



## New Zealand

# Monitoring GHG emission reductions from forested land in New Zealand's Emissions Trading Scheme

## Good practice summary

[Results/insights]

New Zealand was the first country to include the agriculture and forestry sectors in an emission Trading Scheme (NZ ETS). Foresters can sell 'NZ Emission Units' (NZUs), worth 1 tonne of CO<sub>2</sub> equivalent, to emitters but must repay the NZUs to the government if the forest is cut down. To monitor such changes in forested land participating in the ETS, the NZ Ministry of Agriculture and Forestry (MAF), now the Ministry for Primary Industries (MPI), developed a specialised mapping tool; Climate Change Information System (CCIS). Data is monitored and verified via satellite and photographic imagery so that no anomalies are presented.

## Scope covered

### Functions

Measuring    Reporting    Verification    Accounting

### Administrative scope

National    Regional    City-level    Policy/programme/project    Corporate/Facility-level

### Legal basis

[policies, regulations and commitments that the case study has to comply with]

**Climate Change Response Act 2002<sup>1</sup>**: enables New Zealand to meet its obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, and to provide the regulatory framework for the NZ ETS.

**Climate Change Response (Emissions Trading) Amendment Act 2008<sup>23</sup>**: Established the first version of the NZ ETS which puts a price on greenhouse gases (GHGs) depending on supply and demand of NZUs to provide an incentive to reduce emissions and to encourage afforestation and reforestation activities. It involves all significant GHGs (i.e. Carbon Dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous Oxide (N<sub>2</sub>O) Sulphur Hexafluoride (SF<sub>6</sub>), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Nitrogen Trifluoride (NF<sub>3</sub>) and other fluorinated GHGs) and all sectors (Electricity production, forestry, industrial processes, production and importation of liquid fossil fuels, synthetic GHGs and waste).

**Climate Change (Forestry Sector) Regulations 2008<sup>4</sup>**: Details fees and charges, land status notification, collection of information and the methodology for carbon assessment and pre-1990 forest offsetting.

**Climate Change Response (Emissions Trading and Other Matters) Amendment Act 2012<sup>5</sup>**: Introduced a number of policy and technical changes to improve the operation of the NZ ETS.

## Operational since

Operational since 2008. Spatial mapping tool developed in 2009.

<sup>1</sup>[http://www.legislation.govt.nz/act/public/2002/0040/latest/DLM158584.html?search=ts\\_act\\_climate+chan-ge+response+act\\_resel&p=1&sr=1](http://www.legislation.govt.nz/act/public/2002/0040/latest/DLM158584.html?search=ts_act_climate+chan-ge+response+act_resel&p=1&sr=1)

<sup>2</sup><http://www.legislation.govt.nz/act/public/2008/0085/latest/DLM1130932.html>

<sup>3</sup><https://www.climatechange.govt.nz/emissions-trading-scheme/>

<sup>4</sup><http://www.legislation.govt.nz/regulation/public/2008/0355/latest/DLM1633759.html>

<sup>5</sup><http://www.legislation.govt.nz/act/public/2012/0089/latest/096be8ed8099eb58.pdf>



## How is this related to accounting?

[The following is based solely on the consultant's opinion]

» What kind of measures, policies, or commitments are a) monitored and included in an accounting system, b) only monitored, but not included in an accounting system, or c) not even monitored?

The NZ ETS data can be used for improving the accuracy of the national GHG inventory by climbing up the IPCC Tier Approach of the national GHG inventory data as well as for quality checks. ETS data is verified by third parties and thus provides the highest level of scrutiny.

## Case description

### Background

» What was the need, pre-conditions, and/or experiences that motivated the country to develop this system?

Emissions from the agriculture and forestry sectors account for nearly 25% of global GHG emissions; however, the mitigation potential for both sectors remains largely untapped (e.g. the agriculture and forestry sectors are not presently covered by the European Union Emissions Trading Scheme (EU ETS)). The forestry sector is very important for New Zealand; 37% of land area is covered by forests and the land use, land use change and forestry (LULUCF) sector is a large net carbon sink<sup>6</sup>, as can be seen in Figure 1<sup>7</sup>.

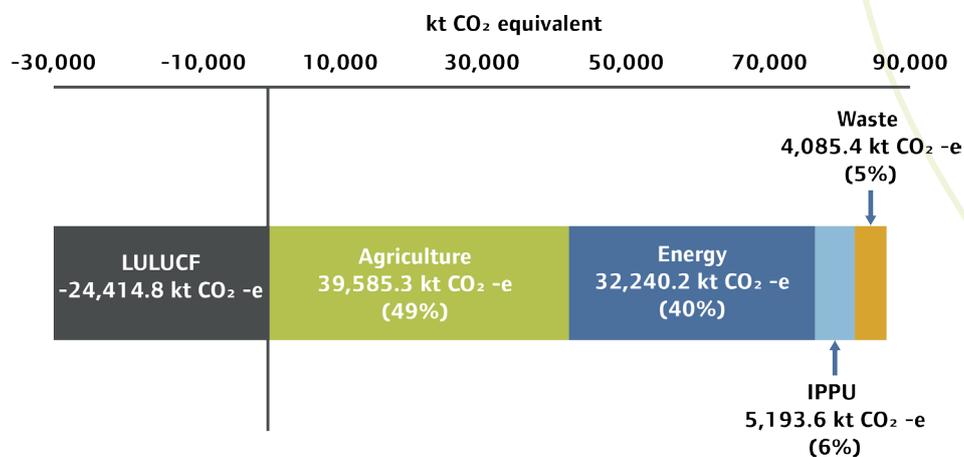


Figure 1: New Zealand's gross emissions by sector 2014

To provide economic incentives for domestic emitters to reduce emissions and tap into the potential GHG emission reductions that could be achieved through the forestry sector, the New Zealand Government launched a GHG emissions trading scheme in 2008, the New Zealand Emissions Trading Scheme (NZ ETS), that covers the agriculture and forestry sectors, among others. The NZ ETS is highly innovative as it is the first emissions trading system in the world to include the forestry and agriculture sectors.

<sup>6</sup><http://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/greenhouse-gas-inventory-snapshot-2016.pdf>

<sup>7</sup>[http://www.legislation.govt.nz/act/public/2002/0040/latest/DLM158584.html?search=ts\\_act\\_climate+change+response+act\\_resel&p=1&sr=1](http://www.legislation.govt.nz/act/public/2002/0040/latest/DLM158584.html?search=ts_act_climate+change+response+act_resel&p=1&sr=1)

## General description of the system

[Questions below should be answered only when applicable]

- » General definition/description of the system
- » What are the main types of action that mitigate GHG emissions?
- » What linkages to other systems/ system elements of environmental information (including adaptation to climate change or emissions trading schemes) do exist and why were they established? What linkages exist to other statistical/ monitoring systems?
- » Which platforms are used to transport information and are they specific to the purpose of usage MRV information?

### NZ ETS system

The NZ ETS includes the agriculture, forestry, fossil fuels and transport, industrial, stationary energy, synthetic GHGs (HFCs, PFCs, SF<sub>6</sub>) and waste sectors, covering covers the six main Kyoto Protocol GHGs (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, and SF<sub>6</sub>). It covers a number of activities for each sector; these are listed in schedules 3 and 4 of the Climate Change Response Act 2002<sup>7</sup>.

All sectors have obligations to report their emissions. Most sectors are required to report annually with the exception of post-1989 forestry participants (explained later) who are required to report emissions at the end of each five year 'mandatory emissions reporting period'. Participants must collect and record emissions information for the calendar year between 1 January and 31 December and then submit an emissions return online at the NZ Emission Unit Register (more information later) to the Environmental Protection Authority (EPA) between 1 January and 31 March of the following year<sup>8</sup>.

The agriculture sector has reporting obligations but does not have to surrender NZUs for biological emissions they produce<sup>9</sup> (specifically, CH<sub>4</sub> from enteric fermentation and manure management as well as N<sub>2</sub>O from animal effluent and fertiliser). The agriculture sector are exempt from having to buy and surrender NZUs as a means to avoid putting producers in a disadvantage when competing globally with countries whose farming sectors are not part of a similar scheme. In 2012, the government committed to considering the inclusion of agriculture in the NZ ETS but has ruled out the decision highlighting that it won't be included until economically viable, practical technologies are available to reduce agriculture emissions, and NZ's trading partners make more progress on tackling their emissions.<sup>10</sup>

Sectors (other than agriculture) are also affected in three ways in regard to the surrender or allocation of NZUs; they either need to surrender NZUs, earn NZUs, or be allocated NZUs as compensation for increased costs under the scheme. In order to surrender NZUs, participants can either buy NZUs from another participant in the ETS or pay the government \$25 for each unit they are liable to surrender. NZUs need to be surrendered by 31 May each year. The NZ EPA runs the New Zealand Emissions Unit Register (NZEUR)<sup>11</sup>: an electronic registry that shows who holds NZUs and allows for the transfer of NZUs between holding accounts. The NZEUR manages the accounting, reporting and reconciliation of emissions and unit holdings and transactions as part of the NZ ETS. The NZUs are traded in a free market.

### NZ ETS online forestry mapping tool

For NZ, forestry offers the largest opportunity for reducing emissions through incentivising carbon sinks. However, the forestry sector has previously not been included in other ETS systems as it is difficult to monitor. The NZ ETS on-line mapping tool was designed to tackle this problem and to enable the MPI to keep track of changed in forested land participating in the NZ ETS; the tool is part of the Climate Change Information System (CCIS). The CCIS, initially developed in 2009, is a spatially-enabled web application that allows foresters and farmers to register the accurate location of their forestry stands. The CCIS is also used to track and process all claims and surrenders of NZUs. Additionally, it produces participant-specific carbon look-up tables for owners of larger forests that are subject to the field measurement approach<sup>12,13</sup>. The system integrates data from multiple sources, including satellite and high definition aerial photographic data, to

<sup>8</sup>[http://www.eur.govt.nz/how-to/guides-hmtl/copy\\_of\\_guide-to-emissions-returns](http://www.eur.govt.nz/how-to/guides-hmtl/copy_of_guide-to-emissions-returns)

<sup>9</sup><http://archive.mpi.govt.nz/agriculture/agriculture-ets>

<sup>10</sup><https://www.climatechange.govt.nz/emissions-trading-scheme/ets-amendments/questions-answers.html>

<sup>11</sup><http://www.eur.govt.nz/>

<sup>12</sup>More information on the field-based measurement approach can be found at <https://www.mpi.govt.nz/document-vault/3666>

<sup>13</sup>Owners of forests located in high-growth areas or being managed under a high-carbon regime would likely receive fewer carbon credits than the amount of carbon their forests sequester if estimating carbon using the method stipulated in the Climate Change (Forestry Sector) Regulations 2008 (and vice-versa). Hence, the 'Field measurement approach' (FMA) was designed for use by participants with over 100 hectares of post-1989 land. The FMA involves the participant requesting sample plot locations from MPI, collecting FMA information (e.g. species, diameter) for trees, submitting plot data to MPI and MPI producing participant-specific tables of forest carbon stocks.

provide a reference dataset onto which foresters and farmers can draw or upload the boundaries and characteristics (e.g. pre-1990 or post-1989, forest species, age, etc.) of their lands, as part of the submission process for obtaining NZUs under the NZ ETS. Foresters can sell NZUs, equivalent to 1 tonne CO<sub>2</sub> equivalent, to emitters but must repay the NZUs to the government if the forest is cut down. The tool, similar to a Geographic Information System (GIS), allows participants to digitalise and edit forest land polygons, known as Carbon Accounting Areas (CAA), over a base imagery backdrop, and to assign the polygon attributes specified in the MPI Geospatial Mapping Information Standard<sup>14</sup>.

## MRV and accounting systems, processes and procedures

[Questions below should be answered only when applicable]

- » How is information generated, communicated, integrated, and verified at each stage of the MRV chain?
- » What information needs to be gathered in order to quantify the effect of these actions?
- » How is such information gathered or estimated? By whom?
- » How is this information reported? How is it verified?
- » In what areas information is shared among accounting and MRV systems?
- » What kind of agreements are used to establish the relevant institutional roles?

### Participant registration

Under the NZ ETS, forested land is separated into two categories - those planted before 1990, and those planted after. Each category has different obligations. Owners of post-1989 forest land can choose to join the scheme and earn NZUs as their forests grow. Owners of pre-1990 forest land face no obligations unless they deforest more than 2 hectares of their land in any five-year period.

To voluntarily join the ETS, owners of post-1989 forest land, or registered forestry right<sup>16</sup> or leaseholders for post-1989 forest land, must first apply/register online or on paper<sup>17</sup> that has to be sent to the MPI disclosing information such as name (matching the legal names that appear on the certificate of title for the land, registered forestry right or lease), contact details and NZU holding account details<sup>18</sup> as well as forest information (described below). If pre-1990 forest owners become eligible for the scheme, they must notify MPI within 20 working days of commencing deforestation and follow the same process as for post-1989 forest land.

### Mapping forested land using online tool

During the registration process and prior to registration being approved by MPI, participants must collect spatial data to determine the area of forest land to be registered in the ETS. For post-1989 forest land, a Carbon Accounting Area (CAA) must be created and labelled (e.g. CAA 1); this can be done using the online mapping tool. A CAA is the basic area used to track units for an area of forest. To create a CAA, the spatial information needed by the system from the participants is essentially a shape file. For the purposes of submitting data, a shapefile must contain the following four digital files:

1. Shape format file (.shp) – the geometry in the shapefile (the map co-ordinates of the end points of the line segments that make up the polygons).
2. Shape index format file (.shx) – the location within the shapefile of the start of the data for each polygon.
3. Attribute format file (.dbf) – the attributes for each polygon in the shapefile (e.g. pre-1990 or post-1989, forest species, age, CAA number, etc.).
4. Projection format file (.prj) – the co-ordinate system and map projection information for the shapefile.

<sup>14</sup><http://www.mpi.govt.nz/document-vault/4756>

<sup>15</sup><https://www.mpi.govt.nz/document-vault/4765>

<sup>16</sup>A forestry right registered under the Forestry Rights Registration Act 1983.

<sup>17</sup><http://www.eur.govt.nz/how-to/ets-application-forms>

<sup>18</sup>Which can be opened on the NZEU register website - <http://www.eur.govt.nz/>

A step-by-step guide is available to help participants to use the online mapping tool. Participants can also use their own GIS to create the required maps. The information submitted and the underlying imagery is then tracked by the MPI, who verifies that all forests that apply are registered in the NZ ETS. The MPI has access to a wide range of satellite imagery, but most of this imagery requires specialised analysis by trained image interpreters, and so is not available as part of the online mapping tool. Applicants are advised if any issues are found with the submitted shapefile and are provided with an opportunity to submit further evidence to support their application if the eligibility of any area is in doubt. Once approved, emissions returns that account for carbon stock increases and decreases can be submitted by the participant. The mapping information is used to estimate carbon stocks on the forest land and is submitted with the emissions return.

### Estimating carbon stocks

The amount of carbon stored per hectare in given CCAs is determined by the use of pre-defined look-up tables<sup>19</sup> which rely on “well-established growth modelling techniques” that define carbon storage depending on age and species. They also allow potential participants to estimate how many credits they can expect to earn or surrender for growing or harvesting their forests. There are detailed instructions available on how to apply the look-up tables for both pre-1990 and post 1989 forest<sup>20</sup>. Look-up tables have important advantages: they are easy to use and involve a low-cost to maintain, they offer transparency to potential investors about the credits they can expect to earn, and they apply the same simple rules to all participants and therefore, are difficult to manipulate. However, their major weakness is that they do not reflect localised (i.e. smaller than national or regional) differences in soil fertility and climate which can affect the quantity of carbon stored in forests<sup>21</sup>. Look-up tables also do not allow individual forest owners who might wish to manage their forests to improve carbon sequestration and storage. Thus forest owners are not necessarily rewarded for improved forest management, which can increase carbon storage<sup>22</sup>. To address these concerns, owners of registered post-1989 forests greater than 100 hectares in size must undertake field measurements of their forests and provide these data to the MPI. The MPI will then produce a look-up table based specifically for that forest area.

The look-up tables are also used by the MPI to verify determine the correct amount of NZUs to either credit or debit ETS forest owners once they submit their emissions returns.

### Reporting emissions

Participants must report the change in carbon stocks in CAAs by submitting emissions returns. An emissions return is a calculation that shows changes in a forest's carbon stock change for a certain period. Types of emission returns include:

- » Voluntary – can be submitted for post- 1989 forest land in any year to claim units.
- » Mandatory – required for post-1989 forest land at the end of a Mandatory Emissions Return period
- » Transmission – required when post-1989 forest land is transferred to another owner, or when a registered forestry right/lease expires or is terminated.
- » Unit Surrender – required when post-1989 forest land is removed from the ETS.
- » Pre-1990 Deforestation – required for deforestation of pre-1990 forest land.

Post-1989 forest owner participants are required to report, via the online tool or by printing, completing and sending to the MPI by postal mail or email, emissions/removals at the end of each five year mandatory emissions reporting period, with the option to report annually as well. A mandatory return period is 1 January 2013 – 31 December 2017, or any subsequent five-year period.

The EPA publishes activity-level emissions data annually as part of its Annual ETS Report<sup>22</sup>.

### Data sharing

All geospatial information is stored in a database held by the MPI. Data submitted by NZ ETS participants are protected by commercial confidentiality agreements. However, under section 149 of the Climate Change Response Act 2002, the inventory agency is able to request information from the EPA for the purpose of compiling NZ's annual national inventory report. The Ministry for the Environment (MFE) requests ETS and other data from the MPI, using them to update and improve the accuracy of their national land use map, which in turn is used as part of New Zealand's national inventory. NZ ETS is largely used in the national inventory for verification activities of CO<sub>2</sub> emissions in the Energy and IPPU sectors (e.g. CO<sub>2</sub> emissions from the production of iron and steel are compared against information provided by these industries in the ETS), emissions data reported for certain activities in the ETS (e.g. data from the aluminium production and mineral industries), activity data for municipal solid waste collection, and for verifying areas forest in the LULUCF sector.

<sup>19</sup><https://mpi.govt.nz/document-vault/4762>

<sup>20</sup><https://mpi.govt.nz/document-vault/4762>

<sup>21</sup>[https://www.researchgate.net/publication/228606401\\_GOOD\\_SHEPHERD\\_OR\\_BLACK\\_SHEEP\\_TACKLING\\_FORESTRY\\_AGRICULTURE\\_EMISSIONS\\_IN\\_NEW\\_ZEA-LAND'S\\_NEW\\_CARBON\\_MARKET](https://www.researchgate.net/publication/228606401_GOOD_SHEPHERD_OR_BLACK_SHEEP_TACKLING_FORESTRY_AGRICULTURE_EMISSIONS_IN_NEW_ZEA-LAND'S_NEW_CARBON_MARKET)

<sup>22</sup><https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/nzets-review-operational-matters-technical-note-final.pdf>

Forest age, area and deforestation as reported under the NZ ETS are used for verifying the areas of pre-1990 planted forest, post-1989 forest and deforestation in the national inventory. The MfE also provides the MPI with geospatial data that they hold. The MPI uses this geospatial data for compliance purposes. The MPI typically approve the MfE with data every 6-12 months; this information collected through the online mapping tool is used to improve the national GHG inventory. For example, to improve land-use classification decisions for the national inventory. The NZ ETS has provided valuable spatial information that has been used to confirm 1990 forest land-use classifications for the inventory. As part of the 2012 land-use mapping process, data from the NZ ETS was reconciled with the 1990, 2008 and 2012 land-use maps. The NZ ETS forest areas were checked against the land-use maps. Where mapping differences were identified, the areas were assessed against satellite imagery and the LUCAS forest land-use definitions to determine whether the 1990, 2008 and/or 2012 land-use map should be changed. After integration, quality-assurance checks were performed to ensure that updates to the 1990 and 2008 land-use maps were accurate and completed.

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## Design and set-up

[Questions below should be answered only when applicable]

- » How was the system designed?
- » What was the overall process to set-up the system?

The NZ ETS was introduced in phases, with different sectors having different obligations over a number of years. Forestry was the first sector to be introduced in 2008. The online mapping tool to aid foresters estimate their carbon stocks was designed by an external software vendor. The online application system was progressively developed between 2007-2012. Upon implementation, owners of pre-1990 forest land received a one-off free allocation of NZUs to partially compensate for the impact of the introduction of the NZ ETS on land use flexibility.

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## Improvement over time

- » Is there an internal evaluation of the systems established aiming to enable improvement over time?

The Minister for Climate Change Issues has a discretionary power to initiate a review of the operation and effectiveness of the NZ ETS at any time, by any method.

In November 2015, the New Zealand Government released a discussion document in which consultation questions were put forward. Readers were invited to make a submission, offering suggestions for improvements to the NZ ETS system as a whole; this process will capture problems and recommended improvements to the Forested land mapping reporting system in the future. The consultation closed at the end of April 2016 so results have not yet been published (as of June 2016).

There is an internal evaluation of the system aiming to enable improvement over time. A project to enhance the system has just started involving engaging with the system users surveyed in order to know the enhancements they would most interested in. The mapping tool will be enhanced as part of this project.

## Institutions involved

- » What institutional arrangements allow for the flow and integration of this information?
- » What types of entities take a role in the above structures?

**Lead:** Ministry for Primary Industries – responsible for the forestry sector of the ETS

**Institutional arrangements:** Environmental Protection Authority – responsible for the day-to-day running of the ETS and for all sectors excluding forestry. They are the main compliance and enforcement agency and are responsible for verifying that the scheme is being complied with. The EPA run the NZ Emission Unit Register.

Ministry for the Environment – responsible for compilation and reporting of national inventory and overall responsibility for the CCRA (inc. the NZ ETS), and climate change policies and programmes in NZ.

Participants (forest land owners).

## Case learning

### Why is it good practice

- » New Zealand is an interesting and potentially very valuable case study for policy makers in other nations because it is a developed country, with strong governmental institutions, yet it has an emissions profile similar to a developing country and hence are the first country in the world to include AFOLU in its ETS.
- » To enable the inclusion of forestry in the ETS, an innovative mapping tool was designed and implemented.
- » The fact that they including forestry and agriculture under the scheme also enables the country to improve the LULUCF sector of the national GHG inventory.
- » Data from other sectors included in NZ ETS (industry and energy) are used to verify national inventory data.
- » Data from the waste sector from the NZ ETS is used as a primary source of activity data on municipal waste disposal in the national inventory.

## Barriers that have been overcome

[barriers that have been overcome till date]

**Information:** Between 2009 and 2012, the online ETS mapping tool often used out of date imagery which resulted in errors<sup>39</sup>. At times the imagery did not show established trees with sufficient clarity to provide adequate guidance to comply with the ETS mapping standard. This meant that unless applicants sourced their own aerial photographs or satellite imagery, mapping forests could be a blind exercise. This meant that there was potential for forest edges not to be followed correctly, areas of failed plantings to be excluded and areas of different trees species not to be differentiated<sup>23</sup>. Updated imagery is now used on the online mapping tool.

<sup>23</sup>[http://www.carbonforestservices.co.nz/uploads/2/1/7/4/21749966/tree\\_grower\\_feb\\_2014\\_ets\\_compliance.pdf](http://www.carbonforestservices.co.nz/uploads/2/1/7/4/21749966/tree_grower_feb_2014_ets_compliance.pdf)

## Barriers to overcome

[barriers that are still present and needed to overcome]

**Information:** Potentially still some non-compliance issues for foresters<sup>24</sup> with foresters failing to register or failing to comply with field measurement approach regulations<sup>25</sup>. However, the number of non-compliance issues is relatively small – 158 incidents out of a total of 2,536 registered participants in 2015 (around 6%).

Because the online mapping tool works over the internet, the amount of information that can be transmitted to or from a user's computer system can sometimes be limited. On-screen digitising requires a responsive computer system, which displays and updates polygons in real time as they are digitised. Digitising becomes difficult if points are added faster than they can be transmitted back to the remote computer system running the mapping tool, stored on that system, and the updated display information sent back to the user. Practical experience shows that it is not feasible to digitise areas of forest land of more than 2000 hectares using the on-line mapping tool, even on a good-quality broadband internet connection. Applicants with larger areas of forest land must therefore prepare shapefiles of their forest land using their own (or their consultants') GIS, and submit those shapefiles to MAF on CDRoms or DVDs.

**Capacity:** Most owners of large forests already have geospatial maps of their forests. The tool provided the ability for owners of small areas of forest to map their forests. Some system users, typically older persons, struggle with the tool.

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## Quantitative information

### Funding obtained

The funding to set up the system was obtained from the Central Government. Value is confidential.

### Funding required

Confidential

### Staff

[Number of staff involved in the design and implementation of the case study]

- » 1 team of 5 compliance officers based around NZ
- » 1 outsourced team that does initial application processing (3 FTEs plus 30% of a team leader)
- » 1 team of 5 Operations Analysts.
- » Geospatial analysis is undertaken by another team and they currently have around 1.5 full-time equivalents working on ETS related work
- » 1 project team working on the enhancement of our online transaction system (1 project manager, 2 business administrators, and an external development provider).

<sup>24</sup><http://www.carbonforestservices.co.nz/ets-compliance.html>

<sup>25</sup><https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/nzets-review-operational-matters-technical-note-final.pdf>

**Time**

[Time required to get to this stage]

5 years (2007 – 2012)

**Further information****Contact for enquiries**

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**Website**

<https://www.climatechange.govt.nz/emissions-trading-scheme/>

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## Organisers

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