# How to Seek a Science Assessment for a Carbon Removal Activity

## Guide for Applicants

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# Me Pēhea te Rapu Aromatawai Pūtaiao mō tētahi Mahi Tango Hauhā

## He Aratohu mā te Kaitono

Ministry for the Environment
Manatū Mō Te Taiao

Te Kāwanatanga o Aotearoa
New Zealand Government

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# Contents

# Tables



# Figures

# Is this guide for you?

This guide builds upon the *Assessment Framework for Carbon Removals* (the Assessment Framework), which you should read first.

If you are interested in understanding whether the science demonstrates the effectiveness of a specific carbon removal activity, this guide is for you. Carbon removal activities refer to deliberate technologies, practices and approaches that remove carbon dioxide ($CO_2$) from the atmosphere and store it long-term in another $CO_2$ pool, such as vegetation, soil or the ocean.[1]

Research, innovation and opportunities for carbon removals are advancing fast. Individuals, organisations or collectives can now apply for the Ministry for the Environment (the Ministry) to assess the scientific evidence of a particular kind of carbon removal activity. By undertaking these science assessments, the Ministry aims to expand the scientific understanding of carbon removal activities that may be conducted in Aotearoa New Zealand.

You may be interested in applying for a science assessment for a variety of reasons, such as:

- including an activity in the New Zealand Emissions Trading Scheme (NZ ETS)
- including a carbon removal activity in the accounting for New Zealand's nationally determined contributions (NDCs)
- exploring opportunities to trade credits on voluntary carbon markets.

This guide explains the process to prepare and apply for a science assessment (see figure 2 for a flowchart outlining the process). The key steps you need to take are:

- understand the Assessment Framework and the pathways to voluntary markets, the NZ ETS and the NDCs
- confirm that the activity you are interested in is eligible
- collate evidence and understanding how the scientific criteria would be applied to it
- use the Carbon Removal Activity Check self-assessment tool to rate your evidence against the scientific criteria
- complete the application form (not all applications will be assessed; for example, if they do not meet eligibility criteria or have insufficient evidence, an applicant will be informed if an application is not assessed and why).

**After you submit your application**

The science assessment results, along with other information, will inform any decisions the Government takes on allowing more carbon removal activities in the NZ ETS or to be accounted for towards our NDCs.

The science underpinning an activity is only one of several things the Government considers in these decisions. If the science assessment demonstrates a carbon removal activity is

[1] See definition of carbon dioxide removal from the IPCC Carbon Dioxide Removal factsheet. Also known as a carbon reservoir, a carbon pool is a system which has the capacity to accumulate or release carbon. See IPCC (2000). *Land Use, Land-Use Change and Forestry*. Special Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, USA: Cambridge University Press.

scientifically robust, and the Government wants to consider it, the Ministry will undertake an inclusion assessment, including a broad range of activity-specific considerations. Inclusion assessments are done as a separate, case-by-case process and aren't detailed in this guide.

**Before you continue, you should understand that:**

- developing the science for new carbon removal activities is a long-term process that can take years: activities will be at various levels of readiness, with many requiring significant base research and field trials before an activity can be considered for inclusion in the NZ ETS and/or NDCs.
- science assessments examine evidence looking at an *activity,* the Ministry doesn't assess projects (eg, forestry is an activity but planting a forest on specific land is a project)
- a science assessment that demonstrates the effectiveness of a specific carbon removal activity **is not** a government endorsement of any projects that undertake that activity
- an assessment may be useful if you want to trade in voluntary markets, however, there are other processes you will need to complete before you can do that
- some activities will be ineligible for a science assessment, for example those already in the NZ ETS, activities storing carbon for a short time, and carbon capture and storage activities (see the Eligibility requirements section for details).

If you've read this guide and used the tool and still aren't sure about applying for a science assessment, please contact us at carbonremovals@mfe.govt.nz.

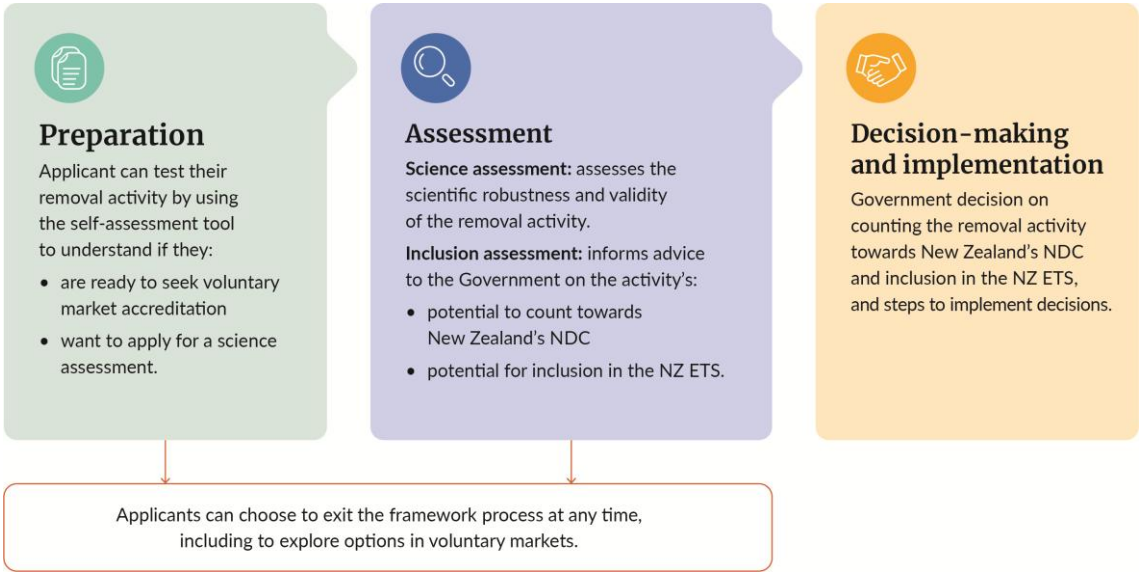
# The Assessment Framework

Removing $CO_2$ from the atmosphere is an essential part of New Zealand's climate change mitigation strategy. In November 2025, the Ministry published the *Assessment Framework for Carbon Removals*, which was a key action in *New Zealand's second emissions reduction plan 2026–30*.

While forestry is already a critical part of New Zealand's approach, the Government wants to encourage businesses and organisations to explore other removal activities. The Assessment Framework aims to do this by establishing a process to expand the scientific understanding of carbon removal activities that may be conducted in New Zealand.

The Assessment Framework has three stages (figure 1).

**Figure 1: The three stages of the Assessment Framework**




## Preparation stage

To prepare for a science assessment, you will need to collate valid and relevant evidence for the nine scientific criteria and mātauranga Māori where relevant. Activities will be at various levels of readiness, with some requiring significant foundational research and field trials. Collating the evidence required for a science assessment could take many years, depending on the activity in question.

You can apply for a science assessment if the activity you are interested meets the Eligibility requirements.

## Assessment stage

Carbon removal activities need to meet high scientific standards before they can be considered for inclusion in the NZ ETS and/or the accounting for New Zealand's NDCs. The science assessment will review the evidence to determine whether the carbon removal activity is effective.

When a science assessment demonstrates a carbon removal activity is scientifically robust, the Minister of Climate Change will decide whether to conduct an inclusion assessment, which will include a broad range of activity-specific considerations.[2]

## The Assessment Framework can also help you prepare for voluntary markets

Voluntary markets[3] can open income opportunities for people and organisations by linking them with investors interested in projects designed to protect nature, including by removing $CO_2$ from the atmosphere. Such projects generate credits which are tradeable and valuable for organisations or individuals who would like to make, or be associated with, environmental improvements.

While the Government is supporting the expansion of New Zealand voluntary nature and carbon markets, these are not directly regulated by the Government. The Assessment Framework will not determine what can participate in and be credited or traded in voluntary markets. Instead, the role of the Assessment Framework is to equip interested market participants with science assessments for activities.

To enter a voluntary market, projects must be verified under a project standard, which involves assessing the science – as well as several other important aspects of a project, like governance and reporting. See the guidance for participants in voluntary carbon markets, and internationally recognised, independent meta-standards for voluntary markets in the Suggested reading section.

Unlike for the NZ ETS, proof of national-scale impact is not required for entry in voluntary markets. If assessment of your evidence indicates you may meet the requirements for many of the scientific criteria but are lacking in areas relating to national scale (such as for the 'material' criterion), you could consider exploring voluntary market opportunities. See the section on Eligibility requirements for further information on the distinction between activities and projects.

# Decision-making and implementation stage

After completing an inclusion assessment, the Ministry will provide advice to the Minister of Climate Change about the suitability and implications of adding a new removal activity into the NZ ETS and/or NDCs.

The Assessment Framework provides a transparent, science-based process that the Government will follow when making decisions about including new activities in the NZ ETS or accounting for them in New Zealand's NDCs.

Because of the complexity of making and implementing such decisions, this stage of the Assessment Framework may be a long-term process, with decisions made on a case-by-case basis. Some of these implementation considerations are set out below.

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[2] Ministry for the Environment. 2025. *Assessment Framework for Carbon Removals*. Wellington: Ministry for the Environment. pp 15–18.

[3] The term *voluntary markets* refers to the broad landscape whereby participants buy and sell nature, carbon and biodiversity credits. The term *voluntary carbon markets* refers specifically to markets in which participants buy and sell carbon credits. The term *voluntary nature and carbon markets* refers to the specific Government work programme to bolster voluntary market activity in New Zealand.

For both the NZ ETS and NDCs, an activity must be included in New Zealand's Greenhouse Gas Inventory.[4] This means there must be data to estimate emissions from the activity, at a national scale, from a defined base year onwards.[5]

## Recognising new removal activities in the NZ ETS

The NZ ETS is the Government's main tool for reducing greenhouse gas emissions and meeting New Zealand's domestic and international climate change commitments.[6]

The NZ ETS works by requiring those who undertake certain activities to surrender units for the greenhouse gases they emit, while allowing those who undertake carbon removal activities to earn units. The primary removals currently recognised in the NZ ETS are forestry activities.

If the Government decides to add a new activity to the NZ ETS, a planned amendment to the Climate Change Response Act 2002 would simplify and speed up the process to enable new carbon removal activities to be recognised.

Other steps would include:

- drafting new regulations for the specific activity
- consultation on the regulations
- changes to the NZ ETS Register and associated processes
- development of any verification or monitoring processes for registered entities in the NZ ETS.

These steps are vital to ensure integrity in the trading of the activity and are required by law. It is important to understand you can't earn credits in more than one market for the same emissions removal.[7]

## Recognising new removal activities in Nationally Determined Contributions

Under the Paris Agreement, each country sets targets for reducing its greenhouse gas emissions. Known as Nationally Determined Contributions (NDCs), these targets outline the contribution each country will take towards delivering on the goals of the Paris Agreement.

If the Government decides to recognise a new removal activity in New Zealand's NDCs, a large amount of work would follow, including:

- updating our target (NDC) accounting
- communicating the change in accounting to the United Nations Framework Convention on Climate Change (UNFCCC)

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4 Ministry for the Environment. New Zealand's Greenhouse Gas Inventory. Retrieved 15 April 2026.

5 A base year refers to a specific historical year used as a reference point against which net emissions in later years are compared, enabling consistent tracking over time. The base year can be any historical year inventoried in New Zealand's Greenhouse Gas Inventory, which starts in 1990.

6 Ministry for the Environment. About the New Zealand Emissions Trading Scheme. Retrieved 15 April 2026.

7 This is referred to as **double counting**, where separate markets issue units for the same emissions reduction. Preventing double counting is essential for market integrity and emissions reductions.

- designing and building national monitoring systems
- updating our Biennial Transparency Report.[8]

On rare occasions, an activity may already be included in New Zealand's NDCs but not recognised in the NZ ETS.

# Upholding Te Tiriti o Waitangi | the Treaty of Waitangi

In practice, carbon removal activities may have implications for Māori rights and interests, depending on the nature of the activity and where it is undertaken (eg, in forests or wetlands). We have built in consideration of Te Tiriti o Waitangi | the Treaty of Waitangi into the application process. It is the Crown's responsibility to consider impacts on Māori rights and interests in decision-making and analysis.

As part of an application for a science assessment, you will need to identify any potential implications of the carbon removal activity for Māori rights and interests. This may include implications for tangata whenua, sites and areas of significance to Māori, Māori land or taonga (including native and protected species) or other identified Māori rights and interests.

In your application, you should also describe the outcomes of any engagement with iwi, hapū and owners of Māori land where this is relevant to the activity and its potential impacts, and summarise the outcomes of that engagement. The nature and extent of engagement will vary depending on the activity and its potential impacts.

[8] Every two years, New Zealand and other parties to the Paris Agreement must submit a Biennial Transparency Report which tracks greenhouse gas emissions, NDCs, climate impacts, adaptation and financial support. See the UNFCCC's Biennial Transparency Reports webpage for further information.

# Eligibility requirements for a science assessment

This section details the eligibility requirements for a carbon removal activity that must be met before a science assessment can be undertaken. They are that:

- the application must be for a removal activity rather than a project
- the activity is proposed to remove $CO_2$ from the atmosphere and store it long-term
- the activity must occur within the territorial limits of New Zealand, including the coastal marine area
- the activity must be permitted under domestic and international law, and be consistent with international agreements and obligations.

The Ministry may also consider other factors before deciding if a science assessment will proceed, such as quality of evidence and nature of the activity. The Ministry will inform the applicant why, if an application does not proceed to a science assessment.

You can apply on behalf of yourself, an organisation or a collective of interested parties. We encourage you to engage with other parties interested in the same carbon removal activities and welcome joint applications for science assessments.

## Science assessments are focused on activities, not specific projects

Activities and projects are related but distinct concepts. An **activity** refers to a type of practice, technology or approach that removes $CO_2$ from the atmosphere in a consistent and repeatable way (for example, a type of wetland restoration). It could be done by several groups in different locations, with variation between exactly how each implements the activity. As the NZ ETS and NDCs have nationwide coverage, they are focused on the activity level and so that is also the focus of the science assessment.

For your application, please consider how to describe the carbon removal activity you are interested in. Table 1 shows three levels of description. The left column shows an example of an activity which would be difficult to do a science assessment of, as it is described too generally. The middle column shows the activity defined within specified boundaries. The level of description you provide will ensure the science assessment is focused on the specific boundaries you have an interest in; for example, enhanced rock weathering using a particular kind of rock. Projects, noted in the right column, are out of scope.

**Table 1: Descriptions of carbon removal activities**

| | General activity | Specific activity | Project |
|---|---|---|---|
| | Too general, may be difficult to do a science assessment | Pitched at right level for science assessment | Not eligible to be considered for a science assessment |
| **Example** | Enhanced rock weathering | Enhanced rock weathering by using a specified rock type with a specified method | Enhanced rock weathering on specified rock type with a specified method by specified party at a specified location and time |

A **project** is the specific, on-the-ground implementation of an activity by a party at a particular place and time (for example, a specific wetland restoration project occurring in Canterbury). Individual projects play an important role in having more removal activity take place in New Zealand. However, not all projects may happen at a large enough scale to be suitable for the NZ ETS or NDCs.

For these projects, a voluntary market may be more suitable. A science assessment for an activity in this situation might still be helpful as the project owner looks at options for voluntary market verification, although there would still be other steps needed for verification beyond that.

## The activity is proposed to remove $CO_2$ from the atmosphere and store it long term

Science assessments are designed to assess carbon removal activities as defined at the beginning of this document. For the purposes of this Assessment Framework, this also includes peatland rewetting.[9] This is because this type of land management reduces or stops ongoing emissions from previously emitting systems in the short-to-medium term and removes emissions via biomass gain in the long term.

## The activity must occur within the territorial limits of New Zealand, including the coastal marine area

This Assessment Framework has been designed to operate within New Zealand's legislative, policy and environmental context. Activities eligible for a science assessment are those that are intended to occur where New Zealand has sovereignty over all activities: New Zealand's land,[10] inland waters and territorial sea, including the coastal marine area.[11] Removal activities occurring outside of these areas may be considered through international mechanisms, not the Assessment Framework.

## The activity must be lawful under domestic and international law, agreements and obligations

Activities that are not permitted under domestic and international law, or that are not consistent with international agreements and obligations New Zealand is party to, will not be considered under the Assessment Framework.

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9 For more information on the role of peatlands in $CO_2$ removal, see: Ministry for the Environment. (25 January, 2024). *Wetland carbon abatement: Technical note* (OIAD-1146); International Peatland Society. Peatlands and climate. Retrieved 14 April 2026.

10 The definition of New Zealand applied in the Assessment Framework is from s29 of the Interpretation Act 1999.

11 New Zealand does not currently have a legislative framework to enable the measurement, reporting or verification of carbon removal activities in the Exclusive Economic Zone, or the extended continental shelf. Activities in these areas are not eligible for a science assessment.

Activities must comply with relevant domestic regulations, policies and legislation, and align with New Zealand's obligation to uphold Te Tiriti o Waitangi. This includes specific legislative commitments to protect the rights and interests of tangata whenua. In the application for a science assessment, you will be asked to identify any potential implications of the carbon removal activity for Māori rights and interests. This may include implications for tangata whenua, sites and areas of significance to Māori, Māori land or taonga (including native and protected species) or other identified Māori rights and interests.

The key domestic legislation governing how land and water are used in New Zealand is the Resource Management Act 1991.[12] Depending on the activity other relevant legislation may include the:

- Biosecurity Act 1993
- Climate Change Response Act 2002
- Hazardous Substances and New Organisms Act 1996
- Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
- Local Government (Water Services) Act 2025
- Marine and Coastal Area (Takutai Moana) Act 2011
- Te Ture Whenua Māori Act 1993.

New Zealand is party to a range of international agreements. Activities assessed through the Assessment Framework must be consistent with these. Please consider your activity in the context of relevant international agreements, such as the:

- Convention on Biological Diversity
- Kunming–Montreal Global Biodiversity Framework
- London Convention and Protocol
- Montreal Protocol
- Noumea Convention
- Paris Agreement
- United Nations Convention on the Law of the Sea
- United Nations Declaration on the Rights of Indigenous Peoples.

In some situations, an activity may have the potential to remove significant amounts of $CO_2$ from the atmosphere, but research has not yet proven it is effective and safe. International environmental law takes a precautionary approach to regulating such activities.

[12] In December 2025, the Government introduced the Planning Bill and Natural Environment Bill in Parliament to replace the RMA. The Government aims to pass the Bills into law in 2026.

# Carbon removal activities which may be considered through the Assessment Framework

The range and type of removal activities being explored and undertaken throughout the world is growing rapidly. Activities will be at various levels of readiness, with many requiring significant foundational research and field trials, which could take years. See table 12.6 in IPCC (2022)[13] for a summary of carbon removal activities, including technology readiness level.

The Intergovernmental Panel on Climate Change (IPCC) will soon publish additional guidance,[14] which will inform future work on carbon removals.

### Emerging carbon removal activities

We are interested in hearing about any innovative or emerging approaches that may not yet be widely implemented, ideas that are still at an early stage, and approaches that have been developed or trialled internationally and are now being explored for their relevance and application in New Zealand's context. You can contact us at carbonremovals@mfe.govt.nz

Table 2 outlines various methods of removal, storage and utilisation, and indicates if removal activities of those types may be considered through the Assessment Framework. Activities that capture or store $CO_2$ come in many forms. However, some are **not** covered by the Assessment Framework including those that:

- **capture emissions from an industrial point source**. These activities are subject to other regulation[15]
- **geologically store $CO_2$.** A separate *Carbon Storage Regime* has been published, and legislation is currently being developed to recognise geological $CO_2$ storage in the NZ ETS
- **directly use $CO_2$ in short-lived products.** This results in $CO_2$ being released back into the atmosphere. Under IPCC and national climate accounting rules, these activities are considered delayed emissions rather than long-term removals
- are already recognised in the NZ ETS and/or accounted for in the NDCs.

For more information, refer to the Suggested reading section of this document.

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13 IPCC. 2022. *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Chapter 12: Cross-sectoral Perspectives)*. Cambridge, United Kingdom and New York, USA: Cambridge University Press.

14 IPCC. 2027 (forthcoming). *2027 IPCC Methodology Report on Carbon Dioxide Removal Technologies, Carbon Capture, Utilization, and Storage for National Greenhouse Gas Inventories (Additional guidance)*. Geneva, Switzerland: IPCC.

15 Climate Change (Stationary Energy and Industrial Processes) Amendment Regulations 2025 require reporting of captured and removed $CO_2$ in industrial processes.

**Table 2: Carbon removal activities**

<table>
<tr><th>Method of removal</th><th colspan="4">Method of storage</th><th colspan="2">Method of utilisation</th></tr>
<tr><td></td><td>Geological<br>(injected underground and stored in geological reservoirs)</td><td>Mineral<br>(locked away through mineral carbonation)</td><td>Open environment<br>(including ocean or land reservoirs)</td><td>Directly used in long-lived products<br>(preventing release back into the atmosphere)</td><td>Directly used in short-lived products<br>(resulting in release back into the atmosphere)</td></tr>
<tr><td>Biological<br>(captured during biomass growth)</td><td rowspan="4">Not considered under the Assessment Framework</td><td>May be considered under the Assessment Framework<br><br>Possible activities include (but are not limited to):<br>• enhanced rock weathering</td><td>May be considered under the Assessment Framework<br><br>Possible activity types include (but are not limited to):<br>• soil carbon sequestration<br>• freshwater wetland restoration<br>• coastal blue carbon management</td><td>May be considered under the Assessment Framework<br><br>Possible activity types include (but are not limited to):<br>• biochar</td><td rowspan="4">Not considered under the Assessment Framework</td></tr>
<tr><td>Geochemical<br>(bound in materials)</td></tr>
<tr><td>Chemical<br>• (captured as gas from the air)</td></tr>
<tr><td>• (captured as gas from an industrial point source)</td><td colspan="3">Not considered under the Assessment Framework</td></tr>
</table>

Note: For more information on these and other carbon removal activities, see*: Climate Change 2022: Mitigation of Climate Change.*

# Collating evidence

This section explains the quality of evidence required to apply for a science assessment of a carbon removal activity. It also helps you collate valid and relevant scientific evidence and mātauranga Māori where relevant. When collating evidence, we recommend you draw upon a wide range of types and sources of evidence. Your sources should be representative of the wider evidence base and should be publicly available, where possible.

## Scientific evidence

Developing and collating the scientific evidence required for a science assessment may take many years. Carbon removal activities vary widely in their level of scientific maturity, with some supported by extensive research and others still requiring foundational research, field trials and validation. While this can be a lengthy process, it is essential to maintain integrity and confidence that activities deliver genuine, measurable and long-term carbon removals.

It is important you understand the nine scientific criteria your application will be assessed against. These criteria draw on the findings of a 2025 technical report from the Bioeconomy Science Institute and have been designed to test whether an activity is grounded in robust scientific evidence.[16]

These criteria are summarised in the box below and detailed in appendix 1, including an explanation of how assessors will apply them in each application.

**Scientific criteria**

**Measurable:** Is there a quantifiable net reduction in $CO_2$ attributable to a human action or intervention?

**Validated:** Are your measurement methods consistent with established scientific techniques, and do they produce results that are accurate and comparable with existing measurements? Do proposed measurements cross-check well against currently available techniques?

**Additional:** Is the $CO_2$ being removed and stored additional to the amount of $CO_2$ that would have been removed and stored over time without the activity?

**Permanent:** Is there long-term storage of $CO_2$ in one or more $CO_2$ pools because of the activity?

**Material:** Is the volume of $CO_2$ potentially being removed and stored detectable at a meaningful national scale?

**$CO_2$ leakage:** Is there a clear assessment of the risk of leakage with this form of removal activity and evidence that this risk of leakage can be reliably mitigated?

**Sustainable:** Is there clear evidence that the proposed activity will not harm the surrounding environment, and do you understand how it might affect biodiversity, habitats and ecosystem health in the places it could occur?

[16] Bioeconomy Science Institute. 2025. *Science framework for assessing new mitigation activities for natural carbon sequestration* (Contract Report: 2526-0025). Wellington: Ministry for the Environment.

**Transparent:** Is the evidence you rely on clearly explained, well documented and available for others to check? Are records of the evidence used to quantify the effect of the proposed activity well documented and accessible?

**Scalable:** Is it clear that the activity would work effectively when applied across larger areas or different locations? Is it clear that the measures and their proposed deployment are effective across various spatial scales?

We recommend you review other existing guidelines, methodologies and standards relevant to your activity, and refer to these in your application. See the Suggested reading section for more information.

Your scientific evidence should come from valid sources and include relevant information. Assessors will expect scientific evidence that is quantitative where possible, independently verified, transparent in methods and applicable to New Zealand conditions. A small number of valid, relevant studies is preferable to a large volume of weak evidence.

We also recognise you may be generating valuable primary research that is specific to the New Zealand context, and that this evidence may not be published. Provided it is valid and relevant, we also welcome unpublished, primary research.

Use the box below to ensure you provide valid and relevant evidence for each criterion.[17]

**A valid source:**

- is authored by qualified experts and reputable organisations such as independent scientific institutions or organisations
- is formally peer reviewed and quality assured (eg, academic journal articles and technical reports)
- is consistent with multiple studies by independent authors
- uses accepted and transparent scientific methods
- is reproducible, has minimal bias and acknowledges assumptions, limitations and uncertainties
- declares any actual or perceived conflicts of interest
- is from a comprehensive study of evidence that brings together results from many studies, rather than relying on one source, or is from a large, well-designed review of multiple studies that looks at overall patterns in the evidence.

**Relevant information:**

- directly and strongly supports a criterion
- is explicitly applicable to the criterion in the New Zealand context
- has clear, measurable, verifiable and attributable results for the criterion and has conclusive findings that have a strong degree of support for the criterion

[17] The information in this box has been adapted from the following sources: Social Policy Evaluation and Research Unit. 2018. *Making Sense of Evidence Handbook*. Wellington: Department of the Prime Minister and Cabinet; Social Policy Evaluation and Research Unit. 2018. *At a Glance Making Sense of Evidence: A guide to using evidence in policy*. Wellington: Social Investment Agency.

# Mātauranga Māori

Where relevant, mātauranga Māori should also be included as evidence in your application. Mātauranga Māori is a distinct and legitimate knowledge system that reflects Māori relationships with the environment, built through generations of observation, practice, values and a world view.

Mātauranga is likely to be relevant where activities interact with land, water, ecosystems or species, or where Māori rights and interests may be affected.

Any mātauranga provided as evidence should be used respectfully and, where applicable, with the consent of the relevant knowledge holders. It will be looked at using the mātauranga framework developed by the Environmental Protection Authority (EPA).[18] The mātauranga framework is designed to support a partnership approach and enable well-informed decision-making by ensuring mātauranga is appropriately considered alongside other forms of evidence in a way that is rigorous, fair and grounded in tikanga Māori.

The mātauranga framework provides a structured way to explore key questions such as the nature of the mātauranga being provided, its origins and connections to people and place, the impacts and implications it identifies, and how it is expressed and supported. These questions are summarised in the box below and detailed in the framework document hosted on the EPA's website and linked above.

**He aha ngā hononga? (What is your connection?)**

Consider the connections between the mātauranga, the people who hold or present it, and the place it relates to. This includes whakapapa, kaitiakitanga and the relationship of tangata whenua to the relevant land, waters or resources.

**He aha ngā pānga? (What are the impacts?)**

Identify the impacts and implications described through the mātauranga, including environmental, cultural, social or intergenerational effects. This step focuses on what the mātauranga indicates is important or at risk.

**He aha te mātauranga? (What is the mātauranga?)**

Understand the nature of the mātauranga being provided, including how it has been developed, maintained and transmitted over time. This includes recognising that mātauranga may be expressed through narratives, practices, observations or values, rather than in written or quantitative form.

**He aha ngā whakangāwaritanga? (What are the mitigations?)**

Consider any mitigations, protections or responses identified through the mātauranga to address the impacts described, including tikanga-based or place-based approaches.

[18] EPA. Mātauranga Framework. Retrieved 15 April 2026.

The mātauranga framework does not seek to validate mātauranga against scientific criteria but instead recognises mātauranga and science as different knowledge systems that can sit alongside one another and together inform robust and credible decision-making.

By using the mātauranga framework, the assessment process seeks to respect the mana of mātauranga and ensure it is considered in context.

# Carbon Removal Activity Check tool

The Carbon Removal Activity Check is a self-assessment tool designed to help you at any stage of your preparation to make an application. It will help you understand how evidence aligns with the Assessment Framework's science assessment criteria. By using the tool, you will be able to gauge relatively quickly how prepared you are to submit an application.

It is a simple online questionnaire that may take you less than half an hour and will not require you to upload any supporting documentation. Using the tool is not a requirement but is strongly recommended.

The tool is designed to help you check whether you have the right evidence to support an application. It can help you identify any gaps and understand where further evidence may be needed. You can use the tool as many times as you like as you continue to gather and refine your evidence. Its purpose is to support you to decide whether you are ready to apply for a science assessment, whether you need to do a bit more work first, or whether this pathway is not the right fit for you.

The tool will ask you to:

- identify what type of organisation you represent
- state the carbon removal activity for which you intend to seek a science assessment
- mention if you have had any engagement yet with iwi or hapū about the activity
- consider how well the evidence you have collated meets each of the nine scientific criteria outlined in the Assessment Framework (see also appendix 1) using the evidence rating system described in the blue box below.

You will receive automated, standard responses based on the evidence rating options you select for each of the nine scientific criteria.

**Evidence rating system**[19]

**Well established:** Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency); high scientific agreement; high confidence.

**Partially established:** Multiple but limited evidence and number of studies, not comprehensive, independent, imprecisely addresses criterion (type, quality, quantity, consistency); general scientific agreement; medium confidence.

**Lacking consensus:** Multiple, independent, but weak and variable evidence (type, quality, quantity, consistency); lack of scientific agreement; low confidence.

**Insufficient evidence:** No or limited evidence, suggestive, speculative (type, quality, quantity, consistency); lack of scientific agreement; very low confidence.

Information used in the tool will not be used in any future application. We will record basic information about the use of the tool – for example, the number of times it is used, and the kinds of carbon removal activities users say they are interested in.

[19] The evidence ratings noted in this box are adapted from: Janzwood S. 2020. Confident, likely, or both? The implementation of the uncertainty language framework in IPCC special reports. *Climatic Change 162*(3): 1655–1675; IPBES. 2018. *The IPBES Guide on the production of assessments*. Bonn, Germany: Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Both of these sources are referenced in Bioeconomy Science Institute. 2025. *Science framework for assessing new mitigation activities for natural carbon sequestration* (Contract Report 2526-0025).Wellington: Ministry for the Environment.

# Submitting an application

You can apply on behalf of yourself, an organisation or a collective of interested parties. We encourage you to engage with other parties interested in the same carbon removal activities and welcome joint applications for science assessments.

You can apply to the Ministry for a science assessment in two ways:

1. through an online portal where applications can be drafted and supporting documents can be uploaded directly
2. by downloading an application form from the portal and emailing it along with supporting documents to carbonremovals@mfe.govt.nz.

The application form is comprehensive and asks for information about:

- you and the organisation you may represent
- the carbon removal activity being proposed for science assessment
- whether you are interested in trading on voluntary markets or seeking the Government to recognise the carbon removal activity in the NZ ETS or NDCs
- any potential implications the carbon removal activity may have for Māori rights and interests
- details of what evidence there is and how it meets the scientific criteria.

You will also need to complete a declaration that the content of your application is complete, true and correct, and that you understand how the Ministry will use, store and protect information submitted.

You will be required to upload a wide range of supporting evidence. Where the evidence is publicly available, you should upload the information as a full document. You may wish to include evidence that is not publicly available, such as consultancy reports, privately purchased or generated research, or project outcome reports. You will be asked to distinguish any documents that are not publicly available by uploading them to a dedicated upload box for information requiring different protections.

If you choose instead to email your application and supporting evidence, you will be asked to let us know which documents are private and whether any documents are sensitive – for example, commercially sensitive or containing culturally sensitive information.

# The science assessment process

Figure 2 demonstrates the assessment process steps for each application. For more information about the steps in the process, see the descriptions in table 3.

**Figure 2: Flow chart view of the application process**

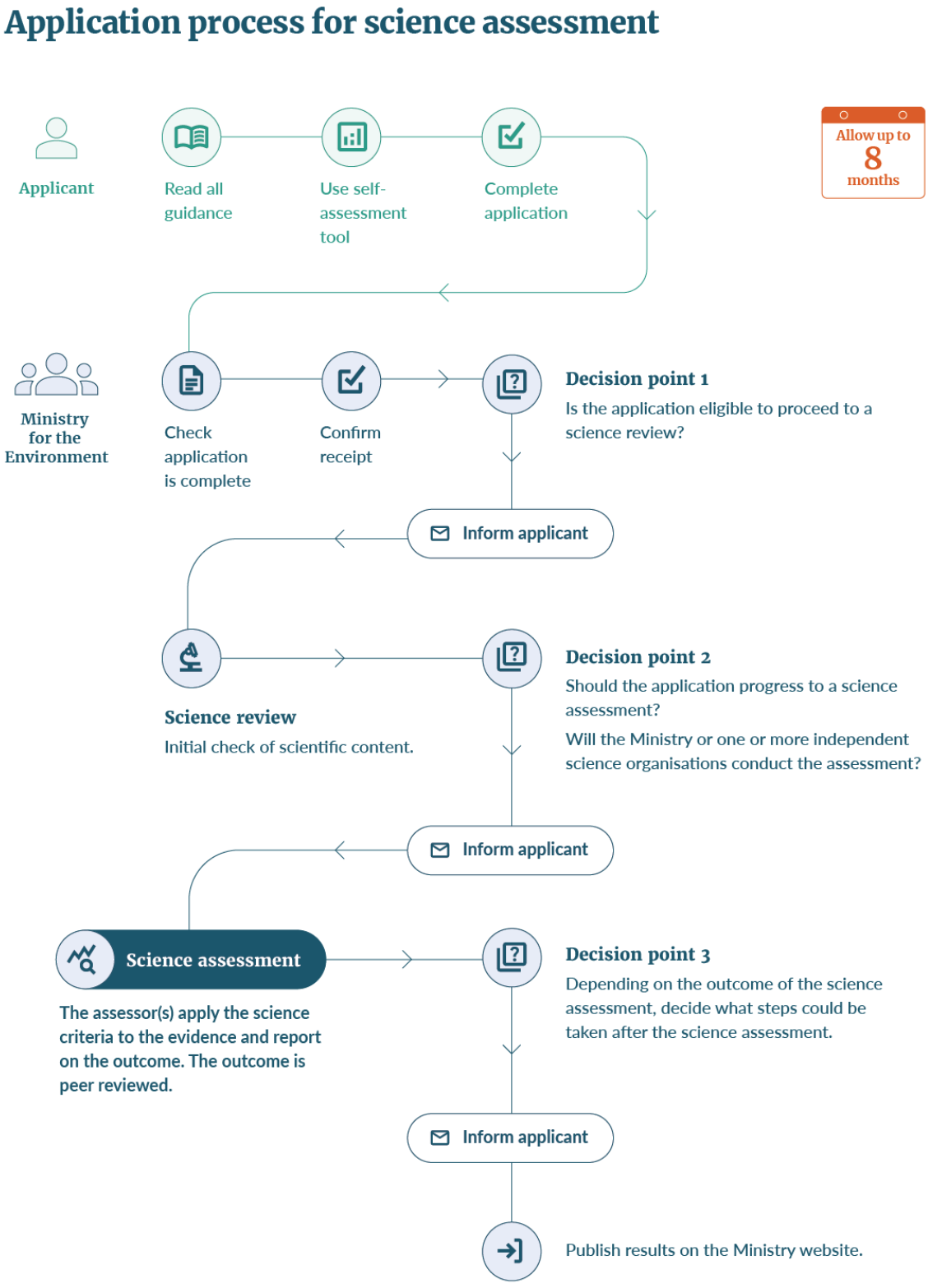

Table 3 provides an approximate timeline for each of the steps in a science assessment process. For an application that proceeds to an independent science assessment, we expect the process will take approximately eight months to complete. This is a conservative estimate. Where possible, we will complete all assessments in shorter timeframes and process multiple applications concurrently.

**Table 3: Overview of approximate timeline for a science assessment process**

| Activity | Timeframe |
|---|---|
| **Screen application**<br>• Log and check application for completeness<br>• Email applicant to confirm receipt and provide tracking number | **Within approximately one week** of receiving application, respond to you to confirm receipt.<br>If the application is not complete, you may be asked to submit additional information within a specified timeframe. The application will not proceed until we consider it complete. |
| **Science review**<br>• Conduct science review | **Approximately one month** for the science review team to conduct an initial check of the scientific content of the application to determine whether the activity is eligible and there is sufficient evidence available to progress the application. |
| **Application decision**<br>• Decision on application proceeding to independent science assessment<br>• Inform applicant if the application will proceed and provide advice | **Approximately one month** for the Ministry to confirm the application decision and inform you.<br>If the decision is for the application to be declined at this stage, you will be informed of what new evidence would be required before you can resubmit an application. |
| **Decide how to assess**<br>• Either internal or external science assessment | **Approximately six weeks** for the application coordinator to **either:**<br>• establish an internal team of suitably qualified science assessors to conduct the science assessment and to complete the assessment, or<br>• negotiate a contract with an external assessor organisation and work through the necessary declarations and conflict of interest management. |
| **Conduct science assessment**<br>• Conduct science assessment<br>• Advise the Ministry of the outcome | **Approximately two months** for the science assessors to consider the content of the application along with other known information and evidence about the specific carbon removal activity in the application.<br>The independent assessors will provide a report to the Ministry on the outcome of the assessment. |
| **Peer review and quality assurance of science assessment and outcome report**<br>• Peer review of the science assessment<br>• Quality assurance process | **Approximately one month** for a peer review of the science assessment and outcome report, which may be done internally where suitable expertise exists or contracted externally.<br>An internal quality assurance process will follow the peer review. |
| **Communicate with you**<br>• Review science assessment findings<br>• Inform you of the science assessment outcome | **Approximately one month** for the Ministry to consider the outcome report and respond to you, which will include the outcome report. The Ministry will also advise the Minister of Climate Change on this stage of the process. |
| **Publish outcome**<br>• Publish relevant information for other interested parties | **Approximately six weeks** for the Ministry to consider what information from the application process is suitable for publication on the Ministry's website and publish as appropriate. |

# Initial check of application

When an application is received, the Ministry will send an acknowledgement email and will check to see if the application is complete. The Ministry will contact you to request any missing information that is essential for the application to progress to a science review. If that information cannot be supplied, the application will be declined at this stage.

The Ministry will consider all applications carefully and may consider other available evidence about the activity beyond that which you supply.

**Decision point 1: The Ministry decides if your application should proceed to a science review**

Your application will likely be progressed by Ministry staff if:

- it requests a carbon removal activity that meets the eligibility requirements
- the application documentation is complete, and scientific evidence is provided
- a science assessment is not already underway on the same or a very similar carbon removal activity
- the Ministry has not already conducted a science assessment on the same or a very similar carbon removal activity, and the results are published, or soon will be
- the Ministry has not already declined to conduct a science assessment on the same or very similar carbon removal activity, and there is no new evidence to consider.

If your application does not proceed to a science review, the Ministry will tell you why and inform you of any relevant information that may assist you.

# Science review

The Ministry will conduct a short science review of your application to consider a range of factors, such as the nature of the activity and the quality of evidence available, before deciding whether to conduct a full science assessment of the specific carbon removal activity.

**Decision point 2: The Ministry decides if application should proceed to a science assessment**

Once the Ministry has conducted a science review of the application, the Ministry will consider whether the application should proceed to a science assessment. The consideration will be primarily on two factors; firstly, whether the application shows the activity is eligible for assessment under the Assessment Framework, and whether there is sufficient evidence available to conduct a thorough science assessment. Other factors may be considered at this stage. If an application is declined for other reasons, they will be explained to the applicant.

If your application does not proceed to a science assessment, the Ministry will tell you why and inform you of any relevant information that may assist you. You, or any other party, will be welcome to revise and resubmit an application for the carbon removal activity once the required evidence has been sourced.

# Science assessment

Applications will be assessed against the nine scientific criteria in appendix 1 to ensure that proposed activities can be tested for effectiveness.

This approach is necessary to ensure consistency with international standards and reporting requirements. Using consistent criteria across all applications supports clear and consistent assessment and decision-making and gives confidence that approved activities will deliver the carbon removals they claim. It also helps ensure that results can be reported accurately and trusted both in New Zealand and internationally.

The Ministry may conduct a science assessment internally, where we have relevant expertise or we can source support from science assessors in other government agencies with suitable expertise. Where we do not have access to science assessors with suitable expertise, we will contract external science assessors to complete a science assessment, following required procurement policies and procedures. This will include, but is not limited to, the requirement for the science assessment to be of high quality thereby requiring external and independent peer review from a relevant science institute. This is in line with the Ministry's science assurance process. We will consider each application carefully before determining how assessors and external peer reviewers will be chosen.

In all science assessments there will be more than one science assessor completing the assessment. All science assessors tasked or contracted to complete an assessment will first complete a process to identify and manage any actual or perceived conflicts of interest in line with the Ministry's conflict of interest policies and procedures.

Science assessors will provide the Ministry with a draft assessment outcome report, which will then be subject to peer review. The science assessors will consider peer review feedback and reflect it in the final assessment outcome report. This report will either explain how the evidence shows the carbon removal activity is effective or will detail where there are gaps. The Ministry will provide you with a copy of the assessment outcome and consider publishing as much of this report as possible on its website to ensure information about the effectiveness of carbon removal activities is transparent and available to all interested parties.

**Decision point 3: The Ministry decides what steps could be taken after the science assessment, depending on the outcome**

The Ministry will consider the outcome of the final, peer-reviewed report and will determine if there is potential to take further steps to consider inclusion of the carbon removal activity in the NZ ETS and/or the NDCs. The Ministry will inform the applicant of any further consideration that it may undertake.

Where the peer-reviewed science assessment shows the carbon removal activity is supported by the science, and you have signalled an interest in progressing to an inclusion assessment, the Ministry may provide advice to relevant ministers. This advice would be specific to the activity in question and would likely outline the process for an inclusion assessment for NZ ETS and/or NDCs. Ministers are responsible for decisions related to inclusion of activities in the NZ ETS and NDCs.

Where the peer-reviewed science assessment shows the carbon removal activity is not yet supported by the science, the Ministry may provide advice to an applicant about what further work may be needed to prove the effectiveness of the activity in the future. The Ministry will invite applicants to reapply for a science assessment when the range of available evidence for a carbon removal activity improves in relevance and validity.

# After a science assessment is complete

The Ministry will inform you when the science assessment concludes and will provide you with the peer-reviewed science assessment outcome report.

The Ministry will also publish the information to support other parties interested in the activity. This will take place regardless of the outcome of the science assessment as it is important for interested parties to be informed about where the science can or cannot demonstrate that an activity is effective.

If the effectiveness of an activity is demonstrated, the Ministry will advise the Minister of Climate Change. The Government will decide if the activity should be considered against broader inclusion considerations to determine if it could be included in the NZ ETS and/or NDCs.

If you are interested in exploring whether you can trade in voluntary markets for carbon removal projects you are undertaking, you may choose to use the assessment result as part of your verification process.

If a science assessment concludes that the carbon removal activity is not yet scientifically robust, the Ministry will only consider any new application for the same activity if it includes new scientific evidence.

If you are unsatisfied with the outcome of a science assessment you have applied for, you are welcome to share your concerns by contacting us at carbonremovals@mfe.govt.nz

# Suggested reading

We encourage you to do wide-ranging research before you make an application. Here is some suggested reading.

**Assessment Framework for Carbon Removals**

- Assessment Framework for Carbon Removals
- Science criteria technical report
- Mātauranga framework
- Carbon Removal Activity Check

**Related Government initiatives**

- New Zealand's Emissions Trading Scheme
- Nationally Determined Contribution
- A Carbon Storage Regime

**Understanding carbon removals**

- Climate Change 2022: Mitigation of Climate Change
- Carbon Dioxide Removal Factsheet
- Technology Readiness Level: Carbon Dioxide Removal Methods

**Greenhouse gas inventory and methodologies**

- New Zealand's Greenhouse Gas Inventory
- IPCC Methodology reports

**Voluntary markets**

- Voluntary nature and carbon markets in New Zealand
- Guidance for Voluntary Climate Change Mitigation
- Paris Agreement Crediting Mechanism
- The Integrity Council for the Voluntary Carbon Market
- Carbon Offsetting and Reduction Scheme for International Aviation

**Government strategies and plans**

- The Government's climate strategy
- New Zealand's second emissions reduction plan 2026–30

# Appendix 1: How assessors will apply the scientific criteria

Before collating evidence, it is important you understand the nine scientific criteria your application will be assessed against. These criteria draw on the findings of a 2025 technical report from the Bioeconomy Science Institute[20] and have been designed to test whether an activity is grounded in robust scientific evidence.

This appendix shows how science assessors will apply the nine scientific criteria to each application. The terms used for each criterion are widely used in other contexts, with slightly different definitions applied. Please ensure you read the Assessment Framework criteria in line with the definitions below.

## Readiness criteria

The readiness criteria focus on evidence that shows the activity does have the potential to affect $CO_2$ in this way, safely and effectively.

### Measurable

**Is there a quantifiable net reduction $CO_2$ attributable to a human action or intervention?**

When assessing the measurable criterion, assessors will consider how well the evidence addresses each of the following questions.

- Are there methods, approaches, tools, techniques or technologies that can identify the change in carbon stocks and/or emissions or flux in all relevant pools that can then be attributed to the activity being considered?
- Are these methods, approaches, tools, techniques or technologies reliable and appropriate for use with the activity in the New Zealand location and environment?

[20] Bioeconomy Science Institute. 2025 *Science framework for assessing new mitigation activities for natural carbon sequestration* (Contract Report 2526-0025). Wellington: Ministry for the Environment.

**Table A1.1: Assessment of evidence for measurable criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency)<br>• High scientific agreement<br>• High confidence | Established measurement procedures have been developed that could generate appropriate data, or data are available to demonstrate a change in carbon stocks and/or emissions or flux across all relevant areas attributable to the activity.<br>Reliable/robust quantification has been established using national measurements. |
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br>• Medium confidence | Established measurement procedures have been developed that could generate appropriate data to demonstrate a change in carbon stocks or emissions, but the change is not clearly attributable to the activity.<br>Reliable quantification has been established overseas, and measurements in New Zealand indicate that quantification in New Zealand is feasible. |
| **Lacks consensus**<br>• Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>• Low confidence | Some measurement approaches exist and are being developed, but these often have mixed results and large uncertainties.<br>Quantification could be possible, but few measurements have actually been made and/or current methods are expensive. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>• Very low confidence | It is unclear if measurement approaches are valid and appropriate, and significant development is still ongoing.<br>Measurement approaches are not ready to be considered in a New Zealand context. |

# Validated

### Do proposed measurements cross-check well against currently available techniques?

When assessing the validated criterion, assessors will consider how well the evidence addresses each of the following questions.

- Is there detail of chosen measurements, the tools, techniques and protocols used, and how they were applied?
- Is there explanation for the chosen measurements, covering how they do or do not align with established techniques, and what makes them appropriate for the carbon stocks and/or emissions or flux involved and the context of the activity?
- If new or innovative measures are being proposed, is there evidence of how their results align with established methods?

**Table A1.2: Assessment of evidence for validated criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency)<br>• High scientific agreement<br>High confidence | There is good validation of measurement protocols, data collection methods and analytical approaches for the quantification of carbon stocks and stock change.<br>No new techniques are required – there are available standards or methods. |
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br>Medium confidence | There is some validation of measurement protocols, data collection methods and analytical approaches for the quantification of carbon stocks and stock change.<br>No new techniques are required, but some and/or minimal measurements may be required for validation of protocols, methods or approaches. |
| **Lacks consensus**<br>• Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Low confidence | There are limited details of measurements, data collection and analysis for the quantification of carbon stocks and stock exchange, with no clear established techniques or protocols.<br>Some new techniques and/or measurements are required to establish and validate protocols, methods or approaches.<br>The environment and/or landscape the activity would occur in is highly dynamic and variable, so currently relies heavily on modelled estimates. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Very low confidence | There may be some modelled estimates or new and innovative tools and techniques, but they have not been validated.<br>Significant new techniques and measurements are required to establish and validate protocols, methods or approaches. |

# Additional

**Is the $CO_2$ being removed and stored additional to the amount of $CO_2$ that would have been removed and stored over time without the activity?**

When assessing the additional criterion, assessors will consider how well the evidence addresses each of the following questions.

- Is there an appropriate, realistic and quantified baseline of the relevant current net $CO_2$ removals?
- Are the assumptions for baselines and changes in carbon stocks clearly stated and appropriate?
- Is there quantified status quo forecast or prediction of the $CO_2$ sequestration trajectories, or relevant $CO_2$ emission trajectories (the likely changes in $CO_2$ over time from natural causes and human activities that are already likely to occur)?
- Is there comparison of the status quo forecast to various other scenarios that, at a minimum, include the deployment of the activity?
- Is there explanation of how additionality is being calculated (eg, land-use change models or counterfactual processes or analyses calibrated with field data)?

**Table A1.3: Assessment of evidence for additional criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency)<br>• High scientific agreement<br>High confidence | A robust quantified baseline of relevant changes in carbon stocks and emissions exists, or existing rates of net removals.<br>There are robust forecasts and/or predictions of net carbon sequestration trajectories for status quo and with the activity.<br>Significant evidence and measurements exist of carbon gain that is attributable to the activity and methodologically consistent with the baseline. |
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br>Medium confidence | Some quantification of baselines for relevant carbon emissions or removals exists.<br>There are some forecasts and/or predictions of carbon sequestration trajectories for status quo and with the activity.<br>Short-term evidence of carbon gain or enhanced net removals exists, but the activity requires longer-term, (eg, decadal) time-scale monitoring to confirm additionality attributable to the activity. |
| **Lacks consensus**<br>• Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Low confidence | Limited and varying baseline quantification for relevant carbon emissions or removals exists.<br>Causality is unresolved, because enhanced carbon removals attributable to the activity have not been measured or are uncertain but could be attributed to the activity or intervention with more research or data collection.<br>The activity may or may not have additional effects beyond status quo. Zero to small carbon response to the activity is reported in some research. Over |

| Assessment of evidence | For example |
|---|---|
| | the longer term, additional effects on carbon stocks are possible.<br><br>International studies have reported a change in carbon emissions or removals in response to the activity, but New Zealand evidence has some mixed results.<br><br>A complex environment makes attribution of carbon changes complex and difficult to demonstrate. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br><br>Very low confidence | The baseline quantification is unclear, as are effects beyond status quo.<br><br>A change in carbon emissions or removals is implied or estimated, is rarely measured, and is rarely attributable to the activity.<br><br>More evidence is required. |

# Permanent

### Is there long-term storage of $CO_2$ in one or more carbon pools because of the activity?

When assessing the permanent criterion, assessors will consider how well the evidence addresses each of the following questions.

- Is there evidence that the storage of carbon under this activity is long term (generally considered a minimum of 50 years or in line with a scientifically agreed 'best case scenario' for the carbon pool in question)?
- Is there clarification of how the storage of $CO_2$ through this activity may be affected by changes in the environment, and how these changes can be managed and mitigated (ie, whether the $CO_2$ will remain embodied as temperatures rise, or when geological disturbances or biogeochemical changes occur in the location and/or process of the storage)?

The reference to 50 years in the box above is a minimum amount that is required as evidence for the science assessment. If a removal were entered into the NZ ETS, surrender obligations would still be owed if the carbon were emitted after 50 years (this aligns with the permanent forestry category in the NZ ETS).

**Table A1.4: Assessment of evidence for permanent criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency)<br>• High scientific agreement<br><br>High confidence | Durable long-term carbon storage (a minimum of 50 years) can occur in New Zealand.<br><br>Impacts of environmental change and disturbance are well documented.<br><br>Appropriate and effective methods for monitoring, management and mitigation exist. |
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, | Durable removal (a minimum of 50 years) is evidenced internationally and/or overseas. |

| Assessment of evidence | For example |
|---|---|
| imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br>Medium confidence | Impacts of environmental change and disturbance could contribute to a change in associated carbon stocks, but potential management and mitigation options exist. |
| **Lacks consensus**<br>• Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Low confidence | Durable removal (a minimum of 50 years) is possible but uncertain and/or unclear.<br>More measurement, modelling or understanding of the response from the impacts of environmental change and disturbance are required. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Very low confidence | Durable removal (a minimum of 50 years) is unlikely.<br>Long-term activity would be needed for the carbon response to not reverse.<br>Complex environmental changes and disturbances are an increasing risk.<br>Evidence is lacking – new data and evidence are required. |

# Sufficiency criteria

Once an activity has been assessed under the readiness criteria, assessment then concentrates on sufficiency criteria which focus on whether an activity can be translated into real-world outcomes that warrant further consideration.

## Material

**Is the volume of $CO_2$ potentially being removed and stored detectable at a meaningful national scale?**

When assessing the material criterion, assessors will consider how well the evidence addresses the following questions.

- Are there current baseline data or measurements that would allow identification of the impact of the activity at a national scale?
- What is the potential overall impact of the proposed activity on carbon stocks nationally?

**Table A1.5: Assessment of evidence for material criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency)<br>• High scientific agreement<br>High confidence | The activity has a quantifiable effect on carbon sequestration at a scale that is nationally meaningful in New Zealand (ie, national-scale impact).<br>Measurable, verified, permanent change in carbon pools can be clearly attributed to the activity.<br>The activity occurs at a broad spatial scale – either through being nationally representative, or by applying at a spatial scale that effectively contributes to national carbon estimates. |

| Assessment of evidence | For example |
|---|---|
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br>Medium confidence | Methods to quantify carbon sequestration nationally indicate meaningful national impact.<br>Measurable, verified, permanent change in carbon pools can be attributed to the activity or could be through established methods.<br>The activity is readily feasible at a broad spatial scale, either through being nationally representative or applying at a spatial scale that effectively contributes to national carbon estimates. |
| **Lacks consensus**<br>• Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Low confidence | The effect of the activity on carbon sequestration nationally is not well quantified or is not clearly meaningful.<br>Unclear measurement and verification methods for a permanent change in carbon pools that is attributable to the activity but may be possible.<br>The activity may have some potential at a broad spatial scale, either through being nationally representative or applying at a spatial scale that effectively contributes to national carbon estimates. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Very low confidence | National-scale impact of the activity on carbon sequestration is unquantified.<br>It is challenging to identify a measurable, verified, permanent change in carbon pools and attribute it to the activity.<br>The activity's potential at a broad spatial scale is very unclear. |

## Carbon dioxide leakage

Carbon dioxide leakage refers to the escape of captured $CO_2$ from a storage site.[21] Any escape of $CO_2$ to the atmosphere or environment would undermine the climate benefit.

**Is there a clear assessment of the risk of leakage with this form of removal activity and evidence that this risk of leakage can be reliably mitigated?**

When assessing the carbon dioxide leakage criterion, assessors will consider how well the evidence addresses each of the following questions.

- Is there detail on how leakage (ie, activity and emissions displacement) could occur from this activity and how it could be detected, measured and monitored?
- Is there evidence of effective strategies that project owners could use to avoid or mitigate and manage the risk of leakage?

[21] Intergovernmental Panel on Climate Change, *IPCC Special Report on Carbon Dioxide Capture and Storage* (SRCCS, 2005), p 385.

**Table A1.6: Assessment of evidence for carbon dioxide leakage criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency)<br>• High scientific agreement<br>High confidence | Leakage risk as a consequence of the activity is clearly identified and well understood, including through direct carbon escape or increased emissions elsewhere.<br>Clear and/or established methods exist for effective and transparent detection, measurement and monitoring of leakage.<br>Clear and/or established strategies exist for mitigation and management of leakage risk. |
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br>Medium confidence | Leakage risk as a consequence of the activity is clearly identified and well understood to some degree, including through direct carbon escape or increased emissions elsewhere.<br>Perverse or negative carbon outcomes are possible, but these have been explored in several studies.<br>Some methods exist that could be used for detection, measurement and monitoring of leakage.<br>Some strategies exist for mitigation and management of leakage risk. |
| **Lacks consensus**<br>• Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Low confidence | Leakage risk as a consequence of the activity has been studied, but it is not clearly identified or well understood, including through direct carbon escape or increased emissions elsewhere.<br>There is some suggestion of methods that could be used for detection, measurement and monitoring of leakage, but further investigation is needed.<br>Further investigation into mitigation and management of leakage risk is required. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Very low confidence | Leakage risk as a consequence of the activity is not identified or understood, including through direct carbon escape or increased emissions elsewhere.<br>Significant further investigation is needed into methods that could be used for detection, measurement and monitoring of leakage.<br>Significant further investigation into mitigation and management of leakage risk is required. |

# Sustainable

**Is there clear evidence and that the proposed activity does not negatively affect the wider ecosystem, with an understanding of how the proposed activity could affect the wider ecosystem or biodiversity of the areas where it would occur?**

When assessing the sustainable criterion, assessors will consider how well the evidence addresses each of the following questions.

- Is there clear evidence and description of the likely positive and negative impacts of this activity on, for example, soils, biodiversity, habitats and ecosystems?
- Is there a description of any areas, ecosystems or environmental conditions where the activity would be inappropriate, and an explanation of why?
- Where negative impacts are possible, is there an outline of:
  - the scale of risk of this impact
  - effective strategies for mitigating and managing this risk
  - the relative size and scale of the trade-off between the impact and the potential for $CO_2$ removal?

**Table A1.7: Assessment of evidence for sustainable criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency)<br>• High scientific agreement<br>High confidence | Positive and negative impacts of the activity on biodiversity, ecosystem processes or services are clearly understood.<br>There is clear understanding of how the situation and/or environment in which an activity occurs can influence the impacts, including when this could lead to an activity being inappropriate.<br>There is clear understanding of where the activity would be appropriate for application.<br>Robust assessment exists of linkages or trade-offs between carbon effects and other effects related to biodiversity or ecosystem processes.<br>There is clear understanding of how benefits of the activity can be maintained. |
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br>Medium confidence | Positive and negative impacts of the activity on biodiversity, ecosystem processes or services are fairly understood.<br>There is fair understanding of how the situation and/or environment in which an activity occurs can influence the impacts, including when this could lead to an activity being inappropriate.<br>Some assessment exists of linkages or trade-offs between carbon effects and other effects related to biodiversity or ecosystem processes.<br>There is some understanding of how benefits of the activity can be maintained. |
| **Lacks consensus** | Understanding of the positive and negative impacts of the activity on biodiversity, ecosystem processes or services is limited. |

| Assessment of evidence | For example |
|---|---|
| • Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Low confidence | There is limited understanding of how the situation and/or environment in which an activity occurs can influence the impacts, including when this could lead to an activity being inappropriate.<br>Limited assessment exists of linkages or trade-offs between carbon effects and other effects related to biodiversity or ecosystem processes.<br>There is limited understanding of how benefits of the activity can be maintained. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Very low confidence | There is almost no understanding of the positive and negative impacts of the activity on biodiversity, ecosystem processes or services.<br>There is almost no understanding of how the situation and/or environment in which an activity occurs can influence the impacts, including when this could lead to an activity being inappropriate.<br>Almost no assessment exists of linkages or trade-offs between carbon effects and other effects related to biodiversity or ecosystem processes.<br>There is almost no understanding of how benefits of the activity can be maintained. |

# Transparent

### Are records of the evidence used to quantify the effect of the proposed activity well documented and accessible?

When assessing the transparent criterion, assessors will consider how well the evidence addresses each of the following questions.

- Is there clear and accessible documentation setting out:
  - scientific methods and approaches used to measure and monitor removals
  - underlying assumptions, data and inputs used in any calculations or modelling
  - any statistical models or analytical approaches used?
- Is there assurance that, where relevant, the underlying assumptions, data and calculations have been tested and scrutinised by appropriate experts, and peer reviewed and tested for reproducibility of results or predictions?
- Are there demonstrated efforts to ensure the evidence underlying the proposed activity is in the public realm, open to review and consideration?

**Table A1.8: Assessment of evidence for transparent criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency) | There are well-documented and accessible designs and data collection on carbon sequestration measurements, as well as data quality standards, analyses and interpretation. |

| Assessment of evidence | For example |
|---|---|
| • High scientific agreement<br><br>High confidence | Underlying data, assumptions and calculations have been tested and scrutinised, including through independent quality assurance, reproducibility of results or predictions, and peer review.<br><br>Data and evidence underlying the activity are publicly available and easy for others to access, consider and review. |
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br><br>Medium confidence | There are generally well-documented and largely and/or broadly accessible designs and data collection on carbon sequestration measurements, as well as data quality standards, analyses and interpretation.<br><br>Underlying data, assumptions and calculations have been tested and scrutinised to some degree, including through independent quality assurance, reproducibility of results or predictions, and peer review.<br><br>Data and evidence underlying the activity are largely publicly available for others to consider and review. |
| **Lacks consensus**<br>• Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br><br>Low confidence | There are some, albeit limited, documentation and accessibility of designs and data collection on carbon sequestration measurements, as well as data quality standards, analyses and interpretation.<br><br>Underlying data, assumptions and calculations have not been clearly tested and scrutinised but are largely publicly available for others to consider and review, including through independent quality assurance, reproducibility of results or predictions, and peer review.<br><br>Data, analyses and assumptions could become more accessible in the short term with effort. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br><br>Very low confidence | There is almost no documentation and accessibility of designs and data collection on carbon sequestration measurements, or on data quality standards, analyses and interpretation.<br><br>Underlying data, assumptions and calculations have not been tested and scrutinised, including through independent quality assurance, reproducibility of results or predictions, or peer review.<br><br>Data, analyses and assumptions are not publicly available or easily accessible for others to consider or review. |

# Scalable

**Is it clear that the measures and their proposed deployment are effective across various spatial scales?**

When assessing the scalable criterion, assessors will consider how well the evidence addresses each of the following questions.

- Is there detail about the sampling methods and monitoring regimes associated with all preferred measurement approaches at various scales?
- Is there an outline of any data used as inputs to support measurement or build accurate predictive forecasts or models of effects at scale (eg, land-use data, vegetation coverage information or soil quality assessments)?

**Table A1.9: Assessment of evidence for scalable criterion**

| Assessment of evidence | For example |
|---|---|
| **Well established**<br>• Robust, comprehensive, demonstrable, independent evidence (type, quality, quantity, consistency)<br>• High scientific agreement<br>High confidence | Robust sampling, monitoring, measurements or methods are available, which are capable of accurately quantifying or monitoring carbon pool responses to the activity across spatial scales and scale and/or magnitudes of carbon pool changes.<br>There is a clear outline of the combination of data, measurements and methods that should be used across scales for high spatial accuracy of carbon measurements in New Zealand, including data on land use, vegetation or soil. |
| **Partially established**<br>• Multiple but limited evidence and number of studies, not comprehensive nor independent, imprecisely addresses criterion (type, quality, quantity, consistency)<br>• General scientific agreement<br>Medium confidence | Some sampling, monitoring, measurements or methods are available, which are capable of quantifying or monitoring carbon pool responses to the activity across spatial scales and scale and/or magnitudes of carbon pool changes.<br>There is good awareness of the combination of data, measurements and methods that should be used across scales for high spatial accuracy of carbon measurements in New Zealand, including data on land use, vegetation or soil. |
| **Lacks consensus**<br>• Multiple, independent but weak and variable evidence (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Low confidence | Limited sampling, monitoring, measurements or methods are available to demonstrate a range of capabilities of quantifying or monitoring carbon pool responses to the activity across spatial scales and scale and/or magnitudes of carbon pool changes.<br>There is limited awareness of the combination of data, measurements and methods that should be used across scales for high spatial accuracy of carbon measurements in New Zealand, including data on land use, vegetation or soil. |
| **Insufficient evidence**<br>• No or limited evidence, suggestion, speculation (type, quality, quantity, consistency)<br>• Lack of scientific agreement<br>Very low confidence | Almost no sampling, monitoring, measurements or methods are available to demonstrate a range of capabilities of quantifying or monitoring carbon pool responses to the activity across spatial scales and scale and/or magnitudes of carbon pool changes.<br>There is almost no awareness of the combination of data, measurements and methods that should be used |

| Assessment of evidence | For example |
| --- | --- |
| | across scales for high spatial accuracy of carbon measurements in New Zealand, including data on land use, vegetation or soil. |