

Departmental Memo



Department of
Conservation
Te Papa Atawhai

Date: 19 July 2021
To: Senior Leadership Team
From: Meg Rutledge – Director Threats
Subject: Forest and Bird carbon sinks report analysis

Executive summary – Whakarāpopoto ā kaiwhakahaere

1. This memo is in response to a request from Lou Sanson to provide the DOC Senior Leadership Team with an analysis of the recent Forest and Bird report on the protection of natural carbon sinks.
2. Forest and Bird released a report on 18 June 2021 focused on carbon stored in natural carbon sinks and the impacts introduced browsing pests cause to these sinks.
3. This memo analyses the key conclusions drawn from the report, provides a DOC and MfE expert view on their validity, and likely implications to work underway or planned.
4. DOC agrees New Zealand's natural forests need to be managed so that they do not lose carbon. Turning the entire natural forest carbon stock from carbon equilibrium to a net loss could be catastrophic. Enhancing carbon sequestration in natural forests is secondary to managing them to prevent carbon loss.
5. Further research and monitoring is required to better understand the relationship between carbon storage and control of introduced browsing pests in the various natural ecosystems across New Zealand.

Purpose – Te aronga

6. The purpose of this memo is to analyse the conclusions of the Forest and Bird report 'Protecting Our Natural Ecosystems' Carbon Sinks' and provide a DOC expert view on their validity.
7. This memo provides an overview of potential strategic implications of the Forest and Bird report for DOC's Senior Leadership Team.
8. Note, the Acting Minister of Conservation was provided with advice regarding the Forest and Bird Report [21-B-0456] on 18 June 2021.
9. Note, a separate memo will be provided to the Senior Leadership Team regarding the final Climate Change Commission Advice, including analysis of advice on maintaining, protecting, and restoring existing carbon stocks.

Background and context – Te horopaki

Forest and Bird report context and conclusions

10. On 18 June 2021, Forest and Bird released a report on New Zealand's natural ecosystem carbon sinks.
11. The report estimates carbon stored in the various natural ecosystems across New Zealand, assesses the impact of introduced mammalian herbivores on these ecosystems, and estimates the emissions mitigation potential of wide-spread pest control.
12. The report highlights the decline in carbon stored in kāmahi-podocarp forest and attributes this to introduced mammalian herbivores. The report also assesses the potential emissions mitigation that could be achieved through widespread herbivore control.
13. The report concludes that control of mammalian herbivores is likely to be one of the most significant and cost-effective options for protecting and enhancing the country's massive stores of natural carbon and contributing to emission targets.
14. The report proceeds a Forest and Bird submission on the Climate Change Commissions draft advice report. The submission used context from the subsequent report to call for greater emphasis on the management of browsing pests in the final Commission advice.
15. The final Commission advice report incorporates some of the recommendations of the Forest and Bird submission regarding increased protection of natural carbon stores.

Use of LUCAS/Tier 1 inventory data

16. The Forest and Bird report relies heavily on the most recent analysis (Paul et al. 2019, i.e. the "Scion report") of the LUCAS (Land Use and Carbon Analysis System)/Tier 1 natural forest plot measurement programme (referred to as the Natural Forest Inventory in the Forest and Bird Report).
17. The Scion report concluded that New Zealand's natural forest estate is in equilibrium, but also showed there are four forest types showing statistically significant changes in carbon stock. Three of which were gaining carbon, and that Kāmahi-podocarp (a widespread forest type) was losing carbon.
18. The Scion report clearly states that tall NZ forests are at equilibrium – neither gaining nor losing overall. This conclusion is supported by the previous analysis by Manaaki Whenua (Carswell et al. 2014), which also reported similar measures of average carbon stock (228.75 t/ha compared to the 227 t/ha for the Scion report). However, a difference in the methods between these two reports makes direct comparisons difficult.
19. The LUCAS programme commenced in 2002 to monitor and report on carbon stock and change in NZ forests and shrublands. DOC took over collection of the LUCAS inventory data for MFE exclusively from 2011 under an MOU.
20. In 2011, DOC built on MFE's plot network and implemented Tier 1. The 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.
21. There is considerable overlap in the sites visited, methods and data required by each programme. DOC and MFE work as a central government collective to complete both programmes.
22. LUCAS data was originally collected on a five year remeasure cycle. However, in 2014 the LUCAS programme transitioned to a 10-year remeasurement cycle as this is generally accepted as a good interval for carbon stock and stock change monitoring of indigenous forests and is comparable to measurement intervals in slow growing boreal or temperate hardwood forests (Beets et al. 2009).

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23. The Tier 1 data have remained on five-year measurement cycle so that impacts of management of herbivores on vulnerable ecosystem components can be documented.
 24. The LUCAS/Tier 1 network provides information on carbon stocks and tree dynamism at a landscape scale (8 km grid). This information helps New Zealand to meet its mandatory international and domestic climate change reporting requirements for the land use, land use change and forestry (LULUCF) sector. These data are also used by a variety of New Zealand agencies to answer a range of questions. Recent requests include state and trends of National Parks, North Island Forest Parks (including Raukumara), and as such this data is important for our relationship with mana whenua.
 25. The information has also been used to support national and international plans and strategies such as the DOC Deer Strategy -Te Ara ki Mua, New Zealand State of the Environment reporting, Te Mana o te Taiao (ANZBS) and the Convention on Biological Diversity report.

Gaps in the Forest and Bird Report

26. The drivers of carbon storage loss in kāmahī-podocarp forest are unclear and may not be caused by browsing herbivores.
27. Population maintenance of kāmahī at a range of scales was reported on in 2014 by DOC, MfE, and StatsNZ using the 2014 LUCAS/Tier 1 data. In the South Island the rate of kāmahī recruitment exceeded its mortality rates, which is potentially at odds with a view that herbivores are detrimental to southern populations of kāmahī.
28. In other research (Ramsey et al. 2019) showed that southern rātā canopy condition is enhanced when possum management is applied.
29. It is risky to highlight only one forest type out of suite of natural forest types, as it is important that natural forests are managed as a whole. We would expect some forests to be naturally losing carbon and others to be gaining, because natural forests are comprised of various aged cohorts, regrown after a variety of disturbances (scale/geochemical impact).
30. The report likely over-estimates the potential emissions mitigation that could be achieved by introduced herbivore control. There is little scientific evidence for the potential emissions mitigation identified in the report, and their calculations include a few errors.
31. Manaaki Whenua (Carswell et al. 2014) found it was not possible using current methods to quantify the effect of introduced herbivore control on carbon sequestration in mature native forest because the errors associated with measuring carbon are larger than the impact of browsing on carbon by introduced herbivores.
32. The report does not address the potential for additional carbon storage in regenerating and restored forest. Manaaki Whenua (Carswell et al. 2014) suggested that controlling introduced herbivores could have significant benefits in terms of increasing carbon sequestration in regenerating and restored native forest.
33. The report did not address of the risk of increasing droughts and storm events due to climate change to our native forests, and that ungulate browse means they will be less resilient and likely to recover.

Work underway or required

34. The apparent loss of carbon stored in kāmahī-podocarp forest is a concern and further investigation into the drivers is needed.
 35. The LUCAS/Tier 1 network provides information on carbon stocks and tree dynamism at a landscape scale (8 km grid). This data informs questions about the drivers of gain versus
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loss across all forest types. Demographic work has been proposed looking at what are the relative strengths of growth vs. mortality vs. recruitment across the LUCAS/Tier 1 network. This provides an opportunity to investigate the effect of browsing ungulates and climate change (e.g. drought, cyclone damage) on all forest types.

36. The coarse (8-km) resolution of the LUCAS/Tier 1 network may mask local-scale tree dynamics and carbon stocks that are known to change along gradients of disturbance (forests are often affected by wind and landslides) and elevation.
37. DOC has local networks of plots that can provide catchment-scale resolution of carbon fluxes and tree dynamics and these plots can provide much longer temporal resolution (up to 50 years) – much longer than the LUCAS/Tier 1 network. Candidates for remeasurement are those with up to five measurements already, including Kokatahi, Whitcombe (both established 1972), and Rakiura (established 1980) plots. Remeasurement and analysis of all three sites would reveal spatial and long-term carbon dynamics in the presence of mammalian herbivores, providing additional power to interpreting carbon fluxes in these forests.
38. Since we know that fluxes of carbon depend not only on the dynamism of live trees but also on the sometimes-slow decay of dead trees in kāmahī–podocarp forests (Mason et al. 2013), pools of coarse woody debris also require measurement (measured in the Kokatahi in 1997 but not elsewhere).
39. To enable better transparency for comparing like with like regarding future analyses of the LUCAS/Tier 1 data, the Planning and Support unit is running a process to identify the difference made by methodological decisions/data cleaning/data corrections etc.
40. A DOC strategy to manage deer and other ungulates is being developed. One of its objectives will be to ensure resilience is retained in our forest ecosystems. The strategy will be partly underpinned by the LUCAS/Tier 1 programmes and ongoing collection of data.

Risk assessment – Aronga tūraru

41. There has been a loss of precision regarding reporting on the effects of introduced herbivores on natural forest post 2014, because reporting is now only on half of the data.
42. In 2014 when MfE moved the natural forest remeasurement component to a 10-year cycle, but DOC maintained its investment on a 5-year cycle so that responses to management of herbivores on vulnerable ecosystem components could be documented.
43. However, in 2020/21, DOC decided to reduce the Tier 1 budget by \$500k net. As a result, the programme stopped the vegetation monitoring of all Tier 1 Forest plots and some non-Forest plots on PCL including NI forest parks. This effectively reduces this component to a 10-year cycle as well.
44. Reductions in remeasurement went against internal and external expert advice [REDACTED]
45. In absence of Tier 2 data, DOC is completely reliant on LUCAS/Tier 1 data for making conclusions about the effects of introduced herbivores on native ecosystems. Also, halving to the remeasurements to a 10-year cycle has compromised our ability to relate changes in occupancy and abundance of herbivores to forest recruitment and mortality and provide the underpinning data for the DOC's deer strategy.

Next steps – Ngā tāwhaitanga

46. DOC currently is in preliminary discussions with Manaaki Whenua about the potential delivery of the climate change aspect of the analysis of the LUCAS/Tier 1 data. As well as the potential remeasurement of the Kokatahi, Whitcombe and Rakiura plots. Both research projects would have a focus on Kāmahi.
47. DOC has also initiated discussions between Manaaki Whenua and NIWA about improving the measurement of carbon exchange associated with native forests. This is at a preliminary stage, and the next steps are for Manaaki Whenua and NIWA to scope what a research project would look like.
48. DOC is working with the University of Canterbury testing the use of LIDAR to remotely measure carbon storage accurately in native forest. Preliminary discussion about how to ground truth the LIDAR information are taking place.
49. DOC is working in partnership with iwi to restore the Raukumara forest on the East Coast of the North Island.
50. DOC Partnerships Group is investigating the opportunity to enable biodiversity improvement through native restoration for carbon benefits. This is at the early stages of investigation.
51. As part of the Emission Reduction Plan, which will be set by the Government by the end of 2021, it is currently proposed a longer-term cross-government work plan will be agreed with a particular focus on building the evidence base for interventions to maintain and enhance sequestration and/or avoid carbon loss in existing forests.
52. MfE is working with Scion to analyse LUCAS data collected in the third measurement cycle (2014-2020). This will provide further insight into how carbon stocks are changing through time at the national scale, as well as for individual forest types (such as Kāmahi-podocarp forest). The analysis will be due in June 2022.

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