

## 2019 Submitted Abstracts

### Factors influencing the use of mobile phones and applications by small holder farmers: a potential to disrupt agricultural production in Myanmar

*T. Ramilan, S. P. Thar, R. J. Farquharson, A. Pang and D. Chen*

The dynamic growth of mobile communications technology is creating opportunities for economic growth by providing access to information, markets, and services to millions of smallholder farmers. It also facilitates effective decision making by compiling useful information into mobile applications. This study is the first in Myanmar to highlight the factors influencing effective utilization of agricultural mobile apps and access the potential of farm-based decision support. We have used probit regression to examine household survey data from central Myanmar. The results show that initiatives to introduce mobile apps should target younger, educated farmers with irrigated system and more specialised crops. Further, we found that although smallholder farmers in Myanmar were optimistic and positive towards agricultural apps, there were many barriers for effective utilisation. Possible policy interventions can be skills development, expansion of internet coverage with affordable prices.

### How much value the genes that carry a tree? The case of radiata Pine in New Zealand

*Bascunan, Arturo*

The economic value of the genes that carry a tree can be estimated by different deterministic methods. In this paper we develop a stochastic method to estimate the economic value of tree genes capable to deal with future economic price uncertainty.

### Catchment Collectives – An application of Ostrom's Principles in the Hawke's Bay

*Connolly, Justin*

Catchment collectives are becoming a hot topic in various places around the country. Yet what does this term actually mean? Is it consistently understood? Or should there be more consistency as to how it is applied?

In the Hawke's Bay Region, self-organising 'Catchment Collectives' have been proposed as an optional mechanism for dealing with water quality issues from diffuse discharges. These collectives have been finalised as an option draft 'TANK' NPSFM plan change.

This paper presents research to assess the potential barriers and risks to the success of these collectives. As they are 'self-organising' and dealing with a common pool resource (water quality), Ostrom's Principles have been applied as a guide to determine any barriers and risks. This research is useful for any Regional Councils considering such mechanisms for collective action within an NPSFM plan change process.

### Update on the review of the Agricultural Production Statistics programme

*Helen Grant, Mark Hampshire, Stephen Murray*

Stephen will provide an update on the Ministry for Primary Industry-led review of the Agricultural Production Statistics (APS) programme of work.

### A conceptual tool to understand the dynamics of Natural Capital and Ecosystem Services

*Connolly, Justin*

With the advent of the government's first 'Wellbeing budget' the scene is set for greater use of Treasury's 'Living Standards Framework' in the policy development process. While exciting for proponents of the concepts of natural capital and ecosystem services, these concepts still may not resonate with some decision-makers.

This paper proposes the use of System Dynamics (a.k.a. Systems Thinking) as a tool to support these concepts in policy development. The approach focuses on the conceptual mapping of the impacts on natural capital and ecosystem services. This develops an understanding of their dynamic behaviour (behaviour over time); the constraints and limitations that are likely to cause this; and how this may be affected by different policy interventions. This approach is compatible with many other tools already in use in policy development and, it is argued, may even strengthen their impact.

### Using Systems Thinking to connect (unintentionally) fragmented policy discussions

*Connolly, Justin; Ellis, Tim*

It is well known that the world, particularly the natural world, is highly interconnected and inter-dependent. Change in one policy area will likely have impacts in other policy areas. While these inter-connections may be implicitly known, they usually remain very difficult to make explicit across competing policy agendas, timeframes and organisational mandates.

This paper discusses the ongoing application of Systems Thinking at a Regional Council to map the complex inter-relationships within their policy agenda. This conceptual tool was used to help staff and elected representatives understand complexity and is a complimentary tool in the existing policy process.

Note: This paper still requires final approval from the client organisation. Final inclusion in the programme will be dependent on this. Author will progress and advise as soon as possible.

### The New Zealand dairy sector: Pathways to profit, reduced GHG emissions and improved water quality

*Neal, M*

For the New Zealand dairy sector, the question of how to simultaneously reward providers of management and capital while reducing greenhouse gas emissions and impact of water often receives one of two answers – It's impossible, or it is trivially easy. John Maynard Keynes would offer a third hand, and this hand suggests, perhaps not surprisingly, that the answer could be somewhere in the middle. The answer in economics is often "it depends", and this paper attempts to go the next step, and outline what it depends on.

### "You have just experienced ten years of coastal living affected by sea level rise and storm surge": The use of serious games for communicating adaptation to a changing climate.

*Blackett, Paula; Fear, Alex; Muller, Carla; Luttrell, Jordan; Bell, Rob; Jozaei, Javad.*

'Serious games' are considered practical gaming tools, beyond their entertainment value, which communicate serious notions with a target audience. In the climate change context, serious games aim to provide opportunities to communicate the challenges of adaptation in a changing climate and explore possible solutions. These tools provide unique contexts to learn about the impacts of climate change, explore decision-making around adaptation, and encourage experimentation in a safe and entertaining environment. Through this process, players can explore different perspectives and engage in conversations regarding wider adaptation challenges including insurance and finance, the ethics of selling properties in risky locations, and differences in values and actions. To this end, NIWA has developed three types of games: two portable 5-minute games, one online community decision-making game, and an in-depth, case-specific game, which enables communities to work through their particular situation. In this paper I will be focusing on the two portable 5-minute games (farm flood adaptation and the adaptation to sea level rise) to examine the utility of serious games in public engagement, social learning and pathways thinking.

### Future farm systems: an alternative dairy milking system

*Jonathon Kennett and Victoria Westbrooke*

Future farm systems: an alternative dairy milking system

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Full season, once a day (OAD) milking systems have increased in popularity. A high proportion of Northland farmers (24%) use the system; this study investigated reasons behind this level of adoption. Four OAD case study farmers were interviewed followed by thematic data analysis.

Farmers reported that a OAD system was more resilient to climatic and topographical challenges. This was reflected in higher reproductive rates overall, with a 6-week in-calf rate of 84% compared to the Northland average of 63%. Milk production, overall was lower, (7%) than the Northland average. However, time milking decreased, and flexibility in time management increased. OAD could be used to adapt dairy farming to challenging climatic conditions.

Keywords: dairy system, once a day milking, Northland, climate

### Policy making and planning with deep uncertainty

*Femi Olubode-Awosola; Baylee Kelepamu*

Resource management decision making often requires planning for future when rare events may emerge and changes are usually required. Both the events and changes are so uncertainty that the stakeholders do not often know and therefore cannot agree on i. the appropriate model to describe the problem; ii. the probability distributions of the model's variables; and iii. how to value the desirability of alternative outcomes. This is a situation Lempert et al (2003) describe as policy making and planning under deep uncertainty.

When stakeholders cannot agree on any of those, the decision makers tend to argue against 'do nothing'. Depending on the costs of 'do nothing', more robustness can be built into the decision making process. However, the costs of 'do nothing' is sometimes difficult to weigh against the cost of redundancy from over-engineered robustness.

This study examines 2 recent policy and plan reviews in the Waikato Region to confirm deep uncertainty in plan changes. The policy options and alternative outcomes were not unanimously agreed on by the stakeholders. This study conceptualises adaptive decision making method that is robust rather than optimal and recommends near-term actions but adjust in response to new information. This will minimise the cost of 'do nothing' as well as the cost of redundancy from over-engineered robustness. This will hopefully remove the deep uncertainty as concerned parties acknowledge usefulness and validity of near-term policy actions that hold true for a wide range of plausible futures.

### Effects of Sea Surface Temperature on Tuna Catch of Purse Seine in Eastern Pacific Ocean under Climate Change

*Mediadia, Hanny John; Noy, Ilan; Kahui, Viktoria*

Increase in ocean temperature is one of the primary direct consequences of climate change. Tuna, a commercially important pelagic fish species, demonstrates sensitivity to changes in sea surface temperature (SST). Increased SST has potential impact on the reproductive success and survival of tuna, on the ability to catch it, and may pose a problem to the management of tuna species. This paper applies the production function approach to estimate the link between catch of yellowfin and skipjack tuna by purse seine and SST in the Eastern Pacific Ocean. Monthly total tuna catch and effort data in 1°x1° grid cells from the Inter-American Tropic Tuna Commission are paired with monthly mean SST dataset from Japan Meteorological Agency. Controlling for month and grid fixed effects, results show that the volume of catch increases with SST. The magnitude of relationship changes if we take into account the different types of sets and distance from the equator.

### A bio-economic analysis of harvest and post-harvest innovation in New Zealand apple value chain

*Gahremani M., Tozer P., Ramilan T., Sofkova-Bobcheva S.*

Ranked as the most productive apple producer worldwide, the New Zealand apple industry has had a remarkably robust growth in the past decade. The apple industry is labour intensive. Labour shortages for harvesting in New Zealand apple industry are jeopardizing the competitiveness and sustainable production of apples. This study examines the feasibility of adoption of a robotic harvester for apples, using bio-economic analysis under different orchard sizes across three apple varieties. The model uses net present value (NPV) analysis to compare the investment decision of either to purchase a robotic harvester to deal with the labour shortage or to completely use manual labour. The results of the analysis can aid growers to make effective decisions on the appropriate orchard size and variety selections, which enables adoption of a robotic harvester.

**Keywords:** Innovation adoption, Apples robotic harvester, New Zealand apple industry, bio-economic analysis, Net present value (NPV) analysis.

#### **Eradication economics for invasive freshwater plants**

*Muller, Carla; Hofstra, Deborah; Champion, Paul.*

There is a belief across science experts in freshwater biosecurity that if an eradication programme is implemented at the earliest possible intervention point, the cheaper the cost of intervention, the lower the impact (social, cultural, environmental and economic) of the organism and the higher the chance of success.

Given the inherent complexity in making intervention decisions, responses are often decided in relation to specific incursions as they happen in their particular context. However, there are common themes that contribute to eradication success across invasive macrophyte incursions. Analysing New Zealand examples of control programmes for key invasive aquatic weeds at differing stages of abundance and impact, allow common themes to emerge that support the hypothesis that the sooner eradication is selected the lower the total cost (including impacts on values) is likely to be, and the higher the chance of a successful eradication. The analysis also improves the understanding of what economic elements contribute to success at a macro-level, and improves our ability to forecast costs, benefits and the predictability of intervention outcomes at different intervention points.

#### **The Bilateral Trade Relations between the Pacific Island Countries and**

*Patricia Samani and Sayeeda Bano*

This study explores the trade relationship between the Pacific Islands Countries (PICs), with Australia and New Zealand during the period 1980 -2018. The study uses a combination of approaches for the analysis. It presents an analysis of the PICs historical trade patterns as well as trade development with Australia-New Zealand. The study uses index of trade intensity to identify the strength of trading relationship between PICs and Australia-New Zealand. In addition, the study investigates and presents an analysis of PICs comparative advantage in selected products at two-digit Harmonised System (HS) product classification. Balassa revealed comparative advantage indices are applied to calculate the comparative advantage in selected products. The results of the trade intensity index demonstrate that the bilateral trade flows have been strong between the Pacific Island countries and with Australia and New Zealand. The results also demonstrate that bilateral trade flows have intensified indicating the trading relationship are strengthening over time between these countries. However, some fluctuations in the degree of trade intensity observed. The revealed comparative advantage results show that most of the PICs have comparative advantage in the selected products, which includes sugar, Wood, wood charcoal, cultural pears, cocoa, and ship structures. Few PICs have comparative advantage in a specific other products. The findings also show that the PICs comparative advantages of some product are changing over time indicating diversification and shift in comparative advantage. These results are expected to help in policy formation and implementation for strengthening further trade relationship and for reciprocal free trade agreements between PICs and with Australia and New Zealand.

#### **Optimising Biosecurity Investment and Effort**

*Welsh, Melissa; Brockerhoff, Eckehard; Monge, Juan; Epanchin Niell, Rebecca; Turner, James; Robinson, Andrew; Soliman, Tarek*

Invasive species can be highly damaging to primary production but also by altering the ecosystem they invade. Keeping invaders out through effective pathway risk management is a noble goal, but this is just one part of a successful biosecurity system. It is important to also consider investment in surveillance, to detect any invaders that may slip through preventative measures, and through readiness for incursion response, such as an eradication or containment plan. Investment in each of these activities must also be weighed against the costs of managing a pest, should it become established, as well as the direct and indirect damages attributable to an invader with various levels of control. Previous research has used various approaches to assess only one or two aspects of biosecurity at a time. Our aim is to optimise investment in each stage of the biosecurity system, from pathway risk management through surveillance and eradication expenditure to costs of long-term management and control. We initially parameterise our model for several case study insects, with the overall goal of extending this to optimise for all insect pests that affect plants in New Zealand.

#### **Fast and frugal heuristics: a better way to model policy choice?**

*Yvonne Matthews*

Traditional economic theory would have us believe that rational decision-making requires full information and complete evaluation of all options. We have long known this is not how people usually make decisions. There is a mountain of literature about heuristics (simple rules) and biases which have condescendingly explained heuristics as shortcuts people use when they lack time or mental capacity.

However, the real world often has too much uncertainty and ambiguity to make optimal decisions even with advanced computer models supporting our limited brains. Predictive accuracy involves a trade-off between bias and variance, with more complex models having higher variance. Recent studies have found - counter-intuitively - that simple decision rules using key pieces of information can out-perform optimization models using full information. Heuristic models not only explain choices better, but also lead to better and more robust outcomes in many situations. Evidence of this has been reported in areas such as financial investment, medicine, management, and marketing. What's more, expert decision-makers tend to use less information than novices. This new understanding of rationality is known as "ecological rationality" and requires learning and adapting decision strategies to the decision environment.

What are the implications of this paradigm shift for environmental and resource economics? Environmental issues are synonymous with uncertainty and ambiguity, so traditional risk analysis and optimization models may not be "ecologically rational". In this presentation I demonstrate the use of an R package to fit Fast and Frugal Trees - a heuristic classification tool - to a choice experiment data set. I show how to identify the rules individuals used, and compare predictive accuracy with the MNL family of choice models. Finally, I describe the policy situations under which heuristic models might provide useful insights, and their limitations.

#### **Marginal irrigation decision making in the face of risk and uncertainty**

*Muller, Carla; Neal, Mark; Carey-Smith, Trevor; Srinivasan, MS; Luttrell, Jordan*

Irrigation decision making is complex, it requires farmers to balance multiple risks which vary throughout the year. This research tests the hypothesis that incorporating weather forecasts into marginal irrigation decision making can improve environmental and economic outcomes on dairy farms in New Zealand. It then provides a simple way for farmers to incorporate weather forecasts into irrigation decision making. This research builds off previous work which shows that weather should be a factor in irrigation decision making, however, often the availability and uncertainty in weather forecasts is not considered. When weather forecasts were integrated into irrigation decision making there was environmental and economic benefits relative to a simple deficit-based decision rule. Developing some conditional strategies will enable farmers to capture these benefits. One conditional strategy that appears promising is utilising differing probability percentiles when looking at the forecasts. For example, utilising the 25th or 75th percentile probabilities at different times of the year to balance different risks (drainage, feed supply etc.). This research has shown that a net gain of \$200 could be possible through the use of forecasts relative to a simple deficit-based decision rule.

#### **Water Quality Benefit Transfer in New Zealand – Common Approaches and Applied Problems**

*Patrick Walsh*

The New Zealand government has several ambitious plans for improving water quality across the country. Regional councils also have several ongoing and planned efforts to improve water quality. These policies represent significant benefit to the country and economists have several tools to monetise these benefits. However, the local literature of published NZ-based studies is somewhat thin. Furthermore, the water quality parameters used in many papers do not translate well to policy levers. For example, stated preference surveys ask about changes in water quality from "poor" to "good," which are difficult to translate into changes in nutrients. The scope of water quality changes in the literature is often much larger than actual policy changes. Many benefit transfer functions also violate the adding up condition, so that the estimated benefits vary significantly across the size of the modelled water quality change. Along with several other issues, these challenges can make it difficult to conduct a benefit transfer for water quality. This paper illustrates several important challenges and presents potential ways to tackle them. We use data from recent New Zealand water quality policy applications to demonstrate the implications of these benefit transfer challenges to a benefit cost analysis. Our results show how minor transfer assumptions can have substantial impacts on estimated benefits.

#### **Estimating the costs of erosion across New Zealand**

*Ben Wiercinski and Patrick Walsh*

Erosion remains a costly issue in New Zealand, affecting not just farmers and rural communities, but the entirety of the country. Erosion creates a variety of problems, including losses in productive land, increased water filtration costs, water quality problems, more road and rail repair work, habitat impacts, and a loss of biodiversity. Despite the recognition of the damage caused by erosion, the current total cost of all these problems is currently only roughly estimated. Few projects have tried to quantify all the erosion related costs that the country faces. Those that have tried have suffered from a range of problems such as a lack of data or double counting of costs. Additionally, the costs that are derived are presented as the total cost for the entire country and are not spatially explicit. This project aims to improve cost estimates of erosion through several new advances. First, erosion input data are improved from past estimates through new data on erosion location and severity. Second, avoided erosion costs are updated with new data and databases. Third, we calculate spatially explicit costs of erosion for New Zealand. Finally, new sources of erosion costs are included. This project is part of a multi-year MBIE bid focused on erosion. We present initial results and plans for future advances.

#### **Assessing the Impact of Phasing Out Battery Cages and Switching to Colony Cages in the Poultry Industry of NZ.**

*Harold Mayaba Dr. Shamim Shakur (second author)*

This research aims to assess the impact of phasing out battery cages on New Zealand's poultry farming. In 2012, the New Code of Welfare for layer hens came with a recommendation to phase out battery cages in favour of colony cages as an alternative production system. A 10-year phasing out period is offered for a smooth transition to the new system such that it will be illegal to raise hens in battery cages after 2022. However, even years into this transition period, 44.7 percent of eggs are still produced under the battery cage system in New Zealand, suggesting high compliance cost on farmers. Other production systems used by egg producers include; barn, colony and free - range system.

A review of the literature offered some general leads into the demerits and merits of alternative production systems, their impacts on the welfare of hens, and the cost of production. In order to assess the impact of phasing out battery cages in the New Zealand context, we conducted a survey on the poultry farmers to establish how they have been affected by the New Code of welfare. The survey was complemented by follow-up face-to-face interviews or telephone calls to these participants. Besides descriptive data analysis, preliminary regressions were conducted on selected variables. Secondary data were combined with survey data to obtain these results. A better understanding of the impact of phasing out battery cages that this research offers is important as farmers are making decisions on the best production methods to use.

#### **Assessing the impacts of multiple agri-environmental policies on farms in New Zealand**

*Utkur Djanibekov*

In this study, we analyse the impacts of various agri-environmental policies such as pricing biological greenhouse gas (GHG) emissions from agriculture (GHG levies), payments for carbon sequestration under Emission Trading Scheme (ETS), National Environmental Standards for Plantation Forestry (NESPF), National Policy Statement for Freshwater Management (NPSFM), One Billion Trees Programme (1BT) and combination of these policies. We use the New Zealand Forest and Agriculture Reginal Model (NZFARM), which is a non-linear mathematical programming model to analyse the land use allocation, profits, change in management practices, and agricultural, forestry and environmental outputs. Findings show that NESPF reduces forestry profits, production, and carbon sequestration levels but these reductions are small and do not affect much forestry sector. NPSFM includes establishment of riparian buffers for livestock farmers, which leads to large profit, production and GHG emission decrease for these farmers and reduce overall agricultural profits. The modelled NESPF and NPSFM scenarios do not result in land-use change due to our assumption that these policies influence only riparian buffers and considered costs might be low to change the land use. 1BT scenario includes increase in exotic and native forestry area. This policy increases forestry area and C sequestration, but at the expense of reduction in pastoral area and total profits from agriculture. Also, planting native trees under 1BT scenario substantially reduces agricultural and forestry profits, because of its high establishment costs. GHG levy scenario reduces GHG emissions and total profits from land uses, whereas ETS scenario increases total profits from land uses by generating carbon sequestration revenues and replacing low profit earning sheep and beef farms. Combination of policies result in the highest reduction of GHG emissions and increase in C sequestration, but lead to the highest costs among scenarios.

#### **Quantifying sheep enterprise profitability with varying flock replacement rates, lambing rates, and mating strategies.**

*Farrell, LJ; Tozer, P; Kenyon, PR; Ramlan, T; Cranston, L;*

<p>Lamb sales are the major source of income for most New Zealand sheep enterprises. Lambing rate, lamb survival, and lamb growth rates are factors limiting sheep income. Terminal sires (meat breeds) are used to increase lamb growth rates to finish lambs earlier at higher prices per kg. Their use is limited by requirements for purebred ewe lambs from which to choose replacements. This study investigated the use of terminal sires for a flock with a range of replacement and lambing rates. Values from survey data were used to simulate a representative New Zealand East Coast sheep and beef farm (self-replacing flock of 2,182 adult ewes at a stable size on 549 ha of pasture with 60.8% of total feed consumed by sheep). Three levels each of replacement rates (25%, 30%, and 35%), lambing rates (110, 130, and 150%), lambs weaned per ewe presented for mating, and breeding strategies (no terminal sires, mating the maximum proportion of the ewe flock to terminal sires, and mating half of the maximum proportion of ewes to terminal sires) were modelled. Income from sheep sales increased with use of terminal sires, due to an increase in production of sheep liveweight for sale and prices for slaughtered lambs, resulting in increased sheep enterprise cash operating surplus (COS). When 65% of the flock could be mated to terminal sires, due to a high lambing rate and low replacement rate, sheep COS increased by 18% compared with when only maternal sires were used. Use of terminal sires increased annual sheep energy demand by up to 6%, with an increase of up to 33% in December to meet the demand of growing crossbred lambs and a reduction in demand in January following crossbred lamb sales. Increases in COS are greatest for flocks with low replacement rates and high lambing rate, where their use is over a greater proportion of the flock. In order to realise the benefits in production and profit, there is a requirement for quality feed for lamb growth during late spring and summer.</p>
<p><b>Rural Regions and Global Agri-food Value Chains</b>  <i>Dalziel, Paul; Saunders, Caroline; McIntyre, Tiffany</i>  This research was funded by the Our Land and Water (OLW) National Science Challenge in New Zealand. The OLW Vision is that "New Zealand is world-renowned for integrated and successful land-based primary production systems, supported by healthy land and water and capable people" (<a href="http://www.ourlandandwater.nz/the-challenge/">www.ourlandandwater.nz/the-challenge/</a>). The paper's research tested the hypothesis that the "world-renowned" reputation will allow New Zealand producers and processors (who tend to be based in rural regions) to capture higher returns for their agri-food exports. The research involved five case studies of successful global agri-food value chains sourced from New Zealand. The paper synthesises key results from the case studies, paying particular attention to the governance of value chains.</p>
<p><b>Does individual action crowd out support for national action on environmental issues amongst lifestyle farmers</b>  <i>Knaok, Jorie; Dorner, Zack; Stahlmann-Brown, Pike</i>  Encouraging the voluntary adoption of environmental practices at an individual level is often taken as a first step for environmental action. However, previous research has shown that encouraging individual action might crowd out support for national environmental action. In the rural sector, the focus of environmental action has been on commercial farms. A somewhat overlooked group is the roughly 175,000 lifestyle farms in New Zealand, covering 873,000 ha (about 40% the size of land in dairy). To successfully include lifestyle farmers in future environmental policy it is important to better understand how this group might approach environmental action. As part of the Survey for Rural Decision Makers 2019 we test for crowding out effects. In the experimental set-up fifty percent of the respondents received information on an environmental action: the importance of individual action to save energy and reduce waste. All respondents are then asked to express their support for an environmental action on a national level, either: i) a mitigation action that would affect all users of petrol and diesel; or ii) a conservation measure requiring pest control on private properties. We use a difference in differences approach to test whether any observed crowding out is the same between different types of environmental goods. Finally, we aim to identify the mechanisms responsible for the potential crowding out effects by asking about the decision mode of the farmers.</p> <p><b>Heterogeneous Impacts of Climate Change – The Ricardian Approach Using Vietnam Micro-Level Panel Data</b>  <i>Trinh, Nguyen Chau; Frank, Scrimgeour</i>  This analysis investigates the economic impacts of changes in climatic condition on Vietnam agriculture. The Ricardian approach is applied to ten-year panel data using the two-step Hsiao method. The study overcomes likely biases resulted from the endogeneity of irrigation by applying the control function method. Estimates of the Ricardian model from the panel suggest heterogeneous climate impacts across seasons and across regions. Rising temperature is especially harmful to the Northern Central and the Southern region. Shortage of rainfall in spring only causes losses to the Central Highlands and Northern region. Rising precipitation in the summer is extremely harmful to the Northern Central and the Southern region. Increases in precipitation help to reduce the negative impacts of rising temperature in spring and summer and to harness the benefit of rising autumn temperature. The simulation indicates net agricultural surpluses in the long-run, with the Central Highlands being an exception.</p> <p><b>The Impact of the Comprehensive and Progressive Trans-Pacific Partnership On New Zealand Trade Potential and Trade Growth. An Empirical Analysis.</b>  <i>Bano Sayeeda; Scrimgeour Frank</i>  The Trans-Pacific Partnership Agreement (TPPA) is an ambitious trade and investment agreement. Japan and New Zealand have taken a leadership role in renewing negotiations with other Asia-Pacific countries. On 23 January 2018, negotiations were concluded on the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). Trade Ministers signed the CPTPP on 8 March 2018, in Chile. This revised CPTPP agreements includes tariffs costs reduction for businesses, commitments to safeguard high labour and environmental standards across the Asia-Pacific region and upholds the Treaty of Waitangi  This study examines trade creation (welfare increasing) and trade diversion (welfare decreasing) effects associated with New Zealand's trade with CPTPP countries. Specifically, this study analyses bilateral trade intensity and identify future trade patterns between New Zealand and CPTPP members, using trade intensity index. It investigates comparative advantage of CPTPP countries, using static and dynamic comparative advantage methods. In addition, trade reciprocity index applied to investigate whether trade is reciprocal between member countries. Data will be obtained from UN-COMTRADE; World Integrated Trade Solution (WITS); IMF; International Financial Statistics (IFS); Direction of Trade Statistics (DOTS); the World Bank base; World Development Indicators (WDI); WTO, World Development Reports; NZ Statistics and other country –specific data from CPTPP member countries database.  The findings from this research could lead to the identification of comparative advantage, trade potential of priority areas for promoting New Zealand's trade, investment, bilateral trade balances issues and economic cooperation. Our findings should be helpful for citizens, business interests, policymakers and as a contribution to an informed public debate on the recently signed CPTPP. This study adds to the existing literature and has policy implication.</p>
<p><b>Defining and measuring factors contributing to the resilience of New Zealand dairy farms</b>  <i>Shokri, Elham; Tozer, Peter; Gray, David; Cassells, Sue; Shadbolt, Nicola</i>  Dairy farmers have entered an era of rapid and complex change through which they have to manage short term shocks and long term stresses, from price fluctuations to environmental constraints. The challenge is to balance economic efficiency and environmental sustainability in the face of increasing concern over environmental issues. A resilient farming system is one which can withstand these shocks and long term stresses. Therefore, the concept of resilience needs to be explored in this context.  This study aims to define resilience in the context of New Zealand dairy farming in order to gain an understanding of how resilience can be measured as an emergent property. To achieve this, a capital-based approach was taken and the relative importance of the farms' various capitals were considered. The capitals are natural, physical, financial, human, and social capital.  An exploratory sequential mixed method was used in this research. A set of in-depth case studies were conducted, focusing on resilience characteristics of dairy farmers and their farm business. The findings from these interviews informed the design of a survey instrument disseminated to a larger sample of dairy farmers throughout New Zealand. The survey questionnaire was designed to include multiple questions in order to reveal the essential capitals identified as being pivotal to the overall resilience of a farmer's business. In addition, sublevels of these capitals were identified. The Analytical Hierarchy Process (AHP) was utilized to calculate the weightings of both the capitals and their sublevels. Thus, facing changes, the relative importance of various capitals in dairy farm businesses can be understood. Some early results suggest that human, financial, and social capitals play a relatively important role in farm business resilience. More work will be done to develop a composite index to measure the resilience of a New Zealand dairy farm.</p> <p><b>Helicropping: A case study approach to improve efficiency and economic viability</b>  <i>Young, Suzanne; Tarbotton, Ian, Lane, Murray, Newman, Matthew</i>  Helicropping is a process-driven application of a suite of technologies that enable helicopters to be used for the precision application of herbicides, fertiliser and seed to establish crops and renew pastures. Helicropping enables areas of difficult access to wheeled machinery and poor fertility pasture to be improved with minimal soil disturbance.  Helicropping can be both an economic and environmentally sustainable practice enabling increased profitability to farmers. The success of Helicropping will depend on the, landscape, infrastructure (e.g. water, fencing) and the costs relative to the benefits it can provide.  In this paper, we describe the economics of Helicropping using farmer case study examples to identify the key factors to achieve economic viability. Good practices are identified that significantly reduce the risk of crop failure. One of the case studies will include the opportunity for a (nutrient) catch crop/cover crop for soil protection, post-winter grazing. Environmental sustainability and externalities are addressed in the context of the potential that Helicropping brings to New Zealand pastoral farming.</p>
<p><b>Exploring New and Potential Relationships in Global Dairy Trade Networks: An Application of Link Prediction</b>  <i>Luo, Yangyuyu; Scrimgeour, Frank; Bano, Sayeeda</i>  Exploring new and potential trade relations is valuable for governments and firms seeking to assess the evolution of global dairy trade networks. A better understanding of a trade network can inform policy and business initiatives to reduce trade risks and improve trade policies. This study employs the link prediction approach to explore potential dairy trade links based on the topological attributes of countries (e.g. their number of common trading partners). We observe that link prediction, especially the Weighted Resource Allocation (WRA) algorithm, is best able to predict most existing trade relations. Using this optimal algorithm, we then estimate potential trade patterns and participation in importing and exporting. The main findings are as follows: First, new trade relations that are most likely to emerge involve Argentina, the Czech Republic, and Finland importing milk and cream from New Zealand. Second, relations such as between Brazil and Peru, Malaysia and Portugal, New Zealand and Portugal, and Australia and Canada are expected to be stable over the next decade. However, relations such as between New Zealand and Turkey, Malaysia and Switzerland, and the Czech Republic and the USA are predicted to be extremely active with multiple sequences of trade. Given these findings, we also provide suggestions about future trading strategies.</p>
<p><b>Total Factor Productivity Growth in China's Fisheries</b>  <i>Jiarong Qian, Zhijun Zhao</i>  This study aims to examine the changes in total factor productivity in China's fisheries using the Stochastic Frontier Analysis, and the provincial panel data from 1986 to 2013 are used for estimation. Fishery gross output value is selected as output variable; total intermediate input (measured in gross values), fishery area and labour are selected as main input variables. To improve the estimates, variables of per capital input on unit area are incorporated into the production function to reduce the number of explanatory variables. Estimated results suggest that the elasticity of intermediate input with respect to fishery output is estimated in an increasing trend, while the elasticities for labour and area are in a decreasing trend; the average growth of fishery total factor productivity was estimated at approximately 3.8%, accounting for 58.2% of the total output increases in fishery. Total factor productivity has become the most important driver for the fishery development in China.</p>
<p><b>Transforming land use in New Zealand: Insights from current land-use decision making in New Zealand</b>  <i>Renwick, Alan; Dynes, Robyn; Johnstone, Paul; Holt, Lania; King, Warren; Penelope, Jemma</i>  In response to increased concerns surrounding the environmental impact of current land-use there is a world-wide desire for dramatic (transformational) shifts and changes in agricultural and wider land-use systems. Such shifts may involve technological developments, new crops or production methods, or other production changes; collectively identified as Next Generation Systems. However, it is recognized that the ability of new systems to meet the social, environmental and economic requirements of land managers (and wider society) is highly context specific and will depend on such factors as local drivers of change as well as the needs of individual land managers. Using New Zealand as a case study, this paper therefore focuses on understanding the decision making process of land managers in the context of changing their land-use system to develop a deeper understanding of sustainability and land use change using a Multicriteria Decision Making (MCDM) Framework. The Framework is applied to a number of land-managers in NZ with very different characteristics and requirements from system change. The results confirm the context specific nature of decision making, but also provide useful general insights into the challenges faced in scaling up and scaling out Next Generation Systems in the New Zealand context.</p>
<p><b>Food safety risk perception and its impact on vegetable consumption in Vietnam</b>  <i>Thanh Mai Ha</i>  Food safety from vegetable consumption remains a concern in Vietnam. The objectives of this paper are twofold. First, we investigate the determinants of risk perception of vegetables in the rural and urban region. Second, we analyse the impact of risk perception on self-reported vegetable consumption. Using the data from a face-to-face survey on 498 food shoppers in Hanoi, Vietnam, we found the differences, as well as the similarities in the underlying drivers of risk perception across regions. In both regions, food risk information and perceived consequence of hazards shaped risk perception of vegetables. Respondents' age, education, and trust in food retailers determined risk perception in the rural region only. Personal experience with vegetable poisoning, having home-grown vegetables, perceived control over hazards, and institutional trust only influenced risk perception in the urban region. A high level of risk perceived has resulted in the self-reported decline in vegetable consumption. To cope with the perceived risk, consumers developed risk relievers including avoiding and substituting. A reduction in total vegetable consumption means that consumers limited their freedom in eating and diet diversity. Attenuating risk perception of vegetables is thus important to enhance the sustainability of vegetable production and eliminate economic losses. Rural-urban differences and similarities should be taken into account in designing risk communication policy toward reducing food safety concerns.</p>
<p><b>A cost-benefit analysis of transitions from exotic to native forestry in Gisborne</b></p>

Patrick Walsh, Tarek Saliman, and Thomas Robertson

Gisborne is known for its highly erosion-prone landscape, which is expected to intensify with the increasing frequency of climate change and severe weather conditions. Although most of the erosion-prone land is currently under exotic *Pinus radiata* forest management, there are several other land uses that could retain forest cover while maintaining erosion control. Native afforestation options are particularly attractive for their environmental and cultural benefits. We focus on two native alternatives to exotic forestry. The first uses mānuka plantations for honey production, while the second involves native regeneration with no productive use. To analyse trade-offs associated with these native afforestation scenarios, we employed a cost-benefit framework that combined an agri-environmental economic optimisation model (NZFARM) with a non-market valuation analysis. This combined framework allowed us to assess the impacts associated with land-use change from the exotic production forestry (*Pinus radiata*) to productive (i.e. mānuka plantations) or non-productive native forest. In this analysis, we monetized the opportunity cost of lost production and land value, the cost of native restoration, and the value of erosion, carbon and nitrate leaching. Although we were not able to value other environmental changes, we quantified potential biodiversity gains as well as phosphorous loss. We analysed six different scenarios, which varied by the amount of land converted and the productive use allowed. Across all six scenarios, the monetised benefits were less than the costs. Overall, the analysis illuminates several important trade-offs, and highlights the opportunity costs of changing from profitable exotic forests to other alternatives that might achieve different long-term goals. Monetizing, quantifying, and describing the potential impacts of land use change is a pivotal element in identifying the sustainable future path of the region.

**Soil Acidity, Lime Application, Nitrogen Fertility, and Greenhouse Gas Emissions: Optimizing Their Joint Economic Management**  
*Shoghi Kalkhoran, Sanaz; Pannell, David J.; Thamo, Tas; White, Benedict; Polyakov, Maksym*

Soil acidity is a major limiting factor for crop production in many farming systems worldwide. Lime application is the most common practice to mitigate soil acidity. There are complex economic interactions between application of lime and nitrogen fertilizer, with the greenhouse gas emissions associated with the use of these inputs adding further complexity. We employ a non-linear dynamic optimization model to determine economically optimal application strategies for lime and nitrogen fertilizer accounting for the social cost of the resulting emissions of greenhouse gases. The model is applied in three zones with different rainfall levels, in the northern wheatbelt of Western Australia. Rainfall has important influences on results through its effect on the dissolution and leaching of lime, leaching of nitrogen, and the yield potential of crops. Results show that nitrogen-related decisions, such as the type of nitrogen fertilizer and crop rotation, have a substantial impact on optimal lime application rates and resulting emissions. For example, the use of ammonium sulfate rather than urea, reduces emissions. Similarly, by allowing a reduction in nitrogen fertilizer use the incorporation of legume crops like lupin can reduce emissions by 50 percent, relative to a wholly non-legume crop rotation. Although a carbon tax reduces emissions, the magnitude of the reductions is modest in all modeled scenarios. The private cost to farmers of such a carbon price in this case study region is also small.

**Optimal Land Use Switching Policy**  
*yadipur, mahdi; daglish, toby; saglam, yigit*

In this paper, we examine the real option to switching problems. We evaluate a situation where farmers can switch between different crops in response to crop price changes. We contribute to the literature in a variety of respects. First, in conventional models farmers can always choose to convert between different land uses at a cost. We extend the existing literature by adding a time cost as well as a cash cost. While pure cost models may be appropriate when farmers switch from farming sheep to cows and vice versa, in some activities, such as planting, this is not necessarily true, as there is a waiting time period as there is a delay in yields. Farmers in our example do not only face a cash cost but also face a prolonged period of no production until new crops reach maturity. Second, given the long conversion periods, our model allows farmers to reverse their switches. Given the complexity of the decision and thus the model, we employ computational methods to investigate how various factors enter into the decision making process.

Key Words: Real Options, Optimal Switch, ADI Method, Investment, Stochastic Prices, Dynamic Modelling.

**The impact of climate change and drought persistence on farmland values in New Zealand: An application of a hedonic method of climate-land pricing**  
*Farnaz Pourzand, Ilan Noy, Kendon Bell*

Changing climate and extreme weather conditions will affect agricultural production, consequently, will increase the risk of food insecurity in New Zealand. This project aims to obtain a quantitative understanding of the potential impacts and implications of climate change on New Zealand's agriculture, especially through the impacts of drought events on farmland values. We do so by implementing the Ricardian approach of land climate-pricing using QV data (Quotable Value New Zealand) and historical and projected climate scenarios (CCII/NZESM). The baseline model measures the average effect of linear and nonlinear climate variables on farmland values while controlling for socio-economic and topographical-geographical features. Furthermore, we explore the importance of lagged impacts of climate in our models. Autoregressive (AR) coefficients of daily weather variables are applied to measure the degree of persistence of drought events. Finally, we take the estimated relationships using historical data to simulate agricultural land values forward under climate change. Preliminary results using historical data show the heterogeneity in which rural land values are affected by climate depending on the land use category. In general, we see that the value of rural land decreases with summer temperature among all land uses, while it increases with spring temperature. The cumulative impacts of soil moisture deficit in summer reduce farmland values. This knowledge allows New Zealand to make better target drought adaption efforts and understand which agricultural sub-sectors and areas are the most at risk from future climate change.

**Discounting the environment using the social opportunity cost method**  
*Kendon Bell*

Discounting in New Zealand generally follows the "Social Opportunity Cost" (SOC) paradigm based on contemporary corporate financial practice. When evaluating the merits of a project that provides ecological benefits, the key empirical parameter to estimate within this paradigm is "beta", which measures the extent to which changes in the value of the project correlates with the value of a diversified portfolio of financial assets. Extending modern theoretical research on discounting ecological outcomes based on time-preference approaches, I show that within the SOC paradigm, for most ecological projects, 1) beta is low, and 2) when calculating net present value (NPV), the negative effect of increasing beta (via an increasing discount rate) is mostly offset by the positive effect of an increasing value of benefits over time (via an increasing growth rate). For most ecological projects, the difference between the discount rate and the growth rate of benefits, or the "ecological discount rate", is around 0-1%.

**Financial Impact of the Nitrogen Cap on Lake Taupo Catchment Farmers**  
*Journeaux, Phil, McNae, Darren, Allen, James*

This study analysed the impact of the nitrogen cap imposed on farmers within the Lake Taupo catchment as a result of Variation 5 of the Waikato Regional Plan.

The analysis involved investigation as to the impact on farm working expenses, compliance costs, land values, and various opportunity costs, including the loss of flexibility and restriction on intensification of the farming system.

In addition, the study considered the value of nitrogen trading, whether some farms are more impacted than others, and the potential impact across the wider Waikato as a result of Plan Change 1.