Restoring Forests Through Carbon Farming on Māori Land in New Zealand/Aotearoa

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Forests perform a range of valuable environmental functions, such as sequestering carbon, controlling erosion, and sheltering a diversity of species. Traditional cultures such as the Māori in Aotearoa/New Zealand (NZ) have long seen forests as a source of livelihood. Recent policy innovations in response to environmental issues like climate change are creating markets for environmental services, leading to new opportunities to earn livelihoods from forests. We worked with indigenous Māori landowners in a rural area of NZ to implement a "carbon farming" project—a management system that encourages reforestation and generates marketable offsets for greenhouse gas emissions under the Kyoto Protocol. Our experience in establishing a carbon sequestration project sheds light on the factors affecting uptake and project success for other groups seeking to utilize these markets as a tool for sustainable development.

FIGURE 1 Map of the East Cape of NZ. (Map by Andreas Brodbeck)

A new role for native forests on indigenous lands

We engaged with landowners in the Gisborne/East Cape (GEC) region of NZ (Figure 1) to investigate carbon farming, its value for landowners, and its overlap with existing land uses. Our goal was to work with Māori landowners to create a land use system that harnesses the multiple functions of forests, including carbon sequestration. Here, we explain the policy conditions and the challenges that affect carbon farming, describe the study area, and present a case study of one land block, illustrating how we worked with landowners to provide essential information and utilize carbon credits as one of several sources of revenue from forests.

Policy conditions and practical challenges

With the first commitment period of the Kyoto Protocol beginning in 2008, signatory countries are working to create carbon sinks to have positive impacts on global climate. Each country must stay below its overall emissions cap, either by reducing its own emissions, enhancing sequestration, or purchasing excess emissions allowances from other countries. This "cap-and-trade" system stimulates land use activities that reduce greenhouse gas emissions by creating a market for emissions reductions. NZ has designed a domestic policy, the Permanent Forest Sinks Initiative, to allow private landowners to enter this market. The policy establishes a process for landowners to register reforestation projects and receive carbon credits, which they can sell internationally.

Existing programs for utilizing forest carbon credits have encountered several barriers to effective implementation. First, the amount of sequestration and changes in forest growth rates are difficult to establish without costly site surveys and repeated measurements. Second, the monetary return for establishing forests is uncertain because the market is so new. These two factors create a mismatch between commitment today and uncertain future rewards. Third, information and procedures for certifying projects can be uncertain and costly, but without them landowners are unable to make an informed decision about land use. These factors all reduce the likelihood that landowners will use carbon farming.

Land use in the Gisborne/East Cape area

The GEC area encompasses the eastern side of the peninsula formed by the spine of the Raukumara Range. Much of the original forest was harvested and cleared for pasture by the early 1900s. Pastoral farming dominated until 1984, when radical economic restructuring removed virtually all agricultural subsidies. Farms reduced their stocking levels and could no longer afford to clear woody species from pastures. Also, due to the highly erodible soils in the area (Figure 2), the government began subsidizing forest plantations—mainly exotic *Pinus radiata*—in the early 1990s. These conditions, by increasing forest cover after 1990, meant that much of the new forest land is eligible for carbon credits under the Kyoto Protocol.

The GEC is one of the few regions of the country where Māori own large areas

FIGURE 2 Hill-country erosion is a serious problem in the East Cape region, but reforestation can improve soil stability. (Photo by Jason Funk)

of land, usually held in multiply owned blocks by groups of individuals. Owners hold shares in Māori land blocks and often manage the land through elected trustees. National laws protect Māori land from alienation; however, they also prevent Māori landowners from gaining access to credit, because in most cases the land cannot be used as collateral for loans. Many Māorirecognize the mixed blessing this brings and are searching for development options that require low start-up capital. Māori also place a high cultural value on native forests and believe that protecting native species is important to the health of the land, which is intricately connected to the well-being of the people.

We investigated a low-cost reforestation option of allowing nearby native bush to spread into retired pastures. Although *manuka*, or tea tree (*Leptospermum scoparium*), establishes quickly and dominates regrowing bush for several decades, it also acts as a nursery for a diversity of native forest species. Other species gradually invade the *manuka* understory and eventually become dominant, but their contribution to carbon sequestration and their economic significance is not yet established. Diverse forests potentially add functionality, but these benefits are not guaranteed, due to the presence of an exotic marsupial species (common brushtail possum; *Trichosurus vulpecula*). Securing additional ecological, economic, and cultural benefits requires pest control measures that add to overall management costs. The land block we report on here, which we call "Whakamahi Station," has extensive areas of steep land that have been invaded by *manuka* since the late 1980s.

A pilot project for carbon farming

We adopted a participatory approach in the project to find ways of understanding the barriers to carbon farming. We decided to conduct participatory research to 1) overcome the barriers to information about carbon farming, 2) reduce transaction costs for farmers, 3) determine what factors affect uptake of carbon farming, and 4) explicitly address the goals of Māori landowners. At the outset, part of the project funding was allocated to purchase credits from the farmers for the first Kyoto commitment period at a uniform price of NZ$15 (US$ 11.25) per ton of CO_2e.

The remote location of Whakamahi Station, and the steep, marginal land on much of the farm, made it a likely candidate for carbon sequestration. Importantly, the landowners were already engaged in revenue-generating activities that could overlap with reforestation, including 1) subsidy programs for erosion control, 2) biodiversity reserves, 3) apiaries for harvesting *manuka* honey, and 4) an ecotourism camp that offered bush walks and hunting expeditions. Other parts of the farm were used for grazing sheep and cattle.

We contacted the manager of the station and met at his home. After a brief interview, we presented the concept of carbon sequestration, its role in mitigating climate change, and the potential for market rewards. We showed the manager which areas of the farm would be well-suited to reforestation: steep, erodible areas where grazing is marginal and *manuka* has become established since 1990. The manager had heard of carbon credits and the

"We call the forest 'the cloak of Papatuanuku,' the Earth-Mother. When we see these bare hillsides, it is like leaving our own Mother naked and exposed." (A Māori landowner)

FIGURE 3 The farm manager surveys an area of pasture set aside for forest regeneration. (Photo by Jason Funk)

FIGURE 4 Landowners and researchers greet each other formally before signing the project contract at a Māori meeting house. (Photo courtesy of the *Gisborne Herald*)

Kyoto Protocol, but had questions about the criteria for earning credits, the potential value of sequestration, and how to certify forest credits.

To address these questions, the manager invited us to a meeting with the trustees responsible for the land. At the meeting, the trustees indicated an interest in native reforestation and a willingness to develop a demonstration project, but did not commit to setting aside any land at that time.

We used a carbon sequestration model (Box 1) developed by Landcare Research, supported by a geographic information system (GIS), to estimate the accumulation of carbon on the farm. To avoid overestimating the economic benefits of these forests, we limited our estimates to the value of sequestration in *manuka* only. We offered to buy credits through 2012 from an unspecified 50 ha of land. After several rounds of meetings with the manager and trustees, they selected areas of the farm where they expected the long-term benefits of reforestation would outweigh the opportunity costs of permanently retiring the land from grazing or timber harvest (Figure 3).

A model of carbon farming revenue

We used a modified version of the *Carbon Calculator* developed by Landcare Research to calculate the carbon revenue from carbon farming. The model has the following features:

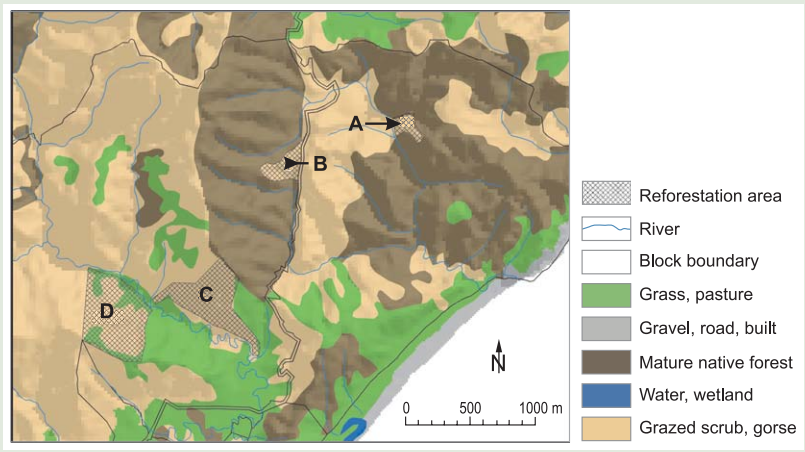
- Begins with treeless pasture;
- Estimates carbon accumulation in *manuka* over 70 years;
- Price remains constant at NZ$15 per ton of CO2e;
- Annual accumulation is multiplied by each year's price.

For further details, see www.landcareresearch.co.nz/research/globalchange/carbon_calc/carboncalc.aspxl

Project outcomes

Together, we found that carbon sequestration on its own was not economically competitive, but in combination with other forest services it can anchor a sustainable land management system that is economically, environmentally, and cul-

FIGURE 5 Land cover map with shaded relief, property boundaries, and areas proposed for reforestation. (Map by Jason Funk)



turally preferable to alternatives. The areas selected for reforestation were very marginal for grazing, often because they were steep and prone to erosion. Two areas were adjacent to a biodiversity reserve, making it possible to add habitat to the reserve. Regarding the lands selected for carbon farming, the land manager said, "I've been on here 20 years now, and I know just about every inch of it. It is obvious [which] areas should be left in some sort of tree cover...We'd rather [the areas] regenerate so [the forest] is always there."

Though features of carbon farming resonated with some Māori values, without careful arrangements, it could violate others. For instance, a few trustees had reservations about setting land aside permanently because it would restrict the right to self-determination of future generations. In response to their concerns, we included flexibility in the project contract to limit their liability and provided clear ways for future generations to exit the contract, if desired. In the end, they supported the program (Figure 4) because 1) re-establishing native forests fits with Māori cultural traditions, 2) it increased their farm profits, and 3) the contract protected the right of future generations to make their own decisions about the land.

With the information we provided from our model about costs, sequestration rates, and potential revenues, landowners were able to make informed judgments about carbon farming. The trustees of Whakamahi Station decided to retire over 50 ha of land that will sequester over 4000 tons of CO_2e by the time the forests reach maturity (Figure 5). The additional revenue from carbon coincided with land uses that add to the overall benefits of the forest, such as protecting the soil and providing more habitat for native species. Furthermore, the trustees now plan to expand their honey production, apply for a new erosion control subsidy, and increase their tourism activities in the reforestation areas, adding to the economic benefit of these young forests.

Lessons learned

1. *Provide scientific information to support decisions.* We used a carbon model to estimate the amount of sequestration on the farm, allowing landowners to come to a decision without needing a costly forest assessment first.
2. *Use a participatory approach to develop culturally appropriate projects.* We developed a project consistent with Māori land law, which acknowledges communal land ownership, the inheritance of future generations, and the rights to customary uses.
3. *Combine revenues from environmental services.* We established a framework for combining the value of carbon with other environmental services.

This project demonstrated how Māori landowners in NZ can incorporate new market-based incentives for carbon sequestration into existing farm practices. In this case, the benefits from carbon farming encouraged landowners to expand forests, adding to their multiple functions on hill-country farms. By utilizing existing scientific data, landowners can identify areas where these forest benefits outweigh those of other land uses. With care, arrangements for reforestation projects can provide better incomes, more sustainable land use, and culturally respectful management.

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