Sustainable Farming Fund
Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere

Objectives of the 'lamb alive' project

The original objectives of the project were to understand the risks associated with a changing climate to sheep farming in the lower South Island and in particular focussing on lambing and lamb survival. The project was stimulated after some severe weather events that occurred in the midst of lambing and severely impacted on farm productivity. The effect of lower lambing percentage in any year flows through to the industries that support farmers (meat processors', agribusiness etc) therefore the potential existed to try and better understand future likely impacts.

Sheep Industry overview

Over the last 15 years sheep flock performance has markedly increased as farmers have adopted cross breeding, improved nutritional management and feeding, scanning and other technologies. Flock scanning levels have increased markedly, from 120-125% to the extent that many flocks now consistently achieve 170-180%.

Over the same period there has been little change in the commencement date for lambing, although typically the lambing pattern is more condensed, and often 3rd cycle mated ewes are culled before lambing.

The consequence is that in any 3-day period of lambing in 2005, 20% more of the ewes in the flock will be lambing compared to the same period in 1990. In the same period, it is estimated that the number of lambs born has increased by over 50%.

So at any period over lambing, the consequence of a severe climatic event on lamb and ewe survival is now potentially more catastrophic, than was the case in 1990. Snowstorms and lamb losses across the lower South Island in spring 2004 highlighted the risks facing pastoral farming and sheep production in particular.

Climatic change is forecast to induce a greater risk of extreme events. Catchments appear to differ in their susceptibility to such adverse events, and an understanding of what climate change will mean at regional, catchment and farm level is desirable.

Current expansion of the dairy industry is leading to a reduction in the area available for finishing lambs and so more hill country farmers need to keep and finish the lambs born on the property. This leads to different requirements for the system and may alter the drive for high lambing percentage.

On farm

We need to know just what the extra risk due to climate change is likely to be, in particular late winter-early spring storms and snow events; the options we have for managing flock performance and productivity; and the implications for modifying our farming systems that will still enable financial, animal welfare and social goals to be achieved.

- Develop tools to estimate the impacts of severe weather events on lamb losses
- Help industry planners to understand the future impacts of climate change by investigating likely climate scenarios and potential impacts on lambing percentage
- To help farmers in long term decision making regarding their farm system
- Provide potential solutions to improve lamb survival on farm.

The sheep farmers in the South Island will have tools and solutions available to them to help mitigate against the potential impacts of storms during lambing. This is envisioned to be one of a number of tools that may be needed to meet future scenarios, making the farming systems more robust in the face of change.

A farm systems approach

A farm systems approach was taken to help understand the issues facing farmers, model future impacts and investigate the likely impact of on-farm management changes. This approach provided a robust analysis of the problem and allowed for solutions to emerge without prejudice. The approach also expanded the project as it evolved and used more resources than were originally allocated.

This project used the scientific data available including weather data, climate projections, future emissions scenarios and sheep industry data (lamb loss etc) to take a look at the challenges likely to be faced by the sheep industry in the future. Without attempting to model the outcome most people are likely to jump to what seems the most obvious or negative outcome. An example in this situation would be the impact of more severe or frequent snow storms such as the 2006 South Canterbury event. However modelling allows this to be balanced by the effect of other likely changes such as the impact of increased temperature, changes to farm systems (increased shelter) etc so that we can have a more fully developed understanding of what farmers may be dealing with in the future.

The project began with two main areas of focus:

- the forecasts for climate change and
- lamb survival and mitigation within farming systems across the lower South Island

Farmer catchment groups

Four catchment focused farmer groups were established and worked through each stage of the project. These were in West Otago, Northern Southland, South Otago, and South Canterbury. Initially each group was asked to discuss the local issues relating to lamb survival and what they thought could be done to improve lamb survival on farm. The best mitigation options for each region were then investigated further through modelling.

The key mitigations that were followed up within the project were:

- Mating date
- Feeding
- Shelter
- Lambing percentage
- Lambing spread
- Genetics

Climate predictions and variations

NIWA provided climate forecast scenarios using the Virtual Climate Station Network which predicts the climate on a grid at 5km spacing (current and future temperature and rainfall data). This meant that changes in climatic conditions were described and modelled across a 20 year time frame. This climate data was modelled for three different greenhouse gas emission scenarios (from the Global Climate models provided by the IPCC). This provided enough detail to examine potential climate changes at a regional scale.

Modelling lamb survival mitigations

The modelling of lamb survival was quite complex and is outlined in more detail in the full report. The model used three factors significantly related to climate around the birth of the lamb; heat loss in the 2 weeks before birth, on the day of birth, and during the 3 days after birth.

The Lamb Alive model was tested using data sets from earlier lamb survival research done in Otago and Southland (comprising over 15,800 lambs, born over 2 lambing's in 2003/04) to see if the predicted data was similar to the actual data. It was also tested using actual climate data (Gore weather station) and comparing the results to actual lambing percentages for the region.

Based on climatic conditions, we assessed the effects of changes in management on lamb survival and potential lambing percentage at tailing in these farming systems.

What were the main findings from this project?

Lamb survival to sale is the major driver of profit in our sheep farm systems. Global warming, land use change and increased lambing percentages threaten lamb survival. In any three day period of lambing the number of lambs born has been estimated to have doubled compared to 20 years ago. How will the climate of the future influence our lamb survival? Which managements can we apply to minimise any potential decline?

Lamb survival modelling using recent AgResearch lamb survival data sets was combined with climate modelling using the NIWA virtual climate station network to interpret global climate change trends for three future scenarios.

Farmer groups at 4 regions throughout Southern New Zealand (West Otago, Northern Southland, South Otago and South Canterbury) helped define the local conditions and provide an insight into the types of on-farm mitigation that may be effective against the climatic impact on lamb survival.

Summary of results

Variability in the current climate in southern New Zealand is already very large. The modelled changes to variability, particularly rainfall, provided little extra variation that farmers do not already manage for. The inability of the virtual climate station network to provide local wind run data creates a gap in the robustness of the predictions, as wind run is the greatest manageable variable that impacts on lamb survival. Future work to improve wind run prediction will improve the outcomes of such modelling.

Modelling the impacts of global warming and on-farm mitigations provided some significant insights into how management may change to improve lamb survival.

- Future global warming will increase temperature at lambing.
- Changes in rainfall will be relatively small.

- Overall the impacts of global warming will improve lamb survival if lambing dates remain where they are now.
- Conversely, farmers may have the opportunity to lamb up to 10 days earlier with no impact on lamb survival, while potentially improving their ability to finish lambs before the onset of summer drought.
- Wind chill was the climatic factor that could be influenced the most through the provision of shelter. This long term mitigation against lamb loss provided benefits both through sheltering the ewe before lambing and the lamb at lambing.
- Improving feeding to the ewe in the final three weeks of pregnancy was the mitigation with the greatest potential as a short term solution. Further increases in lambing percentage will continue to provide more lambs for sale in some environments. The increase in spring temperatures at lambing may also help provide extra feed approaching lambing as spring pasture production will begin earlier in these regions of southern New Zealand. The modelled impacts of feeding, while supported by the literature, need field confirmation to ensure sound recommendations for farmers and so should be viewed with caution.

Farmer attitudes to various mitigation practices varied depending on their practical experience of the solutions. Feeding was recognised universally as the most appropriate solution, though was often the hardest to implement due to varying feeding conditions. Shelter was viewed as more problematic because farmer experience from poor shelter design saw lower lamb survival due to increased risk of disease and mis-mothering. Hill country farmers saw problems of scale impacting on the effectiveness of shelter in those environments.

Changing the spread of lambing did little to change to outcome for lamb survival, so while many more lambs are being born on any one day, the impacts of the climate on the whole lambing period are more important than single events.

This work provides a starting point to help farmers redesign on-farm systems to provide significant mitigations to improve lamb survival in the face of future climate change and increasing ewe flock fertility

Key Farmer Messages

- **The modelled impacts of potential climate change provides little extra variation over that which farmers deal with every season now i.e. New Zealand farm systems are resilient.**
- **Increasing scanning percentage should still be the highest priority**
- **Shelter is most effective and more effective in hill country**
- **Need to concentrate efforts on the ewe**
- **Feeding and sheltering the ewe before lambing has a bigger effect than sheltering the lamb at lambing**