



**Nutrient Trading in Lake Rotorua:
Social, Cultural, Economic and Environmental
Issues around a Nutrient Trading System**

Kelly Lock and Suzi Kerr

**Motu Manuscript
Motu Economic and Public Policy Research**

April 2008

Author contact details

Kelly Lock

Motu Economic and Public Policy Research

kelly.lock@motu.org.nz

Suzi Kerr

Motu Economic and Public Policy Research

kelly.lock@motu.org.nz

Acknowledgements

This paper has been produced as background to a dialogue process (www.motu.org.nz/nutrient_trading) and is released publicly to facilitate discussion. We would like to thank Environment Bay of Plenty, the Ministry of Agriculture and Forestry, and the Ministry for the Environment for their financial support. We also appreciate feedback from members of the Nutrient Trading Study Group, in particular Tina Ngatai, Rick Vallance, Jamie Paterson, Hera Smith and Nigel Wharton, and from Simon Ngawhika. Any opinions expressed are those of the authors and do not reflect the views of the funders or study group. The authors remain responsible for any errors and omissions.

Motu Economic and Public Policy Research

PO Box 24390

Wellington

New Zealand

Email info@motu.org.nz

Telephone +64-4-939-4250

Website www.motu.org.nz

© 2008 Motu Economic and Public Policy Research Trust and the authors. Short extracts, not exceeding two paragraphs, may be quoted provided clear attribution is given.

Abstract

At any point in time, all communities face a number of cultural, social, economic and environmental challenges and opportunities. The Lake Rotorua catchment is no different. Water quality in the Rotorua lakes is one of the pressing issues in the catchment, but it is not the only problem residents are facing. A nutrient trading system is one method regulators are considering to control nutrient loss and improve water quality in Lake Rotorua. Such a system aims to achieve nutrient loss targets at the least cost. However, a nutrient trading system is likely to impact - and be impacted by - other issues in the region. This paper discusses how policy makers should account for wider impacts and factors impacted by a nutrient trading system, and discusses how these factors should or should not affect the design of the system. The paper gives examples of environmental, social, cultural and economic issues.

JEL classification

Q53, Q57, Q58

Keywords

Water quality, nutrients, trading, Lake Rotorua

Contents

1	Introduction	1
2	Designing policies to consider other influences and issues.....	1
2.1	Impacts of the local context on the nutrient trading system	1
2.2	Impacts of the nutrient trading system on the local context.....	2
3	Factors that impact on and are impacted by the Lake Rotorua nutrient trading system.....	3
3.1	Social Issues	3
3.2	Cultural issues	5
3.3	Economic issues	6
3.4	Environmental Issues	7
	References	10

1 Introduction

At any point in time, all communities face a number of cultural, social, economic and environmental challenges and opportunities. The Lake Rotorua catchment is no different. Water quality in the Rotorua lakes is one of the pressing issues in the catchment, but it is not the only problem residents are facing.

A nutrient trading system is one method regulators are considering to control nutrient loss and improve water quality in Lake Rotorua. Such a system aims to achieve nutrient loss targets at the least cost. However, a nutrient trading system is likely to impact - and be impacted by - other issues in the region. This paper discusses how policy makers should account for wider impacts and factors impacted by a nutrient trading system, and discusses how these factors should or should not affect the design of the system. The paper gives examples of environmental, social, cultural and economic issues.

This paper is part of a series of papers on various aspects of the design of a nutrient trading system for Lake Rotorua. These papers can be found at www.motu.org.nz/nutrient_trading.

2 Designing policies to consider other influences and issues

2.1 Impacts of the local context on the nutrient trading system

The effectiveness of a nutrient trading system depends on a range of regulatory, economic and attitudinal factors in the local community. If strict regulations prevent landowners from undertaking many land use and mitigation options, then the system is less likely to achieve the most cost effective nutrient loss reductions. As another example, the efficiency of the nutrient trading system may be reduced if the landowners in the catchment have limited access to capital, preventing land use change from occurring.

Some of the attitudes in the catchment may aid the nutrient loss reductions in the catchment. If there is a strong interest in conservation in the catchment, there is likely to be more support for the planting of riparian boundaries to

improve the environment for native fish as well as the reduced nutrient loss benefit.

Policy makers need to take into account the characteristics of the catchment and its community when designing the nutrient trading system to account for factors that will affect the system. Failure to do so will lead to a sub-optimal nutrient trading system.

2.2 Impacts of the nutrient trading system on the local context

The implementation of a nutrient trading system will have a number of direct and indirect impacts on issues in the Lake Rotorua catchment. For example, improved water quality is likely to have a positive impact on the tourism industry. These benefits will be achieved without altering the nutrient trading system. The direct benefits from improved water quality are well documented elsewhere (e.g. see Environment Bay of Plenty et al (2007)), but a nutrient trading system can also produce indirect impacts which are more difficult to identify and may be altered with small changes in the system design.

For example, the introduction of a nutrient trading system may have conservation benefits if it encourages the conversion of pastoral land into native bush, providing more habitat for New Zealand native birds. The system can be designed to ensure that it rewards the nutrient benefits of native bush and does not create perverse incentives that bias toward plantation forestry. Making small changes to the nutrient trading system can lead to potentially big differences in these co-benefits, so policy makers need to think about these impacts when designing the system.

While the nutrient trading system could be altered to achieve additional co-benefits or to offset negative outcomes, this is not always the right approach. In an ideal world, one policy would be designed to address each issue. Using a single policy to achieve multiple outcomes will require compromise, as there are likely to be conflicts between the different desired outcomes. But there may be justification for altering one policy to achieve additional benefits or to reduce the negative impacts of the system. If, for example, large co-benefits could be achieved at a very low cost by changing the nutrient trading system or if other

issues are not effectively addressed by existing policies. This should only be undertaken if the benefits of doing so outweigh the costs.

3 Factors that impact on and are impacted by the Lake Rotorua nutrient trading system

A large number of issues in the Lake Rotorua catchment will be indirectly impacted by, and/or will impact, a nutrient trading system in the catchment. This section highlights social, cultural, economic and environmental issues in turn.

3.1 Social Issues

The Rotorua region has a particular issue with poverty and unemployment, especially among youth just entering the workforce (Rotorua District Council (2007b)). A number of initiatives are already in place to improve the situation. For example, to improve youth employment, the Mayor's Taskforce has implemented a secondary school level programme, STAR courses and Careers Month. These have been found to be highly effective in reducing youth unemployment in the region (Rotorua District Council (2007a)).

Introducing a nutrient trading system may also affect income and employment levels in the catchment. A nutrient trading system, especially one with a falling cap, is likely to lead to land use change from high nutrient land uses to low nutrient land uses. Therefore it is expected that dairy land may change into other pastoral farming land uses and pastoral farming may change into plantation forestry. Such changes are likely to alter incomes and the number of jobs in the catchment.

Forestry and pastoral agriculture are the second and third largest contributors to the Rotorua economy. In 2002 they made up 10.3% and 7.8% respectively of the area's economic output, behind only tourism at around 11% (APR Consultants (2005)). If we include wood and pulp processing, the forestry sector becomes the most significant sector in the local economy contributing around 16% of gross output.

To assess the impact of land use changes due to a nutrient trading system, it is important to know the value of an additional hectare in each of the land uses.

Work carried out by Bell and Butcher (2003) has identified the employment and value added from 1,000 ha of dairy, sheep/beef and plantation forestry land. 1,000ha of medium intensity dairying employs 27.80 Full Time Equivalent (FTE) workers and adds \$2,600,000 of value each year. In contrast, the same amount of land in medium intensity sheep/beef farming employs only 4.50 FTEs and adds only \$520,000 of value to the region. The effect of plantation forestry in a particular year varies depending on the stage in the rotation the forest is in. On average, 1,000 ha of plantation forestry employs 9.20 FTEs and adds \$2,000,000 of value to the region. However, the majority of the impact occurs in the final year when the forest is harvested and 177.6 FTEs are employed. In general, employment decreases when pasture is converted to forestry (Schirmer (2000)).

Based on the above figures, the impact of changing land use will have effects on both employment and the region's income. Reducing nutrient loss by converting dairy land into sheep/beef land will reduce both employment and the region's income, but reducing nutrient loss by converting sheep/beef land into plantation forestry may have the opposite effect. In the latter scenario, income and employment levels are likely to be more variable from year to year.

It is difficult to attribute these employment and income changes to the introduction of a nutrient trading system *per se*, rather than to the implementation of controls on nutrient loss. Many forms of regulations that aim to reduce the level of nutrient loss in the catchment will lead to the land use change indicated above. The difference with a nutrient trading system is that it is likely to enable the more profitable land uses (in terms of profit per unit of nutrient loss) to stay in business while the less profitable will be shut down. Therefore some of the high nutrient loss but highly profitable dairy properties in the catchment could remain under a nutrient trading system, lessening the impact of the nutrient loss controls on the region's income and employment levels compared to other regulations.

As the amount of land use change that will eventuate from the introduction of a nutrient trading system is unknown, the changes in the region's income and employment levels is also uncertain. With improved water quality, there may also be increased employment in other sectors such as tourism. Given this uncertainty and that there are other policies in place to improve income and employment in this catchment, the nutrient trading system should not be altered to improve these outcomes.

New research suggests that gorse, which covers much of the undeveloped land in the catchment, actually has a high level of nutrient loss and consequently requires a lot of allowances. This would provide a short-term incentive for owners of undeveloped land to remove the gorse and develop the land rather than leave it in its current state. Only landowners with capital can take this option however. If the level of free allocation of allowances is not high enough to cover nutrient losses from undeveloped land there could be serious impacts on poor landowners who are less likely to be able to access the capital needed to develop.

3.2 Cultural issues

Maori have a very strong connection to fresh water. Rivers and lakes are believed to carry ancestral connections and are sources of identity for tribes (Ministry for the Environment (2005)). Traditionally, waterways were also an important source of resources including food, building and weaving materials, dyes and medicines (Ministry for the Environment (2001)).

For the past 20 years, a substantial effort has set out to preserve Maori culture and language, including knowledge of traditional harvest practices. This resurgence is likely to increase support in the catchment for the nutrient trading system, which will provide the capacity, or even financial reward, for Maori who want to enhance or restore their land. For example, the nutrient trading system will provide incentives for Maori land owners to convert marginal pastoral farming land into native bush, restoring it to its original condition. Since native bush requires substantially less allowances than pastoral farming, this conversion would allow landowners to sell excess allowances or reduce the number of allowances they need to purchase. Programmes providing financial incentive for re-establishing native forests by paying for the forest's carbon sequestration have been found to be culturally acceptable by Maori (Funk and Kerr (2007)). Thus payment for conversion to native bush to reduce nutrient loss is also likely to be culturally acceptable.

In addition to providing incentives to restore pasture into forest, a nutrient trading system also provides incentives for restoring other parts of the environment, such as the planting of riparian boundaries. This could have multiple benefits to Maori, including increased availability of traditional resources such as flax.

The current interest in preserving Maori culture and practices is likely to increase acceptance of a nutrient trading system and the likelihood that the system will be successful once it is implemented.

3.3 Economic issues

A nutrient trading system allows required nutrient loss reductions to occur in the most cost effective locations. Unlike other regulations, a nutrient trading system allows landowners to decide the best management decisions for the land given the nutrient loss target and allows the nutrient loss rights to be traded. This leads to the nutrient loss reductions been undertaken in the most cost effective locations. But for this to work, landowners need to have flexibility in their land use and management decisions. The more restricted landowners are, the less cost effective the system will become.

In the Lake Rotorua catchment, flexible land use change is hindered by a lack of access to capital and other regulations such as the RMA. The area has a number of small, undeveloped land blocks, many of which are underdeveloped because landowners do not have the required capital. A nutrient trading system may provide a mechanism for capital constrained landowners to develop their land. In a system where landowners are allocated allowances based on land use capability, the undeveloped land is likely to receive more allowances than it requires to cover current nutrient loss.¹ By selling the extra allowances in the early years, a landowner could generate capital required to start to develop their land.

Land use changes may also be limited by regulation outside the nutrient trading system. For example, to subdivide a property into lifestyle blocks, a landowner needs additional titles to be issued by the council. If the council declines this application, the landowner will not be able to undertake the subdivisions as a method of reducing the nutrient loss of their property. The more restrictive the additional regulations are, the less likely it is that the most cost effective nutrient reductions will be achieved. Lengthy and/or uncertain regulatory processes may also hinder nutrient reductions. If landowners need to go through a lengthy, expensive RMA process to get permission to plant a major wetland on their property, they may be deterred from undertaking this mitigation. Less

¹ See Kerr (2008) for more information on the allocation of allowances in this system.

restrictive regulations controlling land use and management change will increase the effectiveness of a nutrient trading system.

Land use changes and mitigation activities from a nutrient trading system may also alter property values and tourism income in the catchment. Changing the outlook of properties from pasture to forestry or having a view blocked by plantation forestry blocks has been found to lower property values (Gillard (1981)). Large scale landscape changes may also alter tourists' perceptions of the area, and potentially decreasing tourism interest and spending (Schirmer (2000)). However, converting pastoral land into plantation or native forestry is only one way to reduce nutrient loss in the catchment. Creating riparian boundaries and wetlands, which reduce nutrient loss, have also been found to alter property values (Mooney and Eisgruber (2001)). The direction of this effect can be a function of the type of wetland and riparian boundary and its proximity to the property (Doss and Taff (1996)).

The use of a nutrient trading system, rather than other regulation, will encourage innovation and the adaptation of new practices and technology. In a nutrient trading system, as soon as a new technology or management practice for reducing nutrient loss is included in the model, there are incentives for the landowners to implement them. Under other regulations, there may be longer lags until the new technologies are recognised as the effect on different types of properties needs to be assessed. In contrast, in a nutrient trading system, the technology does not need to be forced on a group of landowners, instead only those who will benefit from the technology will implement it. If new technology is developed that can significantly reduce nutrient loss from properties, the cap on the trading system may be able to be lowered faster than originally thought leading to extra long term environmental gains.

3.4 Environmental Issues

The implementation of a nutrient trading system may have indirect environmental benefits, including increasing the amount and quality of habitat available to native species and reducing greenhouse gas emissions from the catchment.

A nutrient trading system may lead to land use and other changes which improve the amount of habitat available to native species, assisting in their

conservation. The potential increase in plantation and native forestry will increase the terrestrial habitat for many native species including native birds.² In addition to this, converting pasture to forestry on the edge of streams will increase the amount of aquatic habitat available for native fish and aquatic insect species (Hanchet (1990), Collier et al (2000)). Planting riparian boundaries also has ecosystem benefits, decreasing stream turbidity and enhancing aquatic habitats for native fish (Rowe et al (2000)).

Introducing a nutrient trading system may also assist New Zealand to reduce its greenhouse gas emissions. Agriculture contributed almost half of New Zealand's total emissions in 2005 (Ministry for the Environment (2007)) and significant reductions in the level of emissions from the agricultural sector may be needed to enable New Zealand to reach its Kyoto targets without undue cost to the New Zealand economy.

Regulation to reduce nutrient loss may also reduce greenhouse gas emissions from the Lake Rotorua catchment. The cost of complying with both systems will not be additive. For example, reducing stock numbers will not only reduce the amount of nitrogen leaving the land but will also reduce the amount of methane released from the property.³ However, not all activities carried out to improve water quality will have a corresponding positive benefit for greenhouse gas emissions. If riparian boundaries are created, they will have a significant negative impact on the amount of nutrients leaving the land but not on the greenhouse gas emissions from the catchment. Other mitigation options may increase the level of greenhouse gas emissions from the catchment. For example, some research has suggested that winter feed pads could increase greenhouse gas emissions by up to 8% (Monaghan et al (2008)).

² New Zealand native birds have been found to live in both plantation and native forests. Thus although many species prefer native bush, increasing the amount of plantation forestry in the catchment will increase the amount of habitat for many native bird species (Clout and Gaze (1984)).

³ The New Zealand Greenhouse Gas Inventory Report calculates the methane produced from enteric fermentation based on the population of each species (sheep, beef cattle, dairy cattle and deer) and the amount of dry matter consumed by the average individual (Dry Matter Intake, DMI) (Ministry for the Environment (2007)). A constant conversion factor is applied to the 'Total Population DMI' to calculate the total level of emissions. Thus if the number of animals decreases so do the methane emissions.

The New Zealand Government is currently designing a nation-wide emissions trading system for controlling greenhouse gas emissions to be phased in from 2008 and will cover agriculture from 2013 (Kerr and Sweet (2008)). With nutrient and emissions trading, landowners in the Lake Rotorua catchment will need to hold allowances to cover their nutrient loss and New Zealand Units to cover their greenhouse gas emissions. The data and model used for the nutrient trading should be similar, if not the same, as the data and model used for the emissions trading system. This would reduce compliance costs to the landowners in the Lake Rotorua catchment. The emissions trading system, once implemented may have a large impact on the nutrient trading system.

References

- APR Consultants. 2005. "Rotorua Economic Profile," *Destination Rotorua Report*. Available online at [http://www.e-c.co.nz/rdc/myfiles/Rotorua Economic Profile - update Dec 04.pdf](http://www.e-c.co.nz/rdc/myfiles/Rotorua_Economic_Profile_-_update_Dec_04.pdf).
- Bell, Brian and Geoff Butcher. 2003. "An Economic Evaluation of Land Use Change Options: Economic Impact on Rotorua District and Bay of Plenty Region of Water Quality Induced Changes to Land Use and Tourism in Rotorua Lakes Catchments," *Report prepared for Environment Bay of Plenty*. Available online at http://www.envbop.govt.nz/water/media/pdf/lake_okareka_economic_reports.pdf.
- Clout, M. N. and P. D. Gaze. 1984. "Effects of Plantation Forestry on Birds in New Zealand," *The Journal of Applied Ecology*, 21:3, pp. 795-815.
- Collier, Kevin J.; Brian J. Smith; John M. Quinn; Mike R. Scarsbrook; Halliday N.Jane; Glenys F. Croker and Stephanie M. Parkyn. 2000. "Biodiversity of Stream Invertebrate Faunas in a Waikato Hill-Country Catchment in Relation to Land Use," *New Zealand Entomologist*, 23, pp. 9-22.
- Doss, Cheryl R. and Steven J. Taff. 1996. "The Influence of Wetland Type and Wetland Proximity on Residential Property Values," *Journal of Agricultural and Resource Economics*, 21:1, pp. 120-9.
- Environment Bay of Plenty; Rotorua District Council and Te Arawa Lakes Trust. 2007. "Proposed Lakes Rotorua & Rotoiti Action Plan," *Environment Bay of Plenty Environmental Publication 2007/11*, Environment Bay of Plenty.
- Funk, Jason and Suzi Kerr. 2007. "Restoring Forests Through Carbon Farming on Maori Land in New Zealand/Aotearoa," *Mountain Research and Development*, 27:3, pp. 202-5. Available online at http://www.mrd-journal.org/pdf/Funk_Kerr_MRD_27_3_pp202_205.pdf.
- Gillard, Quentin. 1981. "The Effect of Environmental Amenities on House Values: The Example of a View Lot," *The Professional Geographer*, 33:2, pp. 216-20.
- Hanchet, S. M. 1990. "Effect of Land Use on the Distribution and Abundance of Native Fish in Tributaries of the Waikato River in the Hakarimata

Range, North Island, New Zealand," *New Zealand Journal of Marine and Freshwater Research*, 24, pp. 159-71.

Kerr, Suzi. 2008. "Nutrient Trading in Lake Rotorua: Cost Sharing," *Draft Motu Working Paper*.

Kerr, Suzi and Andrew Sweet. 2008. "Inclusion of Agriculture and Forestry in a Domestic Emissions Trading Scheme: New Zealand's Experience to Date," Motu, Wellington.

Ministry for the Environment. 2001. "Managing Waterways on Farms: A Guide to Sustainable Water and Riparian Management in Rural New Zealand," *Ministry for the Environment Report*, Wellington. Available online at <http://www.mfe.govt.nz/publications/water/managing-waterways-jul01/managing-waterways-jul01.pdf>.

Ministry for the Environment. 2005. "Wai Ora: Report of the Sustainable Water Programme of Action Consultation Hui," *Ministry for the Environment Report*, Wellington. Available online at <http://www.mfe.govt.nz/publications/water/wpoa-hui-report-jul05/wpoa-wai-ora-hui-report-jul05.pdf>.

Ministry for the Environment. 2007. "New Zealand's Greenhouse Gas Inventory 1990-2005," Ministry for the Environment, Wellington, New Zealand. Available online at <http://www.mfe.govt.nz/publications/climate/greenhouse-gas-inventory-overview-jul07/greenhouse-gas-inventory-overview-jul07.pdf>.

Monaghan, R. M.; C. A. M. de Klein and R. W. Muirhead. 2008. "Prioritisation of Farm Scale Remediation Efforts for Reducing Losses of Nutrients and Faecal Indicator Organisms to Waterways: A Case Study of New Zealand Dairy Farming," *Journal of Environmental Management*, In press.

Mooney, Sian and Ludwig M. Eisgruber. 2001. "The Influence of Riparian Protection Measure on Residential Property Values: The Case of the Oregon Plan for Salmon and Watersheds," *Journal of Real Estate Finance and Economics*, 22:2/3, pp. 273-86.

Rotorua District Council. 2007a. "Mayors' Taskforce Reducing Youth Unemployment," . Available online at <http://www.rdc.govt.nz/News+and+Events/Latest+News/Mayors+taskforce+reducing+youth+unemployment.htm>.

Rotorua District Council. 2007b. "Rotorua District Council: Community Profile," . Available online at

http://www.localcouncils.govt.nz/LGIP.nsf/wpg_URL/Councils-A-Z-Councils-Rotorua-District-Council-C1.

Rowe, David K.; Murray Hicks and Jody Richardson. 2000. "Reduced Abundance of Banded Kokopu (*Galaxias Fasciatus*) and Other Native Fish in Turbid Rivers of the North Island of New Zealand," *New Zealand Journal of Marine and Freshwater Research*, 34, pp. 547-58.

Schirmer, Jacki. 2000. "It's Not Easy Being Green: Perceptions for the 2020 Vision for Plantation Forestry in Australia," Digby Race ed. *Socio-economic Research to Support Successful Farm Forestry: Selected papers and abstracts from the ANU Forestry Colloquium*, ANU Department of Forestry, pp. 22-39.