Context

• MAF Policy funded research as contribution to Primary Sector Partnership Group of SWPoA.
  • Range of possible management practice changes are possible to reduce diffuse discharges to water and increase efficiency of water use under irrigation.
  • Sub-optimal outcomes are likely if targets (or other policies) are developed without understanding the cost-effectiveness of these practices.
  • Method needed to calculate cost-effectiveness.
  • Developed a project to explore what is the least cost way to achieve a particular reduction in discharges.

Method

• Science based linked modeling.
  • Identified 20+ management practices.
  • Seven case study farms. (MAF farm monitoring)
  • Incorporate best science knowledge (AgR, NIWA, C&F, AquaLinc).
  • Modeling tools. (OVERSEER, LUCI, Udder, FarmMax, Financial Models).
  • Results
    • Discharges (N, P, Faecal micro organisms, Water Use)
    • Farm Financial Performance
    • Abatement cost / unit reduction.
    • Practice cost / effectiveness.
Method – Management Practices

- Nitrification inhibitors
- Optimised farm nutrient use
- Wintering pads
- Standoff pads
- Low / No Nitrogen input farming
- Wetlands
- Stream stock exclusion
- Stream vegetated strips
- Stream stock crossings
- Farming system intensity changes
- Land application of effluent
- Deferred effluent irrigation
- Low rate effluent application
- Advanced pond effluent systems
- Improved arable rotation
- Nitrogen budgeting
- Irrigation system audit and redesign
- Irrigation scheduling – low tech
- Irrigation scheduling – hi tech

Method – Case Study Farms

Case Study Farms – based on Farm Monitoring Models
- Waikato Dairy
- Canterbury Dairy
- Waikato Intensive Sheep and Beef
- Central North Island Hill Country Sheep and Beef
- Southland / Otago Hill Country Sheep and Beef
- South Island Deer
- Canterbury Arable
Method – Case Study Farms

Farm Business Impacts on:
- Productivity
- Level of inputs
- Operating costs
- Capital structure
- Debt servicing costs
- Profitability
- Resilience

Results – Reduction in whole farm N discharges.%

- Waikato Dairy
- Canterbury Dairy
- Waikato Intensive F & R
- Central North Island F & R
- South Island F & R
- South Island Shear
- Canterbury Arable

- Nitrification Inhibitors
- Wintering pads
- Low Nitrogen input farming
- Wetlands: 2.5% of the area
- Farming system intensity changes: 10% reduction
- Farming system intensity changes: 20% reduction

- Optimised farm nutrient use
- A tannery pads
- Wetlands: 1% of the area
- Improved animal rotation
- Farming system intensity changes: 10% reduction
- Farming system intensity changes: 20% reduction
Results – Financial Impact

Financial Impact ($/annum)

- Results – Reduction in discharge units

Waikato Dairy

Optimized nutrient use

Stock exclusion

Vegetated strips

FIC 10 %

FIC 25 %

FIC 30 %

Wetlands 1 %

N inhibitors

Wintering pads

Standoff pads

Low Nitrogen Input

Wetlands 2.5 %

Total Farm Units of N Discharge Reduction

[Graph showing financial impact and reduction in discharge units for different areas and practices]
Results – Abatement cost / unit reduction

Farming system intensity changes. 25% reduction
- Stream vegetated strips
- Optimised farm nutrient use
- Stock exclusion

Farming system intensity changes. 20% reduction
- Wintering pads

Farming system intensity changes. 10% reduction
- Wetlands 1% of the area
- Low Nitrogen input
- Wetlands 2.5% of the area

(Cost) / Benefit per Unit of N Emissions Reduction

Results

Waikato Dairy

Cost - Benefit

Optimised nutrient use
Stock exclusion
FIC 20%
FIC 25%
Vegetated strips
Wintering pads
Standoff pads
Nitrification inhibitors

Effectiveness

(45,000)

0

FIC 10%

Effectiveness

45,000

0

Vegetated strips

45,000

0

Standoff pads

Wintering pads

(45,000)

0

Effectiveness

0

FIC 20%
Results

Canterbury Dairy

Cost - Benefit

(32,500)

(65,000)

(30,000)

FID 10 %

FID 25 %

FID 20 %

Low Nitrogen input

Effectiveness

FIC 10 %

FIC 20 %

FIC 25 %

Optimised nutrient use

Standoff pads

Stream stock exclusion

Stream vegetated strips

Low Nitrogen input

Results

Waikato Intensive S & B

Cost - Benefit

(50,000)

(100,000)

(50,000)

0

1,000

2,000

3,000

FIC 20 %

FIC 30 %

Nitrogen

Wetlands 1 % of the area

Wetlands 2.5 % of the area

Effectiveness

FIC 10 %

FIC 20 %

FIC 30 %

Nitrogen

Wetlands 1 % of the area

Wetlands 2.5 % of the area
Results

Central North Island Hill S & B

- Nitrification inhibitors
- Stream stock exclusion
- Stream vegetated strips

FIC 10%: (30,000)
FIC 20%: (60,000)
FIC 30%: (90,000)

Cost - Benefit

Effectiveness

Results

Southland Otago Hill S & B

- Nitrification inhibitors
- Stream stock exclusion
- Stream vegetated strips

FIC 10%: (70,000)
FIC 20%: (140,000)
FIC 30%: (210,000)

Cost - Benefit

Effectiveness
Results

South Island Deer

Conclusions

• All practices can reduce discharges to a varying degree.

• Not many are win: win environmentally and financially.

• Cost effective solutions vary depending on:
  – Farm type
  – Intensity
  – Characteristics – location, soils, slope etc.
  – Productivity and product prices.
Conclusions – Key Messages

• Method can be used to inform decision making at policy and farm level.
• No “one size fits all solution to discharges.”
• Need to research more cost effective and operationally efficient responses.
• Most effective options often require significant capital expenditure.
• Need to consider profitability / affordability as well as operational issues such as ease of implementation etc.
• Some practices have already been targeted by industries as preferred responses and are widely adopted.

Conclusions – Further Work

• Expand scope of case study farm types.
• Test sensitivity to science assumptions and profitability variability.
• Look at potential for combined use of practices.
• Other discharges, co benefits. (sediment, bugs).
• GHG emissions.