathway • Drove consideration of the requirements Operations have for the delivery of the p ogramme Analysis of constraints, requirements, risk and benefits completed • Response=3 potential scenarios selected for consideration post covid • For each the change, benefits, opportunities, resources required, and critical issues are detailed **CRITICAL ISSUES - Delivery** • Recruitment freeze & delays in approvals causing significant challenge for implementation. 9(2)(g)(i) [redacted] • Reduced time for programme of work for BMT will require some outsourcing to complete delivery. **CRITICAL ISSUES - Resources** • 9(2)(g)(i) [redacted] **CRITICAL ISSUES – Data Utility** • Implications of a change in sample size and cycle of remeasurement has long-term implications for programme • Reduce sample size to meet current constraints limit utility of data for DOC and AOG • Redesign of plot cycle would require agreement from stakeholders **CRITICAL ISSUES– Operating /Structure/Systems** • Programme faced pressure prior to COVID-19 with 30% of core team roles vacant • Programme delays prior to lockdown due to extreme weather conditions in 19/20. • Field operating model heavily reliant on temporary staff and contractors • High turnover of staff, loss of core capacity and skills and increased health and safety risks • COVID-19 lockdown resulted in early termination of the summer field season • COVID-19 situation has reduced productivity and caused delays. • Programme end of season BAU work 1 to 2 months behind schedule • Core capacity insufficient to complete the end of season BAU work **and** begin pre-season preparation for 20/21 **and** implement EDC , Database and systems improvements and the Capability and Development Framework
Full Programme: T1 and LUCAS *with* Delayed Start *and* Modified Delivery Model **PLOTS** **ANI=330 (100%)** **VEG=290 (100%)**	DOC ★★★ AOG ★★★	DOC Annual Report Annual Report Dashboard AOG commitments International reporting (CBD, IPCC) MFE Land Domain Report DOC Biodiversity WĀNANGA Pathway Biodiversity Strategy NPS on Biodiversity	Systems improvement (reduced due to time) Capability and Development Framework Better programme management EDC investment now to secure savings in outyears Testing alternate models (Outsourcing/working with others)	**CURRENT** **$4.6M** **COST PRESSURE/ ADDITIONAL INVESTMENT** **$0**	
Minimal Viable Product: LUCAS Programme only **PLOTS** **ANI=0 (0%)** **VEG=130 (45%)**	DOC ★ AOG ★★	~~DOC Annual Report~~ ~~AOG commitments~~ ~~Annual Report Dashboard~~ ~~MFE Land Domain Report~~ International reporting ~~CBD,~~ IPCC) ~~DOC Biodiversity~~ ~~WĀNANGA Pathway~~ ~~Biodiversity Strategy~~ ~~NPS on Biodiversity~~	~~Systems improvement Capability and Development Framework~~ ~~Better programme management~~ EDC investment now to secure savings in outyears	**TOTAL** **$2.5M** **CURRENT** **$4.6M** **COST PRESSURE/ ADDITIONAL INVESTMENT** = **$-2.1M**	






Scenarios

- COVID lockdown and potential constraints on programme delivery required a rethink about what is possible for the delivery of the 2020-2021 Tier 1 and LUCAS Programme
- Created opportunity to reassess and align the Tier 1 annual plan with DOC Biodiversity WĀNANGA Pathway
- Drove consideration of the requirements Operations have for the delivery of the programme
- Analysis of constraints, requirements, risk and benefits completed
- Response=3 potential scenarios selected as viable post covid
- For each the change, benefits, opportunities, resources required and critical issues detailed

Utility of data rating

The utility of the data and value/benefit of each scenario was evaluated. Options to reduce sample size were tested previously and rejected. A check-in was completed again. As before, it was found that at fully implemented programme ensures DOC meets minimum commitments and should be retained;
DOC, MFE and All of Government (AOG) have consistent and standardised data to meet commitments;

- DOC Annual Reporting
- MFE Land Domain Report
- Data for international reporting (CBD, IPBES, IPCC)

Value Benefits

- A fully implemented programme with recommended changes, support from SLT and some additional investment will provide significant benefits for DOC
- Delivers on DOC Biodiversity WĀNANGA Pathway as provides the information and specialist skills to manage biodiversity well
- Delivers on Biodiversity Pathway Investment & Action Plan as National Monitoring System remains intact and there is:
  - Improved environmental data & supporting systems for open data (e.g. DOCMON database and data sharing initiatives like Ebird and align to ICT strategy) Electronic Data Capture technology for collection of biodiversity data that will benefit all of DOC and Nzinc
  - Tier 1 provides the underpinning data such as ungulate abundance for establishing measurable targets to track progress in reversing decline
  - DOC and MFE LUCAS collective actions ensure progress of the NZBS/Biodiversity 'system'
  - Tier 1 continues to provide new monitoring tools (e.g. Bird ID app, Chewcard ID app)
  - There is a Capability and Development Framework ensure a skilled workforce (e.g. botanists, data analysts) underpinning collective action on Biodiversity Strategy and Predator Free 2050
- Gives effect to the Biodiversity Pathway Operating model as Tier 1 defined as National programmes with national stakeholder interest, scale and investment is significant, bespoke skills for delivery
- PLUS Electronic Data Capture will reduce costs and improve sustainability
- BMT restructure mitigates H&S risks, improve staff supervision and create sustainable team structure

Opportunity

Development of scenarios provided timely consideration of new opportunities for improvements

- BMT Structure – rethink and test structure for delivery enables DOC to mitigate H&S risks, improve staff supervision, improve wellbeing, create more sustainable programme
- Database Systems and Improvement – reprioritise to align with ICT strategy and invest in Web Interfaces, Electronic Data capture, Open data systems
- Programme Management – Align with DOC Biodiversity Pathway Structure to formalise Programme and its Governance

Change

CHANGES are proposed in response to the rethink and analysis of scenarios. For a fully implemented programme these will allow DOC to realise the **BENEFITS**, give effect to the **OPPORTUNITIES** and mitigate **CRTICIAL ISSUES**.

- Increase investment
- Restructure BMT
- Establish new base in Rotorua
- Implement Electronic Data Capture
- Formal programme management
- Incr ase capacity
- Hire one new supervisor
- Convert 22 temps to permanent
- Develop Capacity & Development Framework
- Hire a programme coordinator

Resources

What the programme need in terms of resource ($) and support (staff) to deliver each scenario were determined and are based on actuals (time and operating costs).

- Current DOC funding needs to increase in all scenarios
- Decreasing baseline & reallocation over duration of programme
- Increase in delivery costs BUT static FPL
- Unlike MFE revenue, not inflation proofed (2% CPU pa)
- MFE revenue no longer enough to offset costs and sustain programme
- Programme at critical point and to implement full Tier 1 programme investment is required @ $700K (15%)
- This is the equivalent of 2% CPU per annum

- Programme faced pressure prior to COVID-19 (see critical issues).
- To deliver a full programme next season we would need to change BMT structure and build capacity for better programme management
- This would apply if Tier 1 programme delayed

Scenarios considered | Utility of data rating to meet DOC, MFE, AOG requirements | Value/Benefit proposition | Opportunities this provides | Changes to programme to support each scenario | Total cost for delivery + investment required | Staff required to deliver + new roles required | Critical Issues

Critical Issues

Critical issues for 20/21 implementation identified and evaluated. Mitigation of risk and responses developed.

Critical issues and constraints considered but not addressed as no longer relevant are; field team size, group size for training, e Learning solutions, stakeholder support for delivery due to travel restriction, changes to model due to restriction of Back Country Travel and Inter-regional Travel

Critical Issues - Delivery

- Recruitment freeze & delays in approvals causing significant challenge for implementation. 9(2)(g)(i) [redacted]
- Reduced programme of work for BMT will require and remainder of plots outsourced

Critical Issues - Resources

- 9(2)(g)(i) [redacted]
- Implications of a change in sample size and cycle of remeasurement has long-term implications for programme
- Reduce sample size to meet current constraints limit utility of data for DOC and AOG
- Redesign of plot cycle would require agreement from stakeholders

Critical Issue – Operating /Structure/Systems

- Programme faced pressure prior to COVID-19 with 30% of core team roles vacant
- Programme delays prior to lockdown due to extreme weather conditions
- Field operating model heavily reliant on temporary staff and contractors
- High turnover of staff, loss of core capacity and skills and increased health and safety risks
- COVID-19 lockdown resulted in early termination of the summer field season
- COVID-19 situation has reducing productivity and causing delays.
- Programme end of season BAU work 1 to 2 months behind schedule
- Not have enough core capacity to complete the end of season BAU work **and** begin pre-season preparation for 20/21 **and** implement EDC , Database and systems improvements and the Capability and Development Framework