

## **Improving market-based instruments through role-playing-games: Nitrate trading in New Zealand<sup>1</sup>**

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### **Abstract**

Market-based instruments (MBI) such as tradable permits have been shown to be effective and efficient policy instruments. In many circumstances they can lead to better results than more traditional policy approaches. Yet MBIs often face opposition from stakeholders. This may be due to uncertainty about how they will operate in practice and their economic, environmental, and social consequences.

Water quality in Lake Taupo – the largest freshwater lake in Australasia – has decreased significantly over the last 30 years through increased nitrogen inflows, primarily from pastoral farming. The local authority has proposed a catchment-wide limit on the amount of nitrate leaching activity from each farm or other rural property, with ability for land users to trade “nitrogen discharge allowances”. The proposed mechanism faces opposition from a variety of stakeholders.

We tested whether a role-playing-game involving the simulation of the proposed cap and trade regime for nitrate runoff would affect stakeholders’ attitudes towards the proposed instrument, and whether it would help to identify consequences of trading and provide useful information for policymakers on instrument design.

The role-playing game involved several players with hypothetical properties over a number of years, making decisions about how to manage the property (e.g. change the land use) and whether to buy or sell nitrogen discharge allowances. The game was designed to reflect policy settings as proposed by the local authority.

In order to assess attitudinal change, participants completed a survey prior to the game and repeated it immediately afterwards. The results showed a significant positive shift in participants’ views about the willingness of landowners to sell nitrate allowances and indicative positive shifts on several other attitudinal statements. Of the 28 participants, seven showed a significant overall positive shift in their attitudes towards nitrate trading in the Taupo catchment, and one showed a significant negative shift (90% confidence). Of the seven positive shifts, five had an interest in farming and five were over age 50.

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## Introduction

*Availability of good information lies at the heart of effective and equitable decision making (Allen & Kilvington 1999).*

In recent years, understanding of the role of information in sustainable development has moved beyond recruitment of stakeholder opinion on the social, economic, and environmental effects of development proposals, to focus on the complex beneficial interfaces between information exchange and stakeholder participation as a site of social learning. Applying Wenger's (1998) notion of 'communities of practice' to sustainable development places the activities of knowledge sharing at the heart of processes for stakeholder participation that are simultaneously dependent on and generative of collective information. Alongside shared values and social bonds, information seeking by communities has a significant role in growing capacity for change and in propagating practices favourable to sustainable development (Trumbo & O'Keefe 2001).

Market-based instruments (MBIs) such as tradable permits have been shown to be effective and efficient policy instruments to promote behavioural change towards sustainable development. In many circumstances they can lead to better results than more traditional policy approaches (European Environment Agency 2005; USEPA 2004; Sinner & Salmon 2003; OECD 2003).

Despite their potential, MBI proposals often face opposition from stakeholders because of uncertainty about how the instruments will operate in practice and what the economic, environmental and social consequences will be. Translated into risk allegations, this uncertainty has been successfully mobilised by influential interest groups, and MBIs such as eco-taxes and tradable regimes have struggled to gain acceptance even in countries that generally favour ecological fiscal reform (Dijkstra 1999; NRTEE 2005; Sinner *et al.* 2005; Wurzel *et al.* 2003).

Successful efforts at MBI implementation in Europe have included intensive consultation and a range of information investments aimed at increasing knowledge amongst policy regulators and affected stakeholders, to overcome the barriers created by this lack of understanding (Bregha *et al.* 2003). Initiatives have ranged from general public consultation and submissions processes, to public relations efforts aiming to promote awareness of the benefits of MBIs for addressing intractable problems such as those arising from failure to properly account for environmental costs (Bregha *et al.* 2003).

Akin to MBI introductions within Germany's states (Wurzel *et al.* 2003), some of New Zealand's regional environmental authorities have proposed using MBIs to manage demand for water and to control water pollution from non-point source discharges. Promoting stakeholder learning by providing information on how a proposed MBI introduction could work may change perceptions of risk and contribute to reducing stakeholder resistance to their adoption and use.

This paper presents findings from study of a role-playing game designed to assist stakeholders in the catchment of one of New Zealand's iconic inland lakes, Lake Taupo, to explore the potential operation of a market for nitrate discharge allowances. The paper describes the game development process, its design elements and the roles allocated to participants. It then presents attitude changes observed from the series of role-playing workshops, and comments on the positive potential and limitations of a role-playing simulation for assisting stakeholders to resolve policy conflicts over the acceptability of MBIs.

The Taupo study was one of several carried out exploring implementation of MBIs in the management of fisheries, water and coastal space in New Zealand. From an initial set of three case studies, Sinner *et al.* (2005) found that concerns of existing users were a strong influence on political decisions regarding implementation of MBIs for natural resources.

The study was designed to examine the potential of a role-playing game (RPG) as a stakeholder workshop to address one of the factors identified as a barrier to the effective implementation of MBIs – uncertainty on the part of stakeholders about how an MBI may operate in their local context. The game was also designed to help both policymakers and stakeholders better appreciate the land-use and social implications of the proposed MBI, as a tool to assist more informed assessment of the proposed policy.

### **Addressing information gaps: The RPG as a participation option**

Participatory decision-making is recognised in New Zealand as an important means to increase the transparency and accountability of democratic institutions and enhance the legitimacy of their decisions. Regional and district resource planning authorities are legally obliged to consult with affected stakeholders. The practice of stakeholder participation is trending towards deliberative community involvement over and above those consultative policy approaches, particularly in the area of water catchment management (see e.g. MacLennan 2000).

A broad range of claims are made concerning the benefits of participatory processes. At their best, such processes help bind communities in collaborative engagement to define their issues, establish impacts, express preferences, and debate pros and cons of available options for resolution. Participation in this sense enhances the capacity of communities to work together in problem solving, by strengthening awareness of interdependence and providing an infrastructure for ongoing evaluation, monitoring and coordination of action. Participation may also create conditions to support the effective implementation and durability of decisions once made. Lawrence and Deagan (2001:862) note 'many instances' where decisions supported by technical analysis have failed to gain implementation because the process for their introduction was regarded as non-inclusive.

Although the practice of participation has spread since passage of New Zealand's Resource Management Act 1991<sup>2</sup>, concerns have been raised about the effectiveness of participation in providing quality information to decision-making agencies. The transaction costs of participation for developers have been used to justify a reduction in the breadth of participation rights. Attempts to design participation systems for inclusive planning are made more difficult by an increasingly complex social profile in many New Zealand communities, particularly around multicultural and new immigrant changes. Getting the involvement of diverse groups of people in governance and participation is key, and a variety of approaches and methodologies will be needed to accomplish it (Allen, Kilvington & Horn 2002:24).

Moreover the focus is now on participation as a developmental process engaging people in learning that leads to change, rather than on mere information gathering (Allen, Kilvington & Horn 2002; MacLennan 2000). The United Nations has declared a decade for education on sustainable development from 2005 to 2014. Lead agency, UNESCO, called for a comprehensive set of educational tools to be developed that focus on improving critical thinking and rational decision making skills within communities, sufficient to support their capacity to think through complex development and sustainability issues (UNESCO 2005).

### **Role playing games as deliberative participation**

The function and benefits of RPGs in community management of natural resources have increasingly attracted researcher attention. Research on the use of agent-based simulations, systems models, and computer games in managing natural resources has expanded, particularly exploring community options for avoiding conflicts of water demand within catchment areas (Lankford 2003). These RPGs utilise models and simulations to engage stakeholders at the level of experiential learning and dialogue, allowing investigators to examine the appeal of various efficiency and water demand drivers, and land and water management options.

Stakeholders participating in RPGs gain access to information within the experiential and social learning context of the game. Lankford (2003) has used his 'River Basin Game', a role-playing board game, to encourage deliberation on water within local catchments in Africa. The intent of the game is to elicit and deepen knowledge about roles and responsibilities as a precursor to developing strategic planning visions and strategies for water allocation within the catchment community. Lankford (2003:2) comments:

*Role-playing is a well-known tool in participatory rural appraisal, community empowerment and facilitation of natural resource management... Furthermore, role-playing is also seen as a legitimate tool for qualitative social research...though it does need to be carefully managed and encapsulated within formal validation, feedback and follow-up activities.*

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<sup>2</sup> This Act, New Zealand's main environmental statute, integrated resource management within one law. It provides a framework for managing the effects of activities on the environment, with a consents process backed by regional and local planning and appeals to an Environment Court.

RPGs can be utilised as one of a range of ‘deliberative democracy’ approaches to local and stakeholder participation in decision making that seek to encourage social learning while expanding social resources that support the negotiation of conflict resolutions, and increasing collaboration potentials. Deliberative RPGs allow some direct observation of social relationships between stakeholders via observation of their behaviours and interactions within the game (Barreteau, Le Page, & D’Aquino 2003). Of note may be the presence and resolution of conflicts and the construction of alliances or collaborations.

The challenge is to integrate these relationship considerations in future development of the collaborative process. Although, there are clear benefits in providing opportunities for diverse stakeholders to experience working collaboratively, successful approaches have generally been individually tailored to encourage stakeholders’ involvement in their particular context (Allen & Kilvington 1999).

### **Proposed nitrate trading in the Lake Taupo catchment**

Lake Taupo – in the centre of New Zealand’s North Island – is the largest freshwater lake in Australasia (616 km<sup>2</sup>). It lies in a caldera created by a massive volcanic eruption approximately 26,000 years ago. The lake has high water clarity (average Secchi depth 14.6m (EW 2005a:9)) and a highly valued recreational fishery for introduced trout. The lake is the focal point for a significant local tourism industry drawing 1.2 million tourists annually.

Water quality in Lake Taupo has decreased significantly over the last 30 years, with increased nitrogen inflows being the main contaminant of concern. Nitrogen concentrations in streams draining pastoral sub-catchments have increased by between 50% and 300% in all measured streams since the 1970s (EW 2005b:3). Elevated nitrogen levels cause the proliferation of microscopic algae, reducing water clarity, and increasing the growth of weeds in near-shore areas (*ibid*:1).

While historic inflows included wastewater and stormwater discharges, pastoral farming now accounts for an estimated 93% of “manageable” (i.e. human-induced<sup>3</sup>) nitrogen inflows to Lake Taupo (EW 2005a:9). Because of extended lag times between land development and nitrogen runoff reaching the lake, scientists have estimated that, allowing only for existing land use, inflows will increase over time by between 20% and 80%. To maintain water quality in the lake, then, future inflows must be reduced by between 20% and 80%. Environment Waikato (EW), the local authority with responsibility for water quality, adopted a 20% reduction as an initial policy target (EW 2005a:31-32).

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<sup>3</sup> A hydro-electric power scheme that diverts water into the lake contributes 7% of total nitrogen inflows to Lake Taupo, but this scheme is outside the control of EW. EW therefore excluded the scheme from the definition of “manageable” inflows of nitrogen (EW 2005b).

In July 2005, EW issued proposed rules to reduce nitrogen inflows using a “cap and trade” approach to runoff from farming and other land uses (EW 2005b). This involves capping land uses in the lake catchment at recent levels of nitrate leaching, while allowing land users to trade “nitrogen discharge allowances”.

Under the proposed rules, all farm properties in the catchment would receive an allocation of nitrate discharge allowances (NDAs) based on their average estimated discharges during the period 2001-2004. Property owners would be required to submit management plans showing projected discharges to be within their allowance, and anyone planning to increase discharges must acquire allowances from another property owner. In addition, a trust has been established to acquire 20% of the allowances in the catchment, to reduce total inflows and eventually halt the decline in water quality. Due to time delays between land use change and nitrogen reaching the lake, scientists estimate that, even with reduced inflows, water quality in Lake Taupo will continue to get worse for a few decades before gradually improving and returning to current water quality in about 2080 (EW 2005b).

The proposal faces opposition from a variety of stakeholders (EW 2005c). EW has received 136 submissions, many of which challenge substantial aspects of the plan; public hearings were held in mid-2006. Among the points of contention is the initial allocation of discharge allowances – forest owners will need to purchase allowances if they wish to develop their land while, as many forest owners see it, farmers who have caused the problem would be rewarded with allowances and have no obligation to reduce their discharges to the environment. However, EW took the view that many farmers would be forced out of business if allowances were allocated on the basis of land area or some other formula that would require farmers to purchase most of the allowances needed for their operations. EW sought to minimise social disruption caused by the proposed rules and made a conscious decision not to compensate landowners for the cost of foregone development opportunities, following a decision to that effect from central government (EW 2005a:16ff, 23-24, 46ff).

The hearing commissioners appointed by EW are expected to announce their decisions on the submissions in early 2007, after which submitters have a right of appeal to the Environment Court<sup>4</sup>. If appeals are filed, a Court date would be unlikely before the end of 2007, with a decision by mid-2008 at the earliest. Thus, if appeals are filed and not resolved through negotiation, it is likely to be 2009 or later before tradable nitrate discharge allowances become a reality in the Taupo catchment, if indeed the rules survive the submission process and potential appeals.

## **Design of the nitrate trading game**

The role-playing game developed for this study involved players managing hypothetical farm properties while constrained by nitrogen discharge allowances. There were seven

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<sup>4</sup> The Environment Court is a specialist court that hears appeals on decisions made by government authorities on planning documents or applications for resource consent. It can also issue enforcement orders.

properties in the game (see Table 1), plus a trust charged with purchasing 20% of the allowances. In most cases, a single player managed an individual property or the trust, although four farming couples and some other participants played as two-person teams.

Each property had an initial land use and a corresponding initial allocation of NDAs. For some properties, this initial allocation was insufficient for the property’s initial land use. This was designed to reflect the likely effect of EW’s proposed rules – properties on which land use has intensified since 2001 will receive an allocation less than current discharges, because the proposed initial allocation is based on the average for 2001-2004. In the first round of the game, properties with an initial deficit (i.e. insufficient NDAs) had to acquire NDAs from other players or convert some land to less intensive uses.

**Table 1. Farm properties in the Nitrate Game**

<i>Property</i>	<i>Land use</i>	<i>Area (ha)</i>	<i>Sufficient NDAs?<sup>a</sup></i>
D1	Dairy	300	No
SB1	Sheep & Beef	600	Yes
SB2	Sheep & Beef	700	Yes
SB3	Sheep & Beef	400	No
SB4	Sheep & Beef	450	No
MIX1	Sheep & Beef, Pine Trees, Manuka <sup>b</sup>	8000	No
MIX2	Sheep & Beef, Pine Trees, Manuka <sup>b</sup>	6000	Yes
TRUST	(Buying NDA)	0	

<sup>a</sup> See text.

<sup>b</sup> Manuka is a small tree with little or no commercial value; on most farms it is considered non-productive “scrub”. In the game, players could convert this land to productive farmland or pine trees, but this involved one-off development costs.

Each player (or team) had an Excel spreadsheet showing an initial land use and land use options, plus financial returns and nitrate discharges for each land use. They also had a bank balance that was automatically updated each round to show the financial implications of their decisions; this sheet also showed future bank balances assuming no change in land use or prices.

The main sheet allowed players to experiment with changes of land use, showing financial returns and nitrate discharges for the selected land use, and calculated “break-even” prices for NDAs as a guide for bidding. That is, if a player selected a land use option that increased both returns and discharges, the sheet presented the price of NDAs at which the increased returns would repay the purchase of NDAs (i.e. “break even”) over 5, 10, and 15 years. Players were encouraged to use these figures as a guide to how much they should bid for NDAs, depending on their time horizon. Similarly, options that entailed reduced discharges but also lower returns generated break-even prices for selling NDAs.

Land use options in the game were designed to be as realistic as possible, with returns and nitrate discharges based on typical farm budgets and advice from agriculture and forestry officials and consultants. Nonetheless, the game was not fully realistic in some key respects. In particular, some management options were not included, such as ability to vary the stocking rate as a continuous variable or install winter feeding structures where effluent can be collected. Some participants commented on the inability to exit farming or convert land to residential development, while others thought the financial returns for different land uses were not realistic (“profitability of forestry was too high”). And some said simply that they “can’t get serious about hypothetical games” – without real money and real property, there was no “loyalty to the land”.

### **The market platform**

The formal proposal by EW includes no provision for a formal market for NDAs – one might emerge but otherwise property owners will need to find potential trading partners informally, e.g. through farm consultants acting as brokers. In the nitrates game, to expedite the trading process and to overcome bargaining issues that could arise in a new market for which there were no prior price signals, the game manager provided a market for NDAs using a double-sided uniform price auction with sealed (i.e. private) bids. The market design was based on the Watermove market for water permits in the Goulburn-Broken catchment in Australia (Watermove 2006).

In the nitrates game, players had an opportunity to submit bids and offers for NDAs once each round, and were allowed to submit up to two bids and two offers<sup>5</sup>. The game manager then used an Excel routine to match the highest bid with the lowest offer and continued iteratively with the next highest bid/lowest offer until no more matches could be made. The market price was established at the average of the bid and offer prices of the last match, and all successful bids and offers were confirmed at that price.

Players were also allowed to buy and sell NDAs off-market, i.e. informally at privately negotiated prices, provided these were recorded and reported to the game manager. Research staff helped to facilitate these off-market trades much as a private broker or farm consultant might do, but no commission was charged.

### **Playing the game**

The game involved several decision rounds, each round representing five years. At the beginning of each round, the game manager (a member of the research team) announced any changes to land use options (e.g. to reflect new technology to reduce nitrate discharges to waterways), prices for farm production, or rules of nitrate trading. For example, in Round 4 players’ allowances were reduced without compensation, with

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<sup>5</sup> Players submitting simultaneous bids and offers were instructed to ensure that their offers to sell were at prices higher than their bid to buy NDAs, otherwise they could end up selling to themselves.

players told that scientific studies had found that further reductions were needed to achieve water quality objectives for the lake.

After this “market update”, players experimented with land use selections for their respective properties and decided whether to bid (to buy) or offer (to sell) nitrogen discharge allowances, and at what price. After bids and offers were submitted, the market-clearing algorithm run, and market transactions and prices announced, players had about ten minutes to complete any off-market trades before finalising their land use choices for the round, representing the next five years.

Players then made their land use selections and recorded observations about the round before commencing the next round with a market update from the game manager.

Players were offered a payment of NZ\$50 (€25) for attendance (many declined, mostly because they were being paid for their time by an employer), but received no financial reward or penalty related to the performance of their farm property. They were instructed to make decisions according to what they thought a real property manager would do; they could maximise returns if they wished, but this was not required – there were no “winners” and “losers”.

The workshop sessions lasted four hours, including an introduction to the game and pre- and post-game online surveys. One game completed five rounds, one went six rounds and the third managed to complete seven rounds of trading and land use decisions.

### **Selection of participants**

*Finding mechanisms to identify relevant stakeholders (including users and non-users of resources, both inside and outside the watershed) and to facilitate exchange of information, mediation of conflicts and negotiation of mutually acceptable land management options is not an easy task (Water Policy editorial, 2001, quoted in Lankford 2003:2).*

As suggested, recruiting game participants for the nitrates game was not straightforward and we used a variety of methods to advertise the opportunity to participate in the workshops. We met with stakeholders recommended by the regional council several months in advance to elicit interest, ran the game with EW staff who recommended it to other interested people, and recruited from a representative group of local stakeholders via contacts with their lobby organizations, word of mouth, and through public notices.

These methods attracted the collaboration of people from the regulatory agency, industry, local development interests, and various stakeholders from within the district.

However, the games were run during a busy time of the farming year, and there were also indications that some farmers were reluctant to participate out of concern that the game results could be used as evidence to oppose their position in the legal process on the proposed rules.

As a result, somewhat fewer farmers and more professionals were available for the game than expected. In addition to farmers, participants included regional council staff, forestry managers, fertiliser sales representatives, a local development agency manager, trustees of Maori<sup>6</sup> farm incorporations, and the trustees of the Lake Taupo Protection Trust (the body set up to purchase 20% of the NDAs from farmers in the catchment). One player participated twice – he attended the first game as a forestry manager and attended the second as a member of the Lake Taupo Protection Trust – although he completed only one survey.

## ***The attitude survey***

### **Changing attitudes**

The issue of how attitudes act as antecedents of behaviour is important to formulating strategies to change behaviours in order to reduce pressures on the environment. Although many social psychological theories describe actual behaviour as determined by behavioural intentions that are influenced by attitudes, other research suggests the correlation between attitudes and behaviour can be tenuous and subject to a range of influences (White *et al.* 2005).

*The theory of cognitive dissonance holds that people are motivated to hold attitudes that are consonant with others; hence social learning processes have to take into account initial attitudes. The theory of psychological reactance holds that people may react strongly to perceived limitations of freedom; hence they may reject convincing arguments because they are presented in a one-sided, extreme, emotional or untrustworthy manner. Learning processes may thus not always alter behaviour and reduce conflict (White *et al.* 2005:6).*

Social learning seeks to change behaviour by improving the use of information by stakeholders who will influence the process. Social learning is reflective, encouraging review of decisions made against results achieved, and enabling a groundswell of momentum for change to emerge. Stakeholders change their opinions by adding new information gleaned during the experiential learning event that introduces new perspectives including the views and experiences of others within the system. The improved information about how a system functions and impacts on various self- and community interests, increases the range of possible responses that stakeholders regard themselves as having, and improves their comparison of options open to them (Allen & Kilvington 1999).

Enabling participant discussion and reflection is a key property of the collaborative learning involved in RPGs (Moon 1999; Barreteau 2003). Reflecting from and on character roles experienced by participants during the course of an RPG may improve understanding of the complexities faced by a community, and increase insights into the

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<sup>6</sup> Maori are New Zealand's indigenous peoples, numbering approximately 15% of the national population. Local Maori own around 50% of the productive farming and forestry land in the catchment of Lake Taupo, usually managed in a collective ownership structure such as a land management trust or incorporation.

perspectives of other stakeholders, which in turn creates new ways of working (Tsuchiya 1998) that provide a stronger basis for readiness to collaborate.

## Data collection methods

This study collected data using a mix of Q-sort, survey, questionnaire and discursive/observation methods.

Information from sources was integrated at the data analysis stage, using a putative synthesis of the findings to validate or test potential conclusions.

To examine changes in participants' attitudes, a Q-Sort was developed (Brown 1996). An initial workshop of policy managers involved in administering the proposed introduction of nitrate trading included a Q-Sort of 100 opinion statements drawn from submissions on the proposed rules (EW, 2005). This Q-Sort resulted in a refined set (n=63) of positive and negative opinion statements, with subsequent participants asked to indicate their agreement on a 1-5 scale from "Strongly Disagree" to "Strongly Agree", with "Neutral"=3. A "Don't Know/Not Applicable" option was also enabled.

Nine statement themes were included in the final survey; see Table 2. Participants were presented with alternating clusters of negative and positive statements to reduce the potential for confusion, but otherwise the statements were in random order. Themes were not identified to participants. Participant anonymity was preserved by use of a third party survey firm (Research New Zealand) to collect and analyse the data.

The attitude survey was administered to all subsequent game participants (n=28) immediately before their session and repeated (with questions in a different order) at the end of the workshop.

**Table 2. Number of negative and positive statements for each theme in the attitude survey.**

Theme	Neg	Pos	Total	Example
				(A tradable nitrogen allowance system...)
Affect (i.e. emotive)	4	1	5	<i>Is arbitrary and unfair</i>
Behaviour Change: Efficacy of Instrument	2	5	7	<i>Will discourage high nitrogen discharge activities</i>
Confidence in Using System	5	4	9	<i>I don't know how I will set prices for nitrogen trades</i>
Environmental Outcomes: Efficacy of Instrument	3	4	7	<i>Will result in improved water quality in the lake</i>
Fair Distribution of Costs and Benefits	7	4	11	<i>Will fairly distribute the costs of avoiding, remedying or mitigating nitrate pollution</i>
General Attitudes	4	3	7	<i>Won't work because no one will be willing to sell.</i>
Impacts on Land Use	6	1	7	<i>Will impose an unworkable cap on stock units for farming</i>
Land Values & Livelihoods	3	2	5	<i>Will strip away farmers' livelihoods</i>
Social Impacts	5	0	5	<i>Will create divisiveness in the community</i>
<b>Totals</b>	<b>39</b>	<b>24</b>	<b>63</b>	

Data from the pre- and post-game surveys were analysed to identify and assess the significance of changes in opinion, and, in a context-sensitive manner, to examine clusters of opinion in individuals and within demographic groupings.

In keeping with social and experiential learning, participants were also engaged in several forms of reflection administered following the nitrates game. The intent of the reflection opportunities was to encourage participants to initiate for themselves *'the process of internally examining and exploring an issue of concern, triggered by an experience, which creates and clarifies meaning in terms of self, and which results in a changed conceptual perspective'* (Boyd & Fales 1983:99).

Participants' own reasoning for their behaviour during the nitrates game was gathered at the end of each round of play. A single-item online form was used to record their perspectives on the choices made. This qualitative information was supplemented with a 1-5 'life satisfaction' measure, again completed at the end of each round of trading play.

The research team asked a set of brief open-ended reflection questions during a 15-20 minute 'debrief' that allowed participants to share insights they had experienced as a result of the game. Finally, a paper questionnaire was provided to all participants consisting of open-ended questions seeking their observations about what they had perceived to occur during the course of the game. Some participants completed this prior to departure; others returned the questionnaire by post; some did not return it.

The physical setting of the game workshops enabled participants to converse freely with each other and with the research team, while also enabling 'private' decision-making by players. Participants could and did pause during the course of play to ask questions and/or offer insights into what was happening with trades and behaviours during the game. These discussions, collaborations and comments were collected as researcher observations.

In addition to the above, the research team collected data on bids, market and off-market trades, and land use decisions for each round of the game. These data, as well as the data on life-satisfaction scores, are still being analysed and will be reported separately. This paper presents data from the attitude survey.

## **Results**

The nitrates game was designed to encourage participants to perceive that land use change would not be as unduly compromised by the proposed nitrates market as some might have initially believed. The design also enabled property owners to see that they might be able to maintain financial returns while at the same time reducing nitrates discharge to the lake.

## Statistical analysis by survey statement

Means testing was used to identify significant differences between pre- and post-game responses to individual survey statements and to groups of statement by category and by demographic variables.

When analysed using a two-tailed paired t-test<sup>7</sup>, the differences between individuals' pre-game and post-game responses were highly significant (>99%) for all 63 statements. However, this was true even for statements where the mean response was virtually unchanged (2.760 pre to 2.759 post), suggesting that the coarseness of the scale and possibly environmental factors (e.g. fatigue, boredom, resistance), rather than true attitude shifts, were responsible for some individuals entering different responses pre- and post-game and the paired t-test producing significant results.

We therefore tested for significant shifts in the overall mean (i.e. assuming that the two samples were drawn independently and were not in fact paired). The relatively small sample size made it more difficult to detect significant results compared to using a paired t-test. Using the 'independent samples' assumption, one statement showed a significant difference between mean pre- and post-game responses at the 95% confidence level:

*Won't work because no one will be willing to sell.*

When stratified by demographic variables, Primary Industry participants (farmers, foresters, fertiliser reps), those aged over 50 years, and women all showed a significant positive shift on this attitude statement.

Participants were more likely to disagree with this statement as a result of the game, i.e. after the game, participants had a more positive attitude towards the proposed policy instrument in terms of the likelihood that trading would occur.

Other statements that had significant positive shifts for certain demographic groups were:

*Will discourage high nitrogen discharge activities (Pakeha, i.e. New Zealand Europeans)*

*Will not address the adverse effects of pastoral farming (Women).*

Thirteen additional statements showed indicative shifts of opinion across all participants, i.e. were significant at a confidence interval of between 75% and 90%; see Table 3. All of these shifts were in a positive direction.

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<sup>7</sup> See e.g. Snedecor & Cochran (1980, pp 83ff) or another textbook on statistical methods for a description of t-tests and their underlying assumptions for paired samples vs independent samples.

**Table 3. Statements with significant (95% confidence) or indicative (75% confidence) change between mean pre- and post-game responses.**

Statement	Pre	Post	Shift <sup>a</sup>	Signif.
<i>Won't work because no one will be willing to sell</i>	3.08	2.57	Pos	96%
<i>Will not address the adverse effects of pastoral farming</i>	3.30	2.79	Pos	90%
<i>Will cause problems from more intensive settlement</i>	3.59	3.11	Pos	87%
<i>Will prevent any change in land use</i>	2.61	2.18	Pos	86%
<i>I am confident that I know how the trading system will work</i>	2.41	2.75	Pos	85%
<i>Will discourage high nitrogen discharge activities</i>	3.11	3.50	Pos	84%
<i>Will fairly reflect the contribution of Ngati Tuwharetoa<sup>b</sup> to the wellbeing of the lake</i>	2.33	2.79	Pos	84%
<i>Will have a disproportionate effect on Maori freehold land</i>	3.81	3.36	Pos	84%
<i>Some people will manipulate the market at the expense of others</i>	4.07	3.79	Pos	84%
<i>Will result in welfare gains for the community</i>	2.44	2.85	Pos	83%
<i>Will make some rural land unviable to use for pastoral production</i>	4.04	3.70	Pos	80%
<i>Will create uncertainty about how my business will operate</i>	3.88	3.57	Pos	78%
<i>Will give farmers more flexibility compared to land use rules and regulations.</i>	3.22	3.57	Pos	77%

<sup>a</sup>“Pos” indicates that after the game, participants had a more positive attitude towards nitrate trading than before the game. For statements expressed as negative attitudes, a decrease in mean score represents a positive shift.

<sup>b</sup>Ngati Tuwharetoa is the Maori tribe in whose area Lake Taupo is located; the tribe has legal ownership of the lake bed but not the water of the lake.

### Statistical analysis by statement theme

Responses were also tested for pre- and post-game differences for each of the nine statement themes. Responses to negative statements were inverted to make them comparable with positive statements in the same theme; an increase in the mean response therefore indicates a more positive attitude towards nitrate trading as a policy instrument.

There were no statistically significant differences when the results were examined for the entire sample (i.e. the mean ratings of all participants). However, when the responses were stratified by demographic variables, some significant differences appeared at the 95% confidence level; these were mostly positive. See Table 4.

**Table 4. Survey themes showing significant changes (95% confidence) for certain demographic groups.**

Demographic	Theme	Pre	Post	Shift
Maori	<i>Social Impacts</i>	2.06	2.65	Pos
Age > 65	<i>Social Impacts</i>	2.00	2.63	Pos
Primary sector	<i>Impacts on Land Use</i>	2.67	2.97	Pos
Economics training high school level	<i>Behaviour Change: Efficacy of Instrument</i>	2.72	3.61	Pos
Fertiliser reps	<i>Affect</i>	3.60	3.00	Neg
Fertiliser reps	<i>Land Values and Livelihoods</i>	3.07	2.08	Neg

### Statistical analysis by individual participant

Responses were also analysed by individual, first for the set of positive survey statements and then for negative statements. Five of 28 participants showed significant differences (>95%) in their pre- and post-game responses for either the positive or negative statements, a further two had differences that were significant at the 90% level. Of these seven participants, five shifted in the same direction (three positive, two negative) for both the positive statements and the negatively worded statements. See Table 5.

Taking all statements together, five out of 28 participants showed significant differences (four positive, one negative) at the 95% confidence level, and a further three had significant positive shifts at the 90% confidence level. See Table 6.

As can be seen from Table 6, five of the seven respondents with a significant positive shift cited “Farming” as at least part of their primary reason for interest in nitrate trading. One “Farming” interest accounted for the only significant negative shift.

**Table 5. Mean pre- and post-game responses for individuals with shifts >90% confidence for either positive or negative statements.**

ID#	<i>Positive statements</i>				<i>Negative statements</i>			
	Pre	Post	Shift	Signif.	Pre	Post	Shift	Signif.
24	3.13	4.27	Pos**	99.99%	4.18	3.64	Pos	86%
29	2.33	3.25	Pos**	99.83%	3.10	2.95	Pos	51%
25	2.21	2.73	Pos*	96%	3.59	3.43	Pos	55%
7	2.41	1.74	Neg	94%	4.00	4.22	Neg	52%
27	3.44	2.96	Neg	88%	2.81	3.44	Neg**	99.7%
18	4.25	4.00	Neg	85%	3.26	2.74	Pos*	98%
4	2.67	2.33	Neg	54%	3.36	2.69	Pos	94%

\*\* Significant at 99%. \* Significant at 95%.

**Table 6. Mean pre- and post-game responses for individuals with shifts >90% confidence for all statements (negative statements inverted).**

ID#	Pre	Post	Shift	Direction	Signif.	Primary Reason for Interest
27	3.28	2.71	-0.57	Negative	99%	Farming
24	2.32	3.20	0.88	Positive	99%	Farming and subdivision
26	2.75	3.16	0.41	Positive	99%	Farm servicing industry
29	2.68	3.13	0.45	Positive	99%	Environmental values
2	2.27	2.68	0.41	Positive	95%	Farming, forestry, environmental values, research
25	2.33	2.63	0.30	Positive	94%	Farming
17	3.44	3.84	0.40	Positive	93%	Government/regional council
3	2.51	2.76	0.25	Positive	90%	Farming

Table 7 provides a breakdown by other demographic variables. The results suggest that this RPG was particularly effective in assisting those over age 50, and those with farming interests, to learn about how the proposed MBI might work in practice.

**Table 7. Number of participants with significant positive and negative shifts towards nitrate trading, by demographic variables (90% confidence).**

	Positive shift	Negative shift	Total no. in group
<i>"What is your primary reason for interest in trading of nitrate allowances?"</i>			
Farming*	2	1	10
Forestry	-	-	2
Govt/regional council	1	-	4
Community/business development	-	-	2
Environmental values	1	-	3
Other*	3	-	7
<i>Gender</i>			
Female	3	-	9
Male	4	1	19
<i>Age</i>			
18-35	1	1	4
36-50	1	-	9
51-65	4	-	10
Over 65	1	-	5

\* Of those responding "Other", five specified some aspect of farming or land use in combination with some other interest. See also Table 6.

## General observations

Allen & Kilvington (1999) suggest that the process of forming an information sharing collaboration between stakeholders occurs in stages, beginning with an entry and contracting phase of engaging people, establishing relationships and rules for working together, and growing trust. These relationships are critical to building a successful process, providing the foundation for talking, sharing, and working collaboratively. In the entry and contracting phase, understandings are shared, and roles and goals are developed, establishing a "*climate for change [that] is the single most important step in initiating any collaborative approach*" (Allen & Kilvington 1999).

Initial indications about the use of the nitrates game as a participatory information tool are positive. In the reflection 'debrief' and the short post-game questionnaire, respondents held a generally positive attitude towards the value of participating. This was confirmed by participants actively recommending to others that they participate in subsequent nitrates game sessions being offered for this study.

In the post-game questionnaire, when asked for general feedback about the game or for nitrate trading more generally, participants offered several positive comments:

*Enjoyed simulation game – useful tool to demonstrate how N trading can be beneficial to land owners within the catchment.*

*It's a good learning tool for farmers – convincing them to play may be hard though? ... I was a sceptic to some extent about the worth of a game approach but I am now a "believer".*

*The more who "play" the better.*

*Thank you for putting the game together. A useful contribution to the debate.*

There were also some comments indicating that the game was useful in a policy context:

*It did provide a useful insight into how trading may take place into the future. As a basic start it also gave an assessment as to policy changes and their reflection in N levels.*

*Trading is OK. Initial allocation will be a challenge. Better to use outputs eg N than actually limit farming/land use activities. Need very good measurement/modelling to make system work. System operation needs to be cost effective.*

*Need to be able to lease NDA.*

*Gives flexibility & opportunity to make market based decisions when given the opportunity to trade.*

*Trading provided a 'windfall' for those wanting to change land use to less intensive (lower N emitting) land uses.*

*The Trust cannot assume it will dominate the market [for NDAs].*

There is demand for repeated offerings of the nitrates game within the Taupo catchment and in a neighbouring region for which the proposed MBI may be useful. For instance, farming representatives have requested a further iteration of the game to include the provision of NDA leasing options, and have agreed to promote attendance at workshops amongst their members once these options are included in the design of the market aspect of the game.

Given the limitations of the research context of the RPG, it is too soon to evaluate whether more extensive use of the workshop game will generate any substantive change in attitudes towards the introduction of the tradable nitrates market instrument. From the 'entry and contracting' beginnings established by our RPG workshops, an information network could emerge that contributes towards better understanding of, and possibly a wider community consensus on, EW's nitrate trading proposal.

## **Collaboration strategies**

An objective in using role playing games as a means to engage stakeholders in participatory design is to support shared interaction and reflection, and create shared language and experience that supports ongoing dialogue (Iacucci, Kuutti & Ranta 2000). Such games that provide opportunities for the formation of alliances and for cooperative decision making between properties' teams act as a decision support tool where the players become aware of their interdependence as decision-makers (Ubbels and Verhallen 2000; Adamatti *et al.* 2004).

The Taupo nitrates game was designed and refined over the course of several months involving discussion with farm management experts, policy regulators, and stakeholders. During these discussions we observed relationship dynamics that should be considered in process design to achieve consensus policy. They include:

- the mobilisation of lobbying and 'collective perspective' by farming interests around concerns related to community sustainability;
- advocacy from farming interests within Ngati Tuwharetoa to forestry interests within Tuwharetoa in favour of taking a collective 'tribal approach' to assessing the costs and benefits of allocation options; and
- the role of consultant advisors and the reliance of local farmers and iwi governance bodies on farming development advisors.

For the most part, however, collaboration did not form a significant aspect of player behaviour during the nitrates game sessions. Efforts at forming partnerships between property players were observed, such as negotiating a collaborative trading strategy across a particular round, but in only limited form. In contrast, many players actively protected their confidentiality and sought to hide bidding strategies from other players.

## **Are observed RPG behaviours predictive of real life?**

Social learning has a normative aspect. Subjective norms play a role when an individual's social identity motivates them to feel they should act according to the values or views of their social group, rather than personal views. As group positions consolidate, through lobbying action for example, subjective norms become more influential as a driver of behaviour (White *et al.* 2005).

In our examination of existing attitudes towards reform of water management within the Taupo catchment, we identified a set of attitudes that relate to collective identities shared by stakeholders, as farming or forestry interests, for instance. These opinions were expressed in terms of the relative balance or fairness of the proposal with respect to the distribution of costs or benefits within and between these identity-based community sectors.

Participants' self-identities also appeared to have had a bearing on their bidding and land use decisions in the game. This was consistent with the researchers' instructions that participants should manage their hypothetical farms as they thought a real property manager might do but using their own discretion to create a lifestyle and 'character' for that farm manager as they saw fit.

For instance, in one game the dairy property was managed by a real-life dairy farming couple who were about to lose their dairy herd. They said that uncertainty generated by policy debate over nitrate management in the Taupo catchment was the cause of their financial hardship; they felt this was unfair because their farm was a considerable distance from the lake and they considered themselves environmentally responsible farmers. During the game, these players maintained their property in dairy farming and made corresponding bids (generally not successful) for NDAs, even though this was not the apparent profit-maximising strategy for that property. These players commented that they associated the game and the research team with EW's nitrate proposal and their own financial hardship.

Other players also reported that they developed a strategy based on a "life story" for the role they were playing, based either on their own situation (especially for farmers) or an imagined one. One government official said she was playing the role of a farmer ready to retire, and consequently was willing to sell NDAs and plant trees early in the game. While many players were observed to make frequent reference to their bank balances, and the effect of potential land use changes on their bank balance, they also appeared to be making decisions that were consistent with their life goals, real or imagined.

The lack of absolute profit-maximising behaviour is also consistent with real life behaviour. Existing land use in the Taupo catchment does not correspond with what a simple financial analysis would indicate is the profit-maximising land use distribution. This is likely due to a variety of reasons: relative returns to different land uses vary over time, while landowners' lifestyle goals, equity positions, risk profiles, understanding of new land management practices, and conversion costs limit the ability, willingness and speed of landowners to adjust to relative returns.

Even though the survey detected some changes in attitudes immediately after the game, caution is advised in extrapolating to behaviour changes or even to lasting attitudinal change. An RPG such as we used depends on human responses to provide complexity within an otherwise simplified simulation of the real context (Lankford 2003). The RPG as a 'metaphor for reality' seeks to mix controlled interactions with those introduced by human participants in order to simulate some complexity but provide a workable controlled context within which to study (Barreteau 2003).

However, there are limitations on the extent to which observed responses in any RPG can be understood as representative of real world responses. Similar to other types of qualitative research, issues of statistical sampling and bias cause difficulties for reproduction of results, predictability, and comparison of outcomes. Repeatability of an

RPG based research outcome is difficult, as participants cannot re-experience the game and its insights as if their previous experience is erased (Barreteau *et al.* 2001).

In our case, one respondent completed the post-game survey on paper approximately four weeks after the game – the survey software had captured her responses to only a portion of the questions and she delayed completing the paper version supplied to her afterwards. For those questions she had replied to immediately after the game, many of the responses were notably different (e.g. “agree” rather than “disagree” and vice versa) than those recorded on the paper version. The analysis reported in this paper uses only her responses captured immediately after the game, but this experience suggests, albeit only anecdotally, that attitudes can change over time as respondents reflect further upon the game experience and are subjected to other stimuli. It would be of interest to re-survey game participants after several weeks have elapsed, although the demands on participants and therefore their willingness to participate must be taken into account.

## **Conclusions**

An RPG is a way to place real world stakeholders in an exploratory mindset as they are enabled to examine potential options available to them without real world consequences from their choices. In their experiential context, RPGs have shown potential to encourage changes in thinking on policy instruments for water and land use management.

Behavioural change is vital to move from currently unsustainable patterns in consumption and pollution. MBIs offer a means to encourage behaviour change, complementary to existing regulatory policy instruments and potentially more efficient (Wurzel 2003). It is important to overcome perceptual resistances to the introduction of MBIs where these tools have potential to encourage sustainable development. Attitude change may be encouraged by recourse to more effective mechanisms for stakeholders to learn how an MBI might work in practice. An RPG establishing a framework for an operational market broadly representative of real proposals may be one such mechanism.

Our research examined the impact of one such RPG on attitudes held by stakeholders within a lake catchment showing the effects of increasing levels of nitrates pollution. Research on attitude changes arising from RPGs is in its early stages and many questions remain to be fully explored. However, this study has shown that an RPG has some potential as a tool to address stakeholders’ perceptions of risk and uncertainty about a proposed MBI introduction, encouraging indicative shifts in attitude towards the MBI. It offers a glimpse of new potentials for policy proponents to encourage stakeholder engagement by restructuring information exchange and participation as active learning processes using RPGs.

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