Linkages between land management activities and water quality in the Bog Burn catchment, Southland.

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AgResearch, Invermay

agresearch Farming, Food and Health. First
Te Ahuwhenua, Te Kai me te Whai Ora. Tuatahi

Outline

1. Study process & links to farm planning initiatives

2. Mitigation research
   - technical fixes...
   - the BMP Toolbox
     environmental reductions & $$$

3. Lessons learnt

Project participants

Chris Smith, Richard Muirhead, Richard McDowell, Denise Bewsell

Bob Wilcock, John Quinn, Maurice Duncan

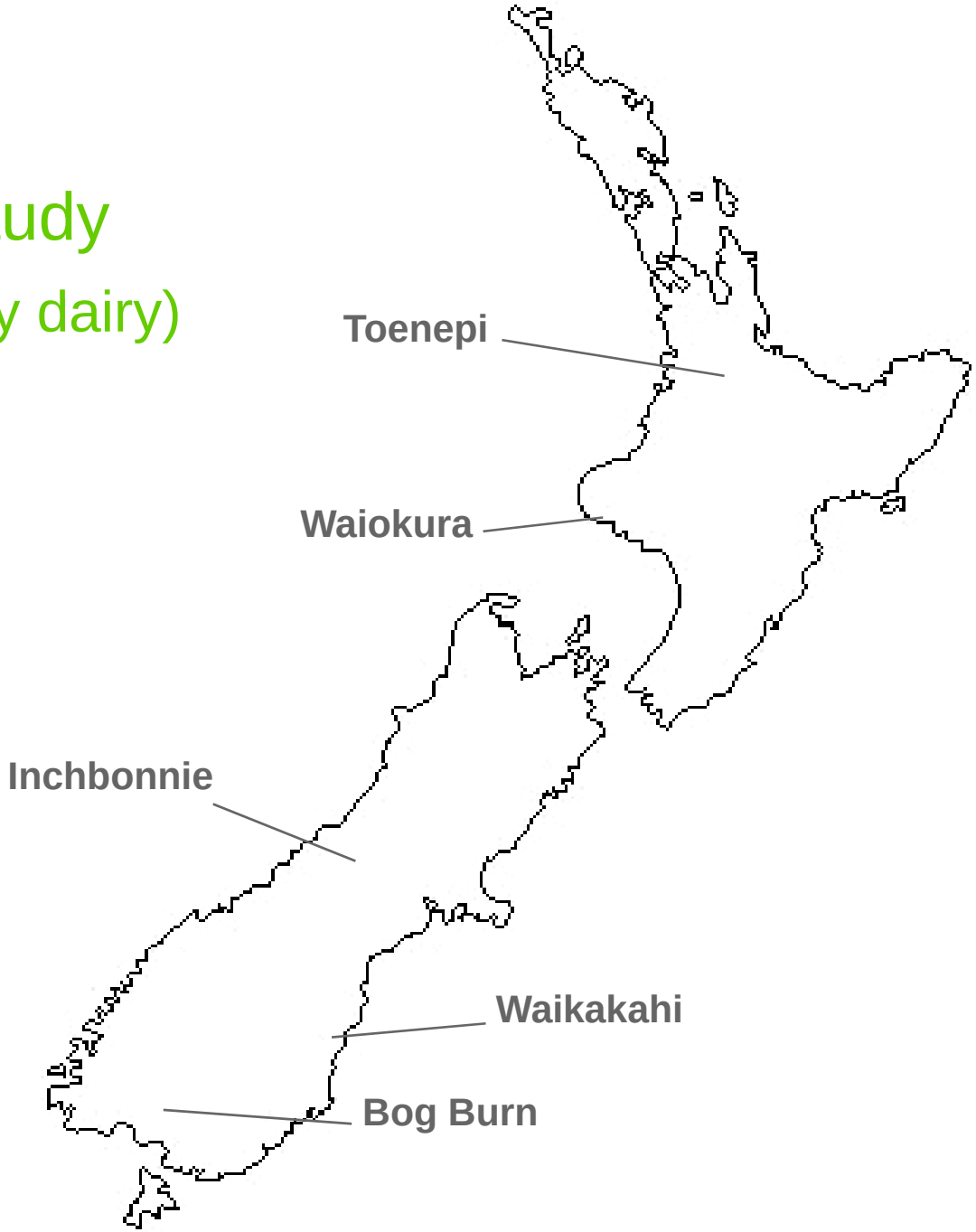
Environment Southland

Bruce Thorrold

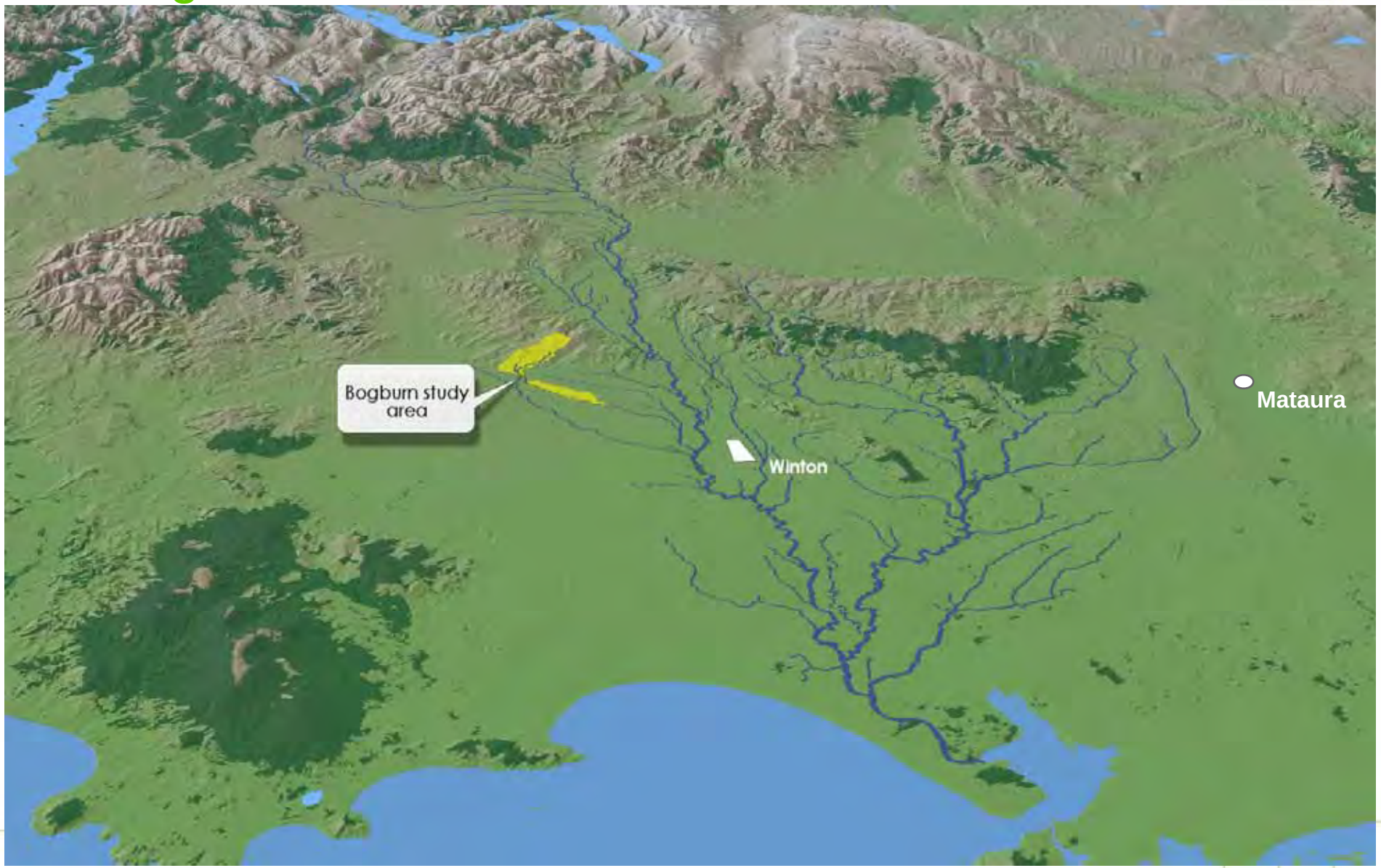
Lew Metcalfe, John Russell, Jim Barnett, Charlotte Rutherford

National Dairy Catchments study

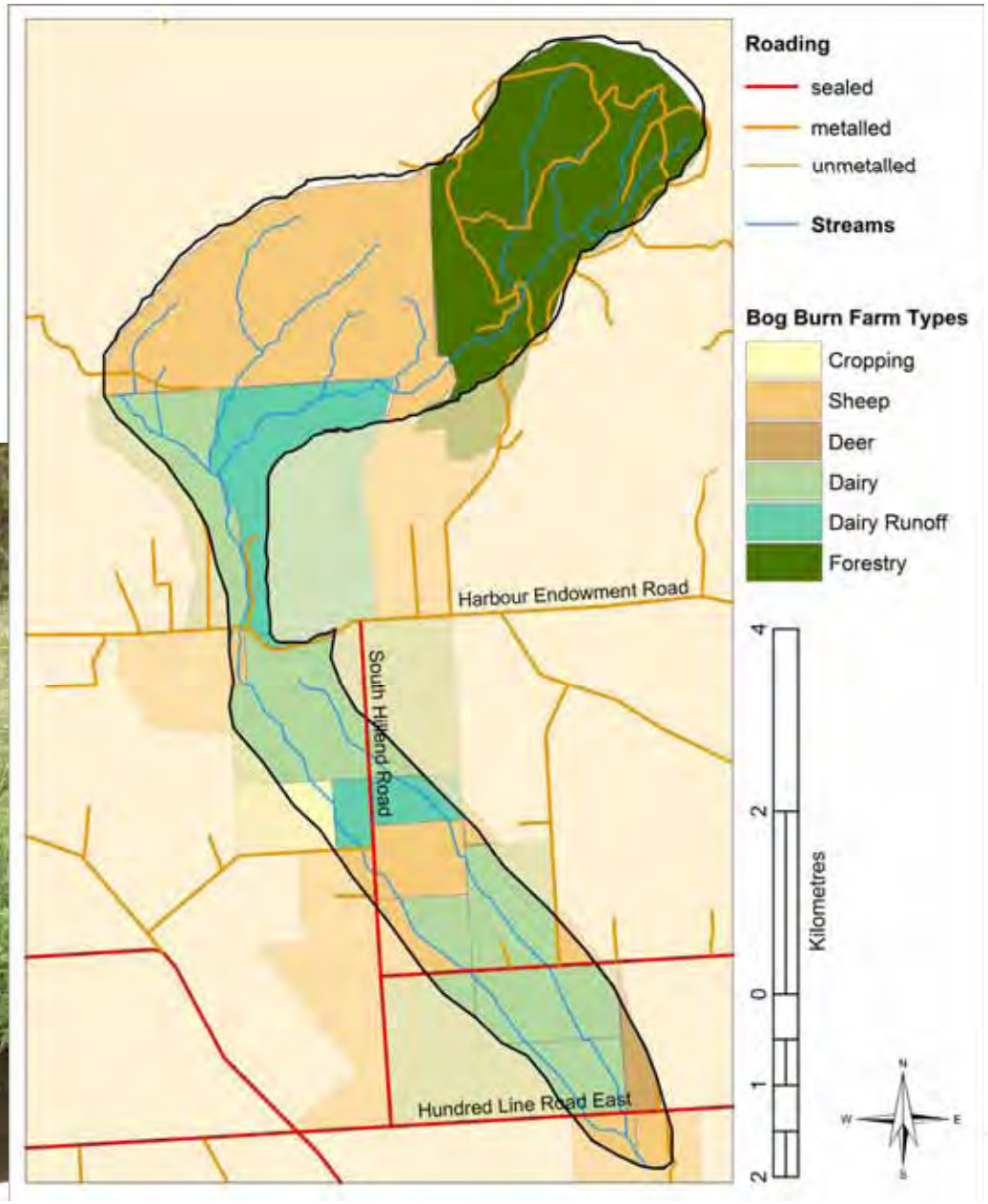
(all predominantly dairy)



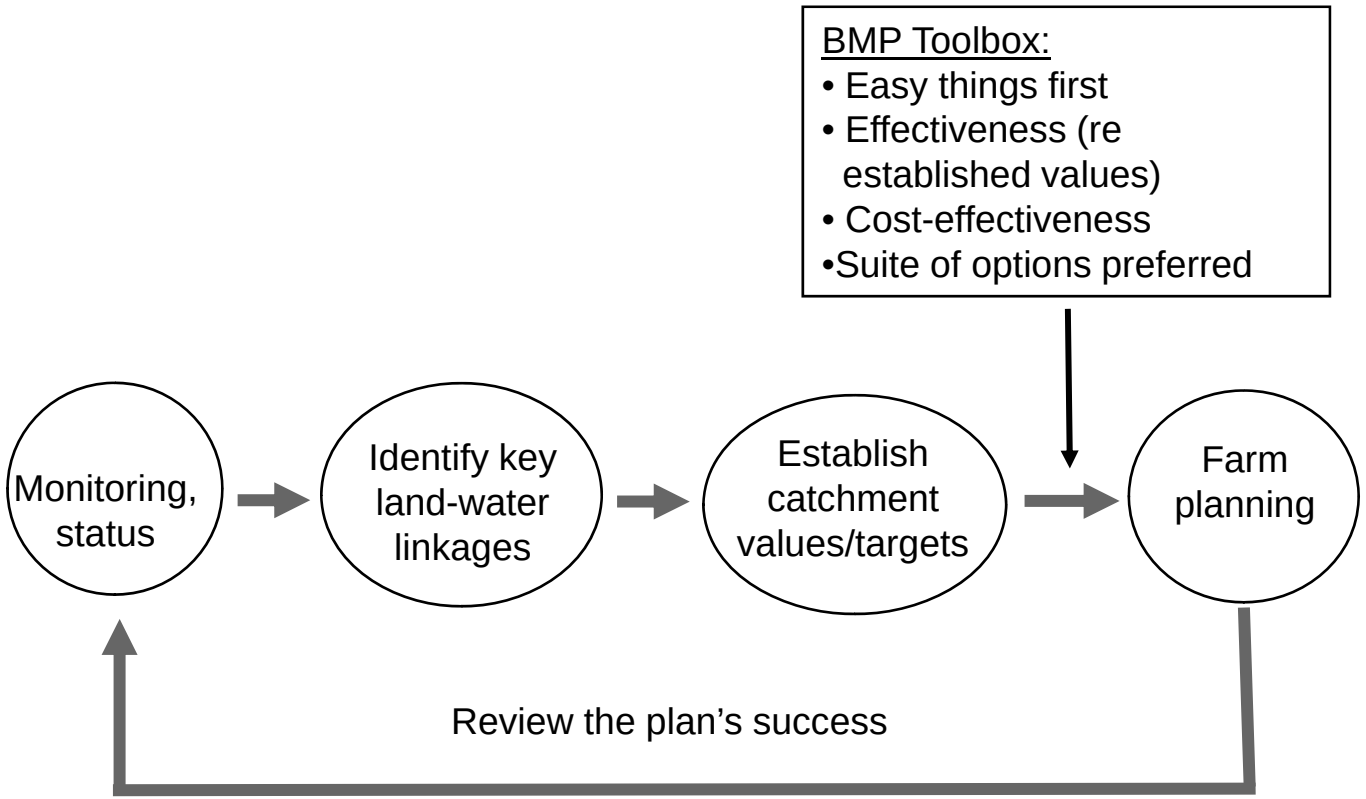
Bog Burn catchment location

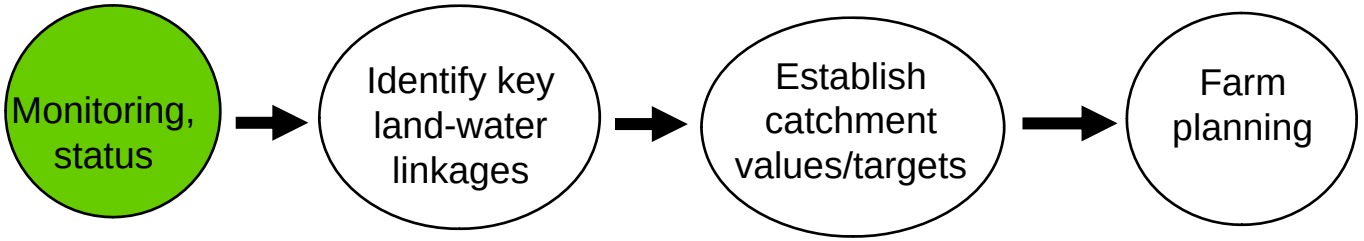


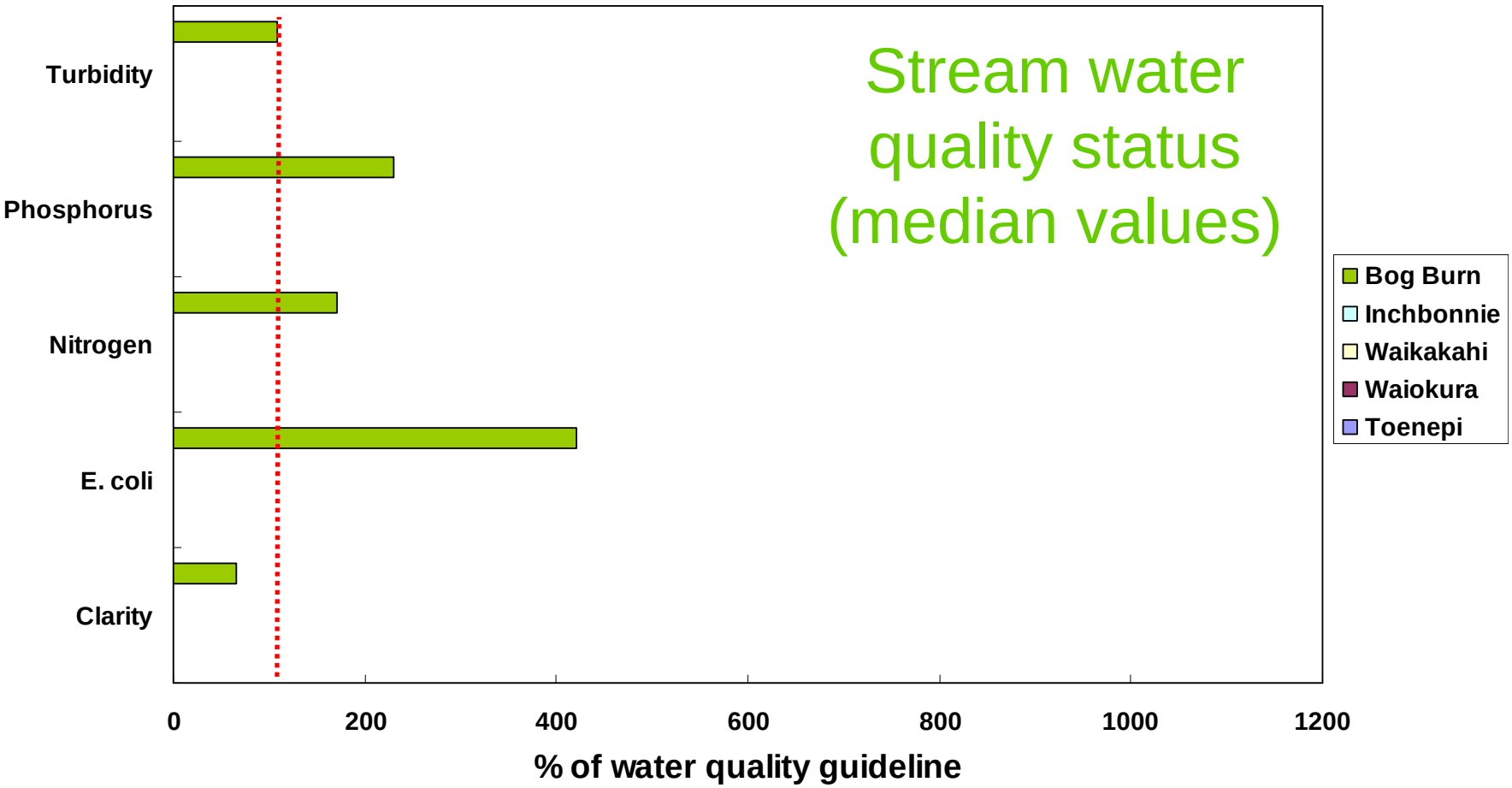
Bog Burn landuse

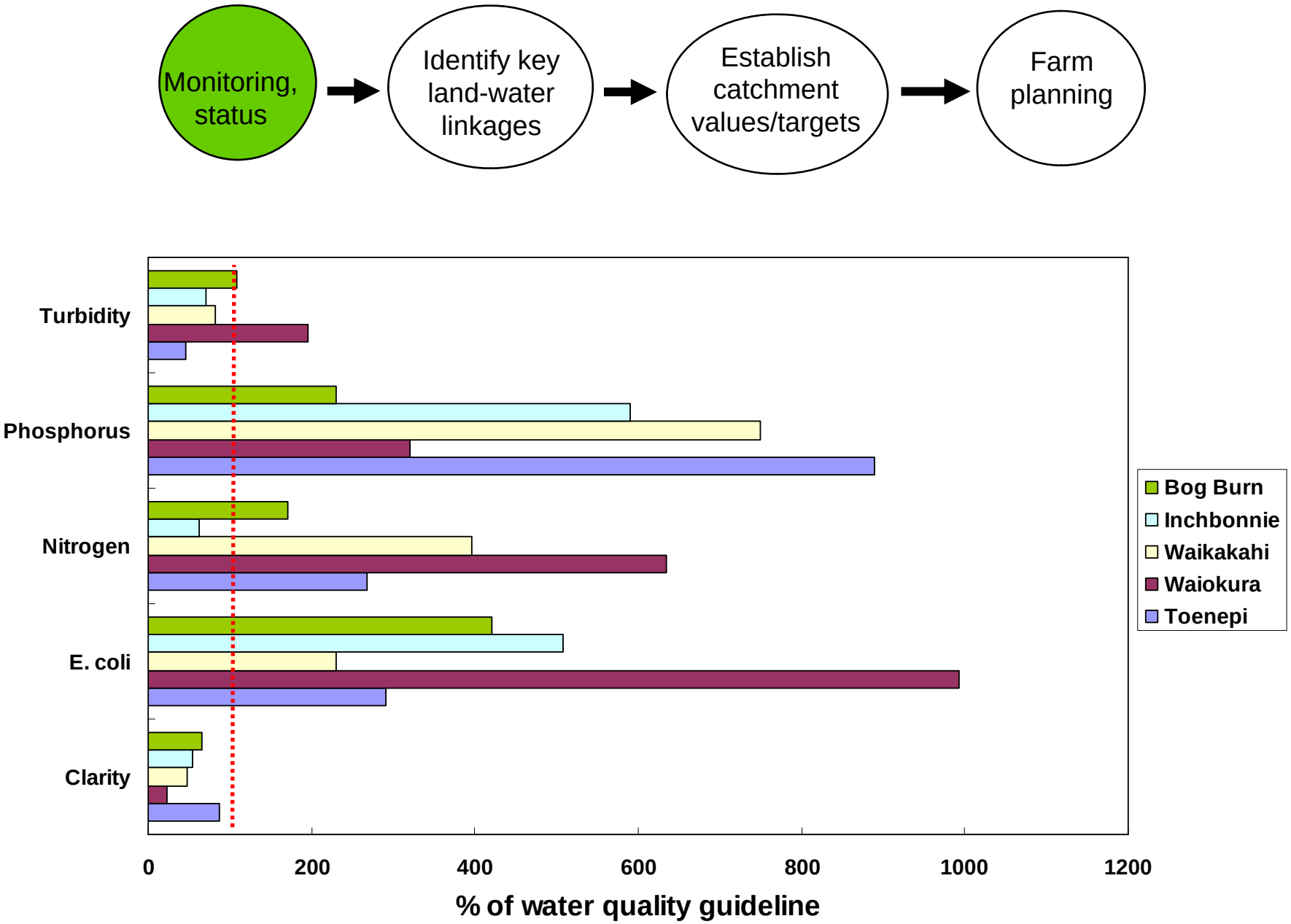


The catchment management planning process




Monitoring, status
Identify key land-water linkages
Establish catchment values/targets
Farm planning


Stream water quality status (median values)
Turbidity
Phosphorus
Nitrogen
E. coli
Clarity
0
200
400
600
800
1000
1200
% of water quality guideline
Bog Burn
Inchbonnie
Waikakahi
Waiokura
Toenepi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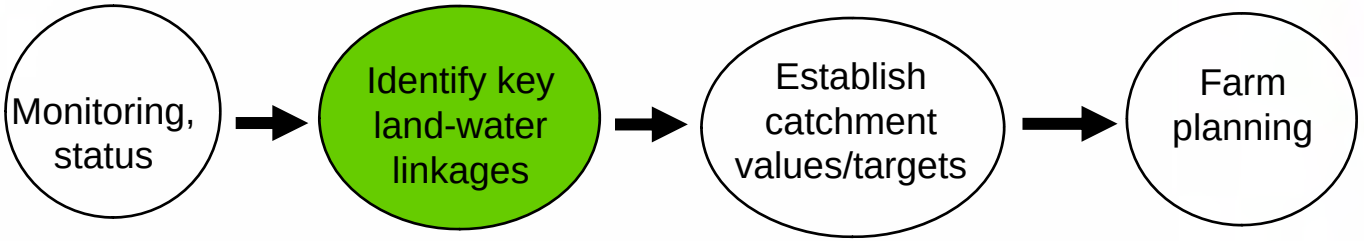
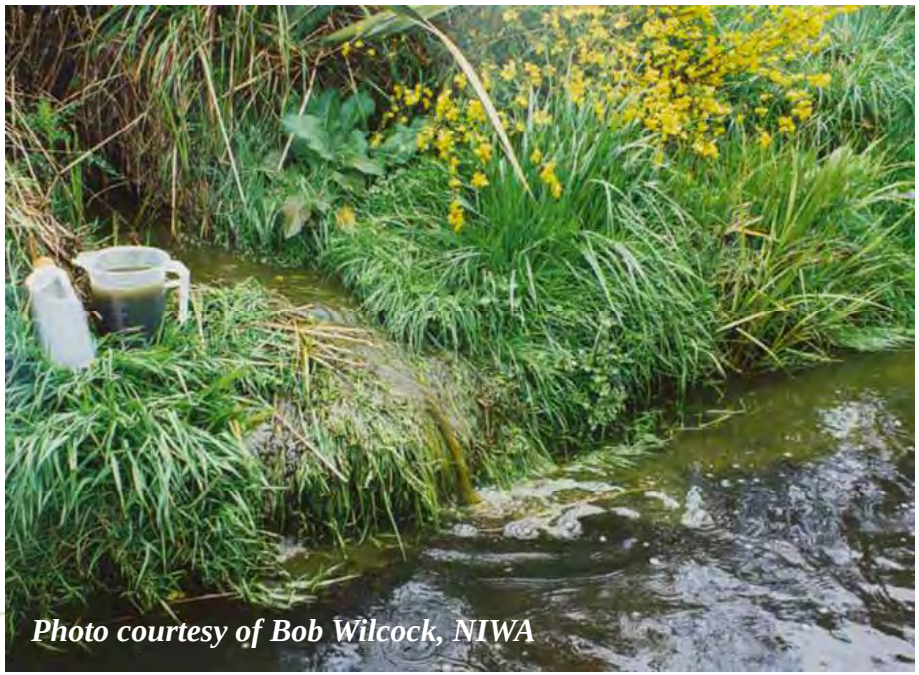


Bog Burn

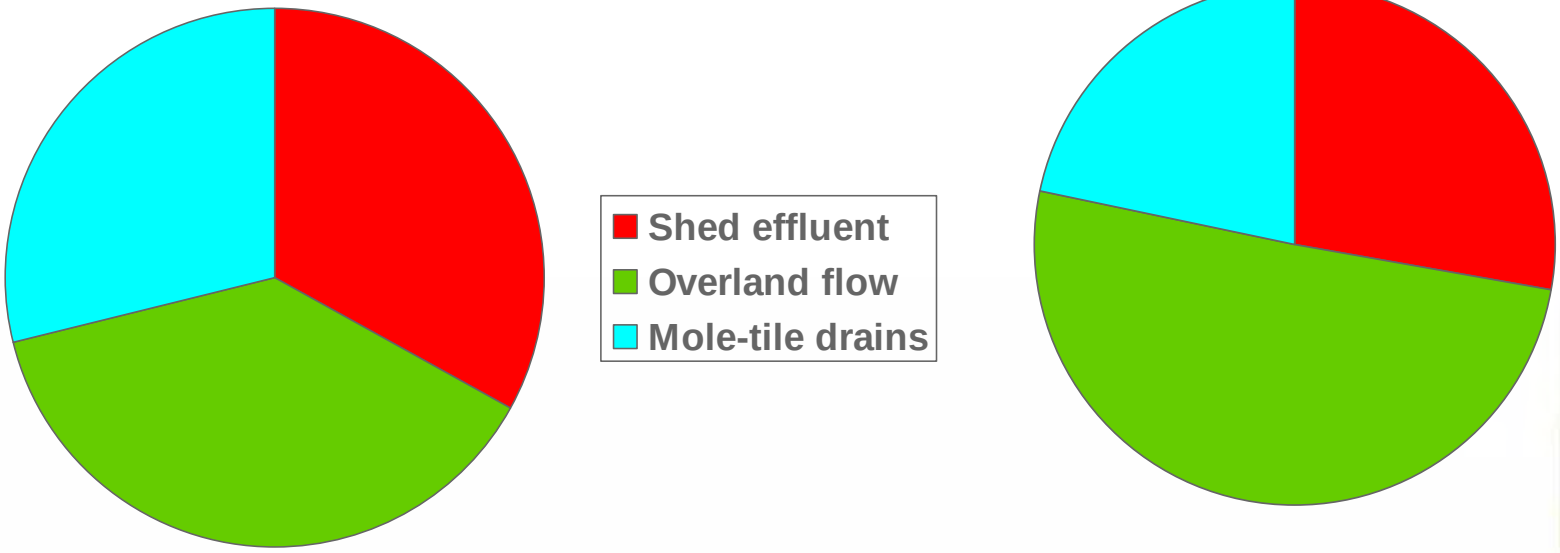
Direct drainage of farm dairy effluent through mole-tile drains

(Monaghan et al. 2007 Ag. Eco. Env. 118: 211-222)



Other key land-water linkages: mole-tile drains, overland flow

Contribution to farm discharges:

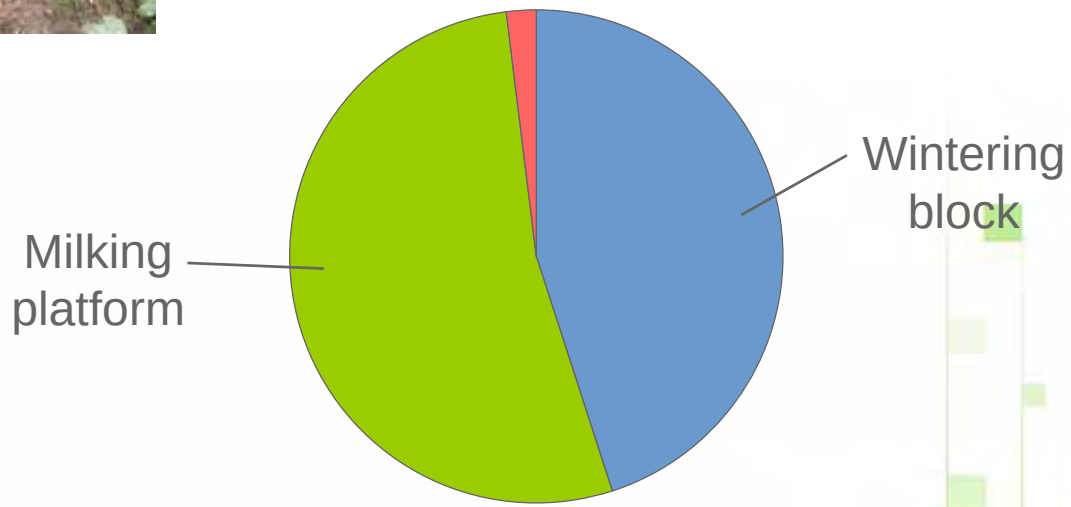


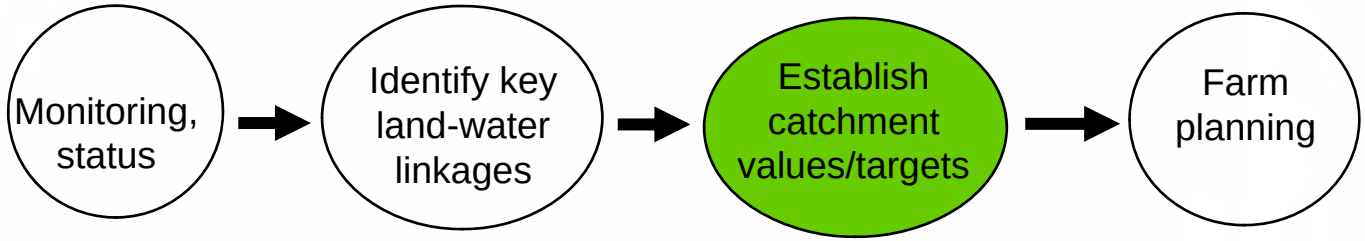
Phosphorus

Faecal bacteria

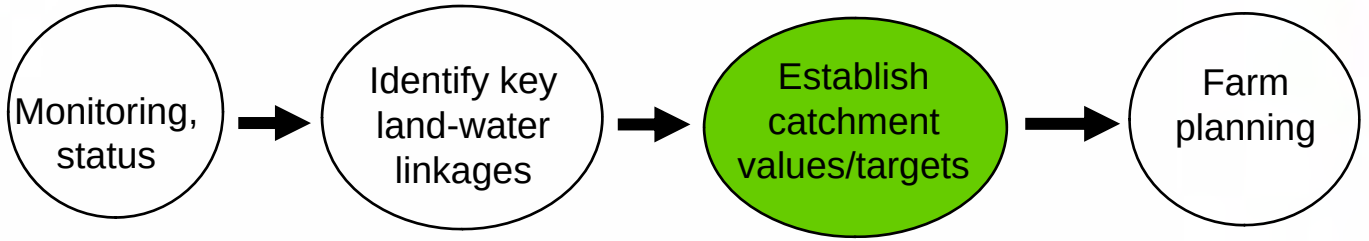
Other key land-water linkages: wintering

- leaching loss of 32 kg N/t milksolids:





Why is this catchment important?



Stakeholder workshop

Farmers

- Local values and information

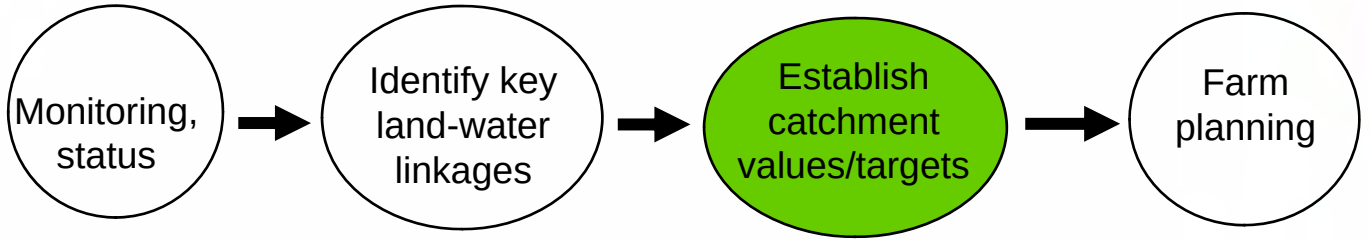
Regional Councils

- Values from their planning processes
- Targets to protect/restore values

Scientists

- Current state of water
- Land-water linkage knowledge

Conceptual linkage model developed



Identified catchment values:

- Trout spawning & rearing in BB
- Contact recreation in Oreti R.
- Farm returns

Bog Burn Dairy Farm Plans

- riparian works more important for small stream habitat in tile drained areas
  - Stock exclusion, planting, erosion control, etc

- effluent mgmt very important for major river WQ
  - Storage, low rate application etc.

Bog Burn Dairy Farm Plans

1. Exclusion of cattle from streams & wetlands
   - including no stream crossings

85%: on track

2. Nutrient management systems are in place
   - OVERSEER runs completed

3. Effluent management complies with local agency requirements….

2. Mitigation research

Improved effluent management systems

- wet, fragile or artificially drained soils

Option 1: Deferred irrigation

1. Large storage ponds (2 – 3 months)
2. Capital cost: $35 – 100 per cow
3. Annualised cost: $4 – 11 per cow

Option 2: Advanced Pond System

1. 4-pond treatment & discharge
2. Capital cost: $90 – 110 per cow
3. Annualised cost: $10 – 20 per cow

Option 3: Low rate (K-Line) technology

- Low application rate (4 mm/hr) & improved uniformity
- High degree of control of application depth
- Intermittent pumping option
- Annualised cost: $3 – 5 per cow

Option 4?: DairyYard

- recent development
- greatly reduces wash-down water volumes
  - ➢ smaller pond required

Option 5+?:

- in progress

- again designed to reduce pond storage reqts

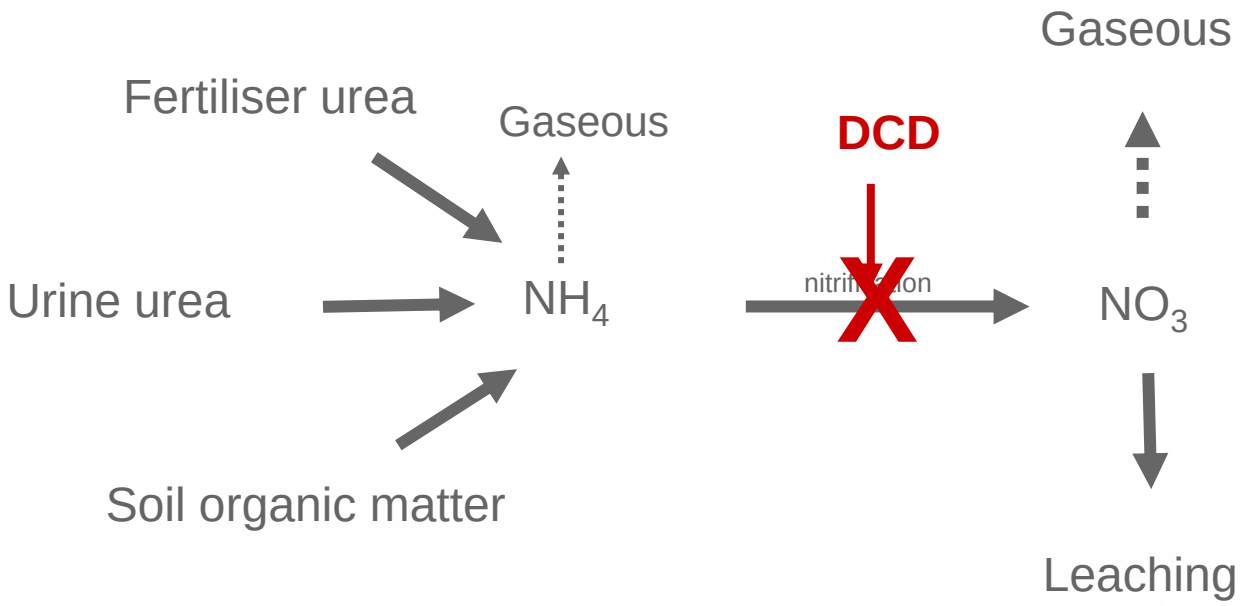
Effluent systems: horses for courses

Recommended minimum effluent storage reqts: Southland

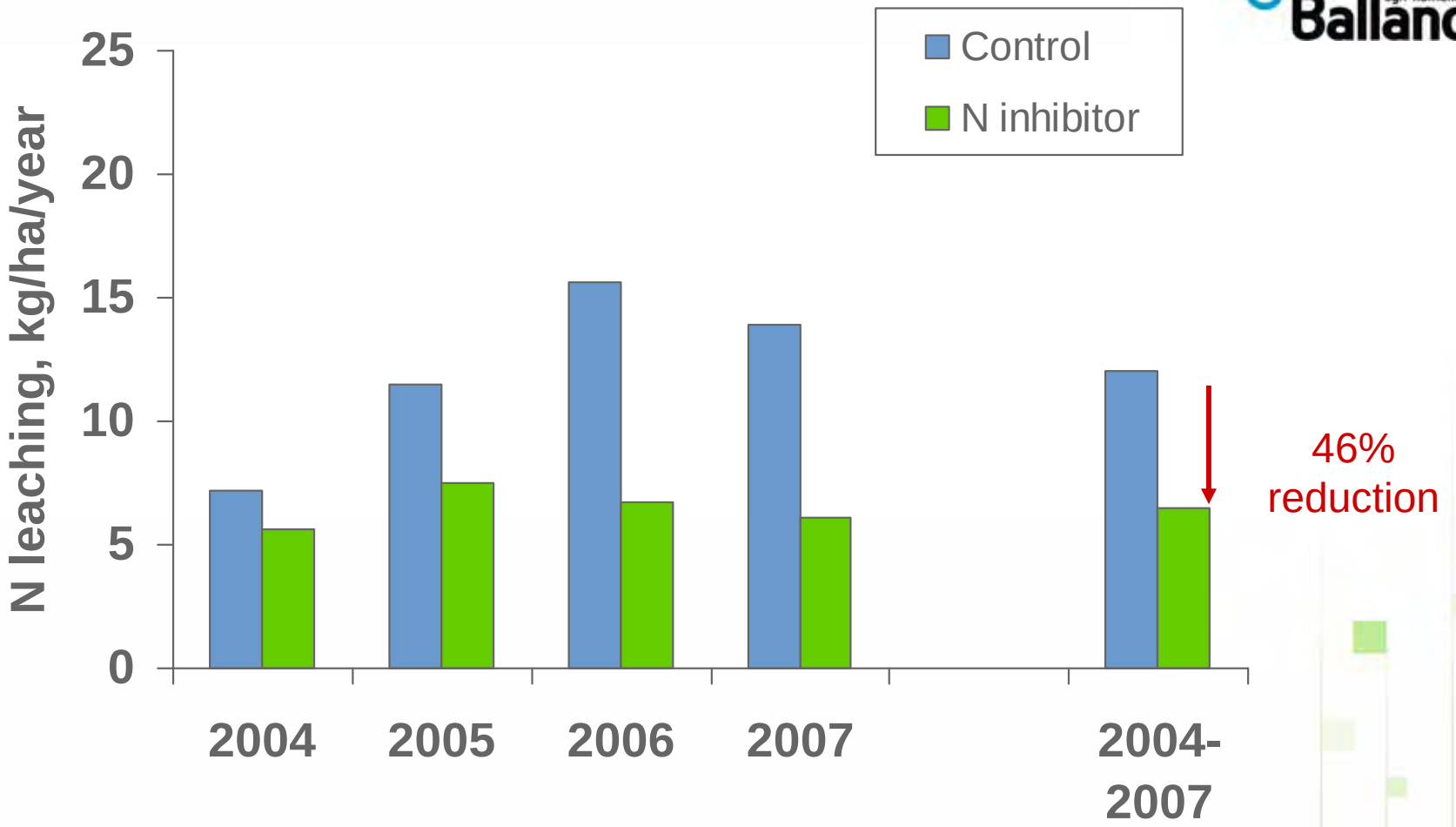
Landscape risk	Effluent applicator	
	High rate/depth i.e. travelling irrigator	Low rate/depth e.g. K line
Low	6 weeks	4 weeks
High	12 weeks	8 weeks

Tackling the nitrogen problem…

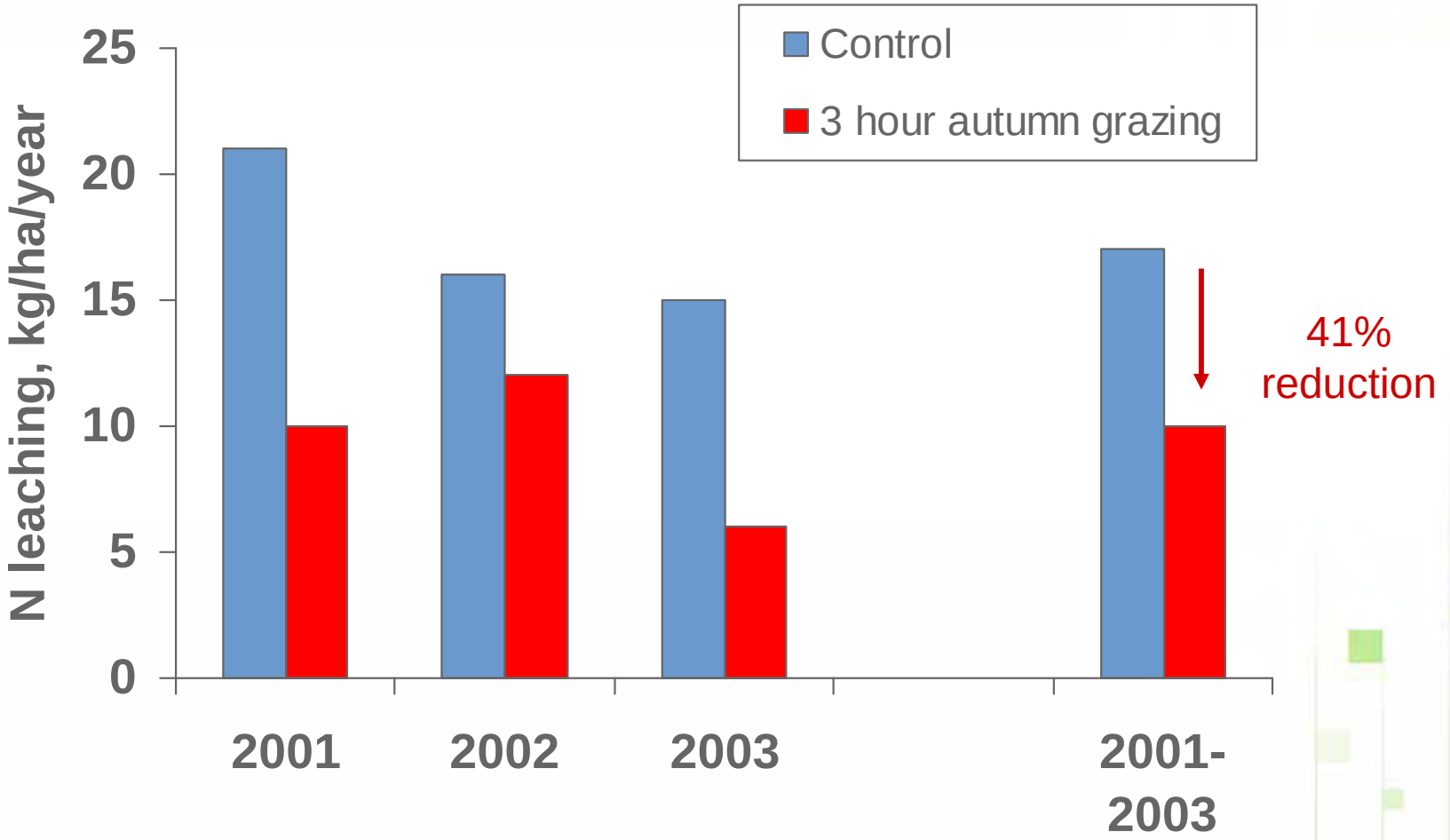
Nitrification inhibitor technology



N leaching losses from DCD-treated pasture: Southland (DCn product)



Nitrate leaching losses under restricted autumn grazing management



The BMP Toolbox

- selecting the right tool for the job

Toolbox of BMPs

- net cost
- effectiveness
- cost-effectiveness

$25-100/cow/year

$-37/cow/year

$4-11/cow/year

$10-20/cow/year

$4/cow/year

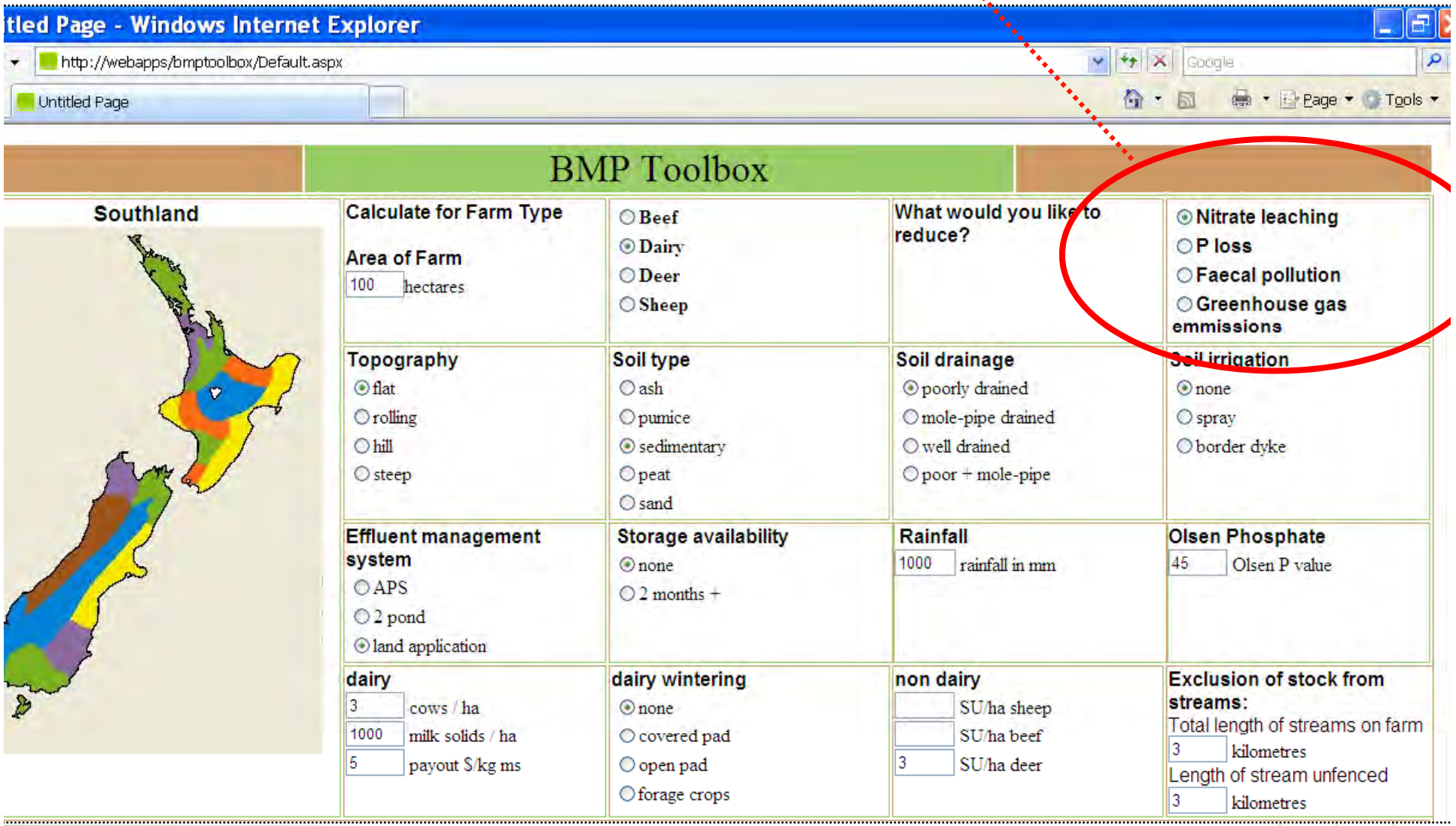
$40-60/cow/year

$20-60/cow/year

$-20-20/cow/year

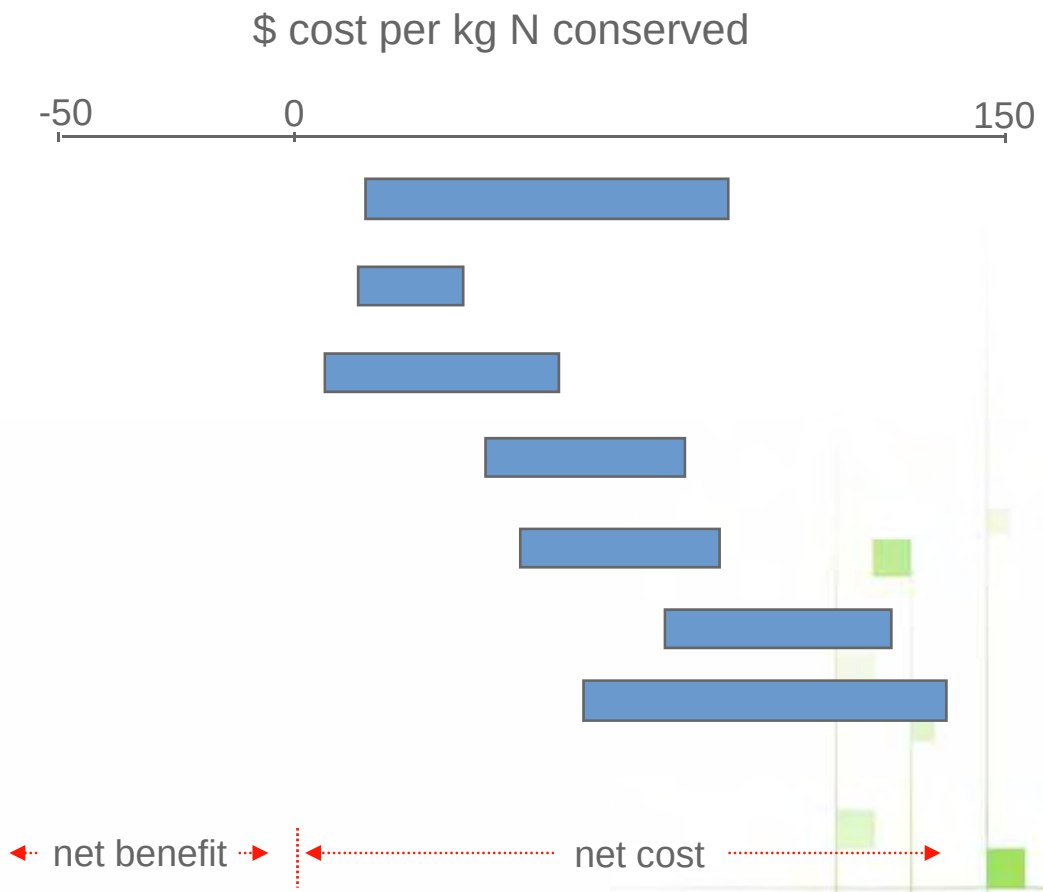
Web-based tool:

As defined by catchment/farm values



Improved N management systems: Bog Burn dairy farms

	Cost $/cow/year
Wintering shelter	73 - 13
Optimal effluent mgmt	6
Nitrification inhibitors	10 - 30
Restricted aut grazing	65
Low N feed	40
Nil N fertiliser	73
Dry stock farming	160 – 700



Lessons learnt

Targeted application of BMPs is important

- but will struggle to off-set dairy conversion rates...

Many environmental impacts of dairy farming are hard to see

Environmental considerations generally not a driver

- logistics & economics are

Range of options preferred

Acknowledgements

DairyNZ

Sustainable Farming Fund

New Zealand Fertiliser Manufacturers' Research Association

FRST

Ballance AgriNutrients

Environment Southland