FARM-SCALE MODELLING OF MITIGATION OPTIONS

AgResearch Invermay
Richard Muirhead
Ross Monaghan
Chris Smith (Overseer)
John Stantiall (Farmax)

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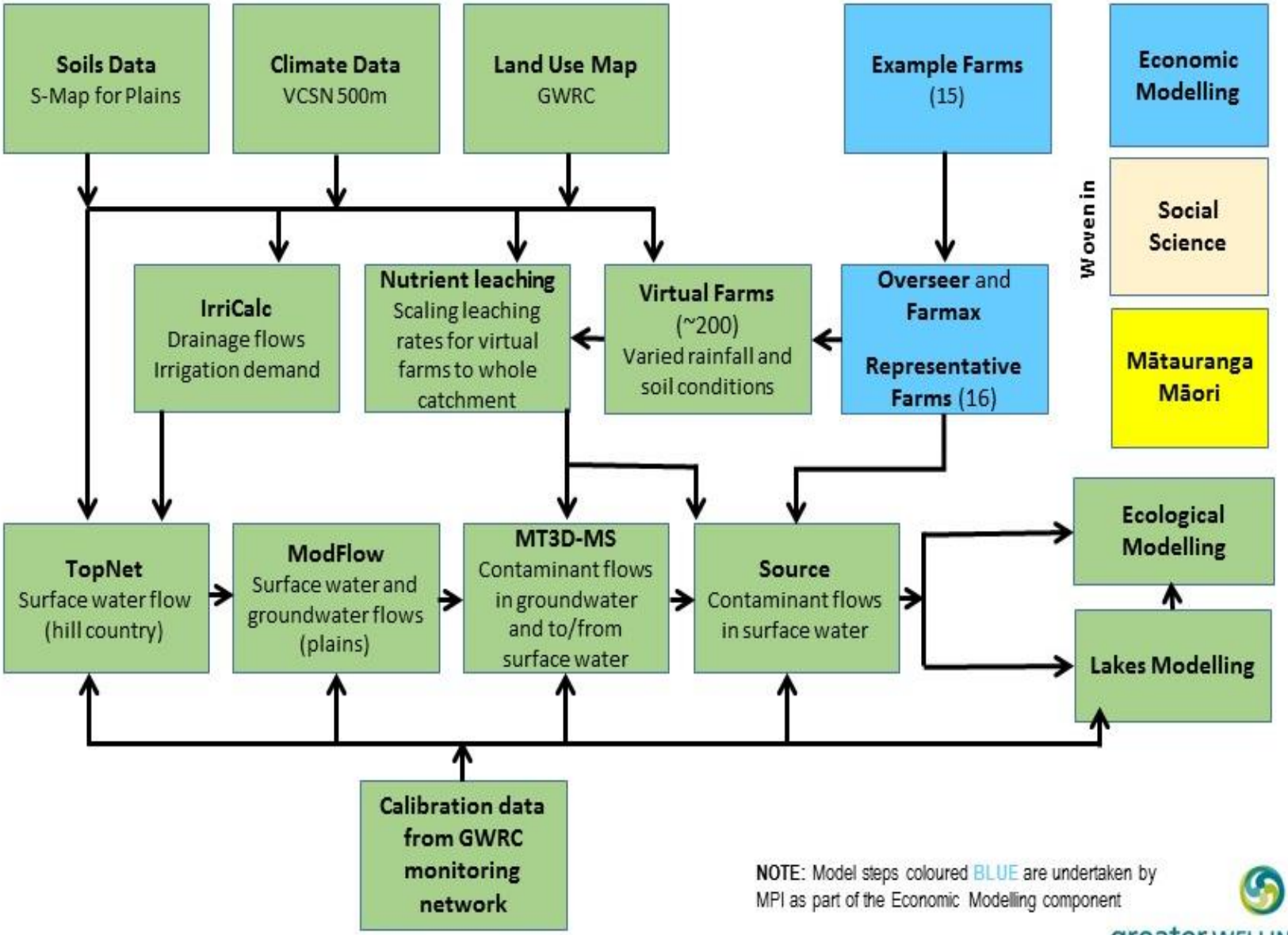
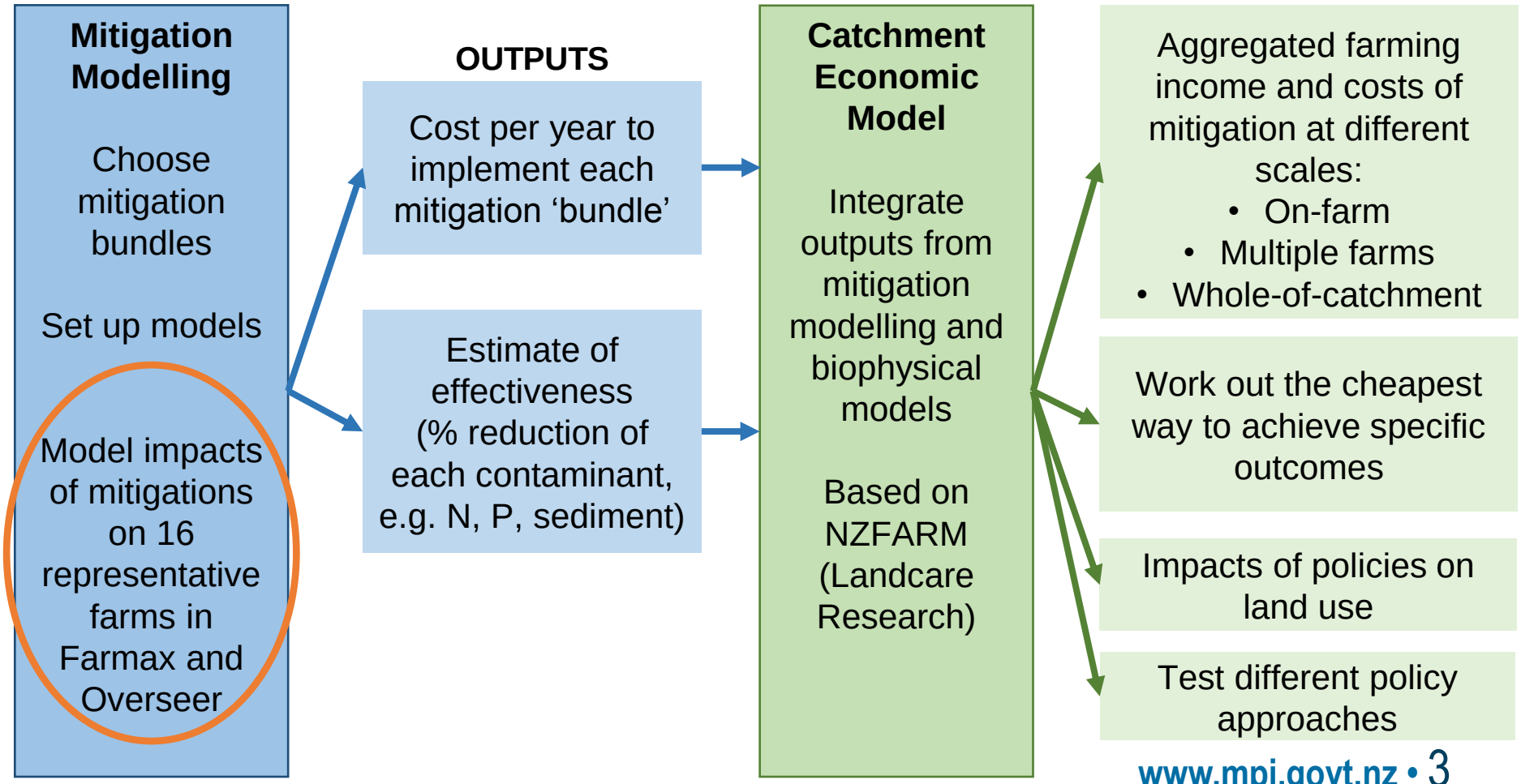

Soils Data
S-Map for Plains
Climate Data
VCSN 500m
Land Use Map
GWRC
Example Farms
(15)
Economic Modelling
Woven in
Social Science
Mātauranga Māori
IrriCalc
Drainage flows
Irrigation demand
Nutrient leaching
Scaling leaching rates for virtual farms to whole catchment
Virtual Farms
(~200)
Varied rainfall and soil conditions
Overseer and Farmax
Representative Farms (16)
TopNet
Surface water flow (hill country)
ModFlow
Surface water and groundwater flows (plains)
MT3D-MS
Contaminant flows in groundwater and to/from surface water
Source
Contaminant flows in surface water
Ecological Modelling
Lakes Modelling
Calibration data from GWRC monitoring network
NOTE: Model steps coloured BLUE are undertaken by MPI as part of the Economic Modelling component
greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

The Economic Modelling Process



FARM-SCALE MODELLING

What you selected to model

1. Current policy

2. Easy + Medium GMP options

3. Hard GMP options

What happened since then?

MPI provided AgResearch with the Overseer and Farmax files for the 16 base farms

And then we got going!

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MODELLING PROCESS

Models used

Overseer for N and P losses

Manuel calculations for Sediment and *E. coli*

Farmax for production and profit

High level stuff

Changes in area of farm blocks adjusted (FDE irrigation, Wetlands, Riparian)

Loss of production areas accounted for by reducing stock numbers

Assumed 26m of stream per ha of land

Wetland area = 1% of catchment size.

Changes in fertilizer checked for maintaining animal feed production

Changes in farm costs in farmax (inc. labour)

Capital costs annualized over 25 years

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EACH FARM IS DIFFERENT

Only applied the mitigations that fitted for each farm
Only applied to part of the farm

Some mitigations were already applied on all farms (fencing)

Some mitigations were not applied to any farms

(1) Did not have enough information (diverting laneway runoff)
(2) Mitigations targeted the same source and pathway (Sed traps & “split grass/clover”)
(3) Too small to justify the effort (off pasture systems)

However – unlikely to have significant effect overall (<1%)

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DAIRY FARMS

M1 - FDE low rate application and storage ponds (Massey pond storage calculator)

M2 - Installed centre pivot irrigators
- Managed irrigation to best practice (soil water balance)
- Increased FDE irrigation areas (equipment)
- Reduced N fertilizer (P21 research)
- Reduced P fertilizer (temporarily: averaged over 25 years)
- Changed from imported barley to low N maize
- Installed a wetland (on a hill block – not flat land)
- Changed from imported silage to low N maize

M3 – Applied planted riparian buffer strips (not to well drained soils)

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DAIRY FARMS – CUMULATIVE % CHANGE

Farm	Profit			Nitrogen			Phosphorus			Sediment		E. coli
	M1	M2	M3	M1	M2	M3	M1	M2	M3	M2	M3	M1
Low Rain, High Prod.	-1	-18	-24	2	-45	-42	10	-10	-20	0	-8	-28
Low Rain, Mod. Prod.	-2	-21	-24	-6	-24	-24	-13	-7	-7	-19	-72	-28
Mod. Rain	-2	-5	-12	0	-8	-8	0	-17	-17	0	-65	-28
High Rain	-2	-17	-22	-2	-11	-11	-6	-6	-6	-22	-39	-21
Irrigated	-1	4	-1	0	-21	-17	0	-11	-11	0	-65	-28
Organic	-1	-6	-7	3	-51	-51	0	-38	-38	0	-22	-21

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SHEEP & BEEF FARMS

M1 - Nothing

M2 - Changed P fertilizer to RPR (sloping land)
- installed wet lands
- CSA protection of winter forage grazing
- earlier reestablishment of pasture after cropping
- Reduced P fertilizer (temporarily: averaged over 25 years)
- Installed centre pivot irrigators
- Managed irrigation to best practice (soil water balance)
- Reduced N fertilizer inputs

M3 - Applied planted riparian buffer strips (not to well drained soils)

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SHEEP & BEEF FARMS – CUMULATIVE % CHANGE

Farm	Profit		Nitrogen		Phosphorus		Sediment	
	M2	M3	M2	M3	M2	M3	M2	M3
Dry, finishing	-16	-25	-10	0	0	-50	-18	-52
Wet, breeding	-17	-25	-9	-9	0	-78	-27	-50
Wet, finishing	-20	-25	-10	-10	-20	-82	-13	-54
S&B finishing	-31	-47	-11	-11	-22	-56	-10	-38
Irr. S&B trading	-18	-27	-20	-20	-33	-56	-21	-33
Trading, 20% crop	-7	-12	-20	-20	-17	-17	0	0
Breeding Sum. Dry	-20	-31	0	0	0	-50	-19	-52

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DAIRY SUPPORT FARMS

M1 - Nothing

M2 - CSA protection of winter forage grazing
- Earlier reestablishment of pasture after cropping
- Reduced N fertilizer inputs

M3 - Applied planted riparian buffer strips (not to well drained soils)

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DAIRY SUPPORT FARMS – CUMULATIVE % CHANGE

Farm	Profit		Nitrogen		Phosphorus		Sediment	
	M2	M3	M2	M3	M2	M3	M2	M3
Fin. Beef + 65% crop	-34	-46	-5	-5	0	-20	0	-33
Dairy S. 15% crop, sum. dry	0	0	-7	-7	0	0	0	0
Dairy S. 48% crop, sum. wet	-6	-15	-27	-27	-10	-30	-17	-44

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SUMMARY

N reductions in the 0 – 45% range

P reductions in the 0 – 82% range

Sediment reductions in the 0 – 72% range

E. coli reductions in the 21 – 28% range on Dairy Farms only

Profit changes in the +4 to -47% range

Data can be used to generate cost abatement curves

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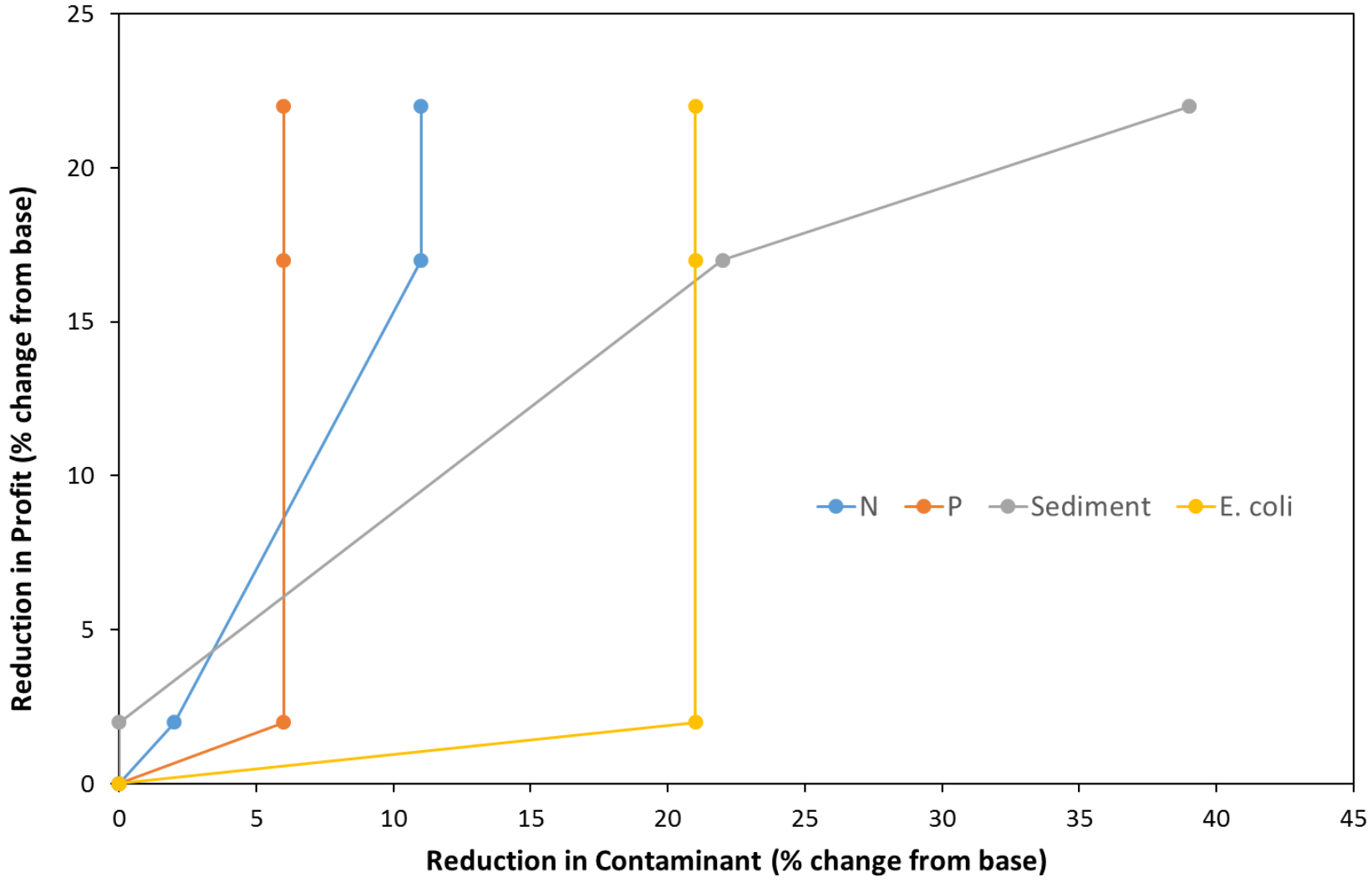
COST ABATEMENT CURVE



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