Ministry for Primary Industries
Manatū Ahu Matua

Ruamahanga Farm-Scale Modelling

Whaitua and Stakeholders' Meeting

Jess Grinter, Environmental Economics Unit, MPI
Terry Parminter, Agricultural Consultant, KapAg

Carterton, Wednesday 11 May 2016

www.mpi.govt.nz

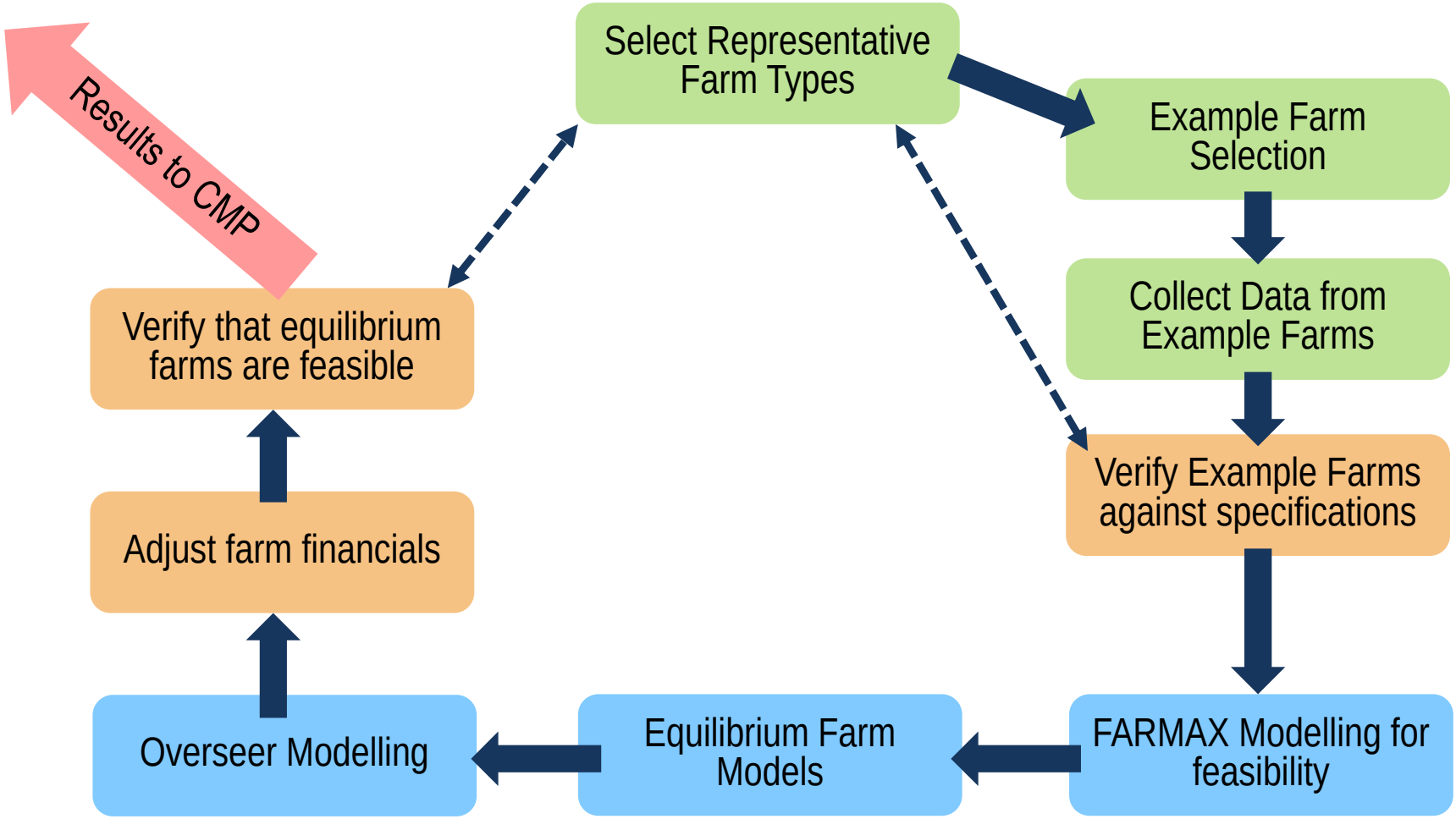
Items to Cover

1. Purpose
2. Overview of the process
    a) Representative farm selection
    b) Collecting data from example farms
    c) Response to feedback from industry groups
    d) Modelling in Farmax and Overseer
3. Final results

Purpose

- Understand:
  - Typical farm systems within the Ruamahanga catchment (80/20 rule)
  - Nutrient losses associated with typical farms (existing situation)
- ‘Fit-for-Purpose’ modelling
- Use this information to set realistic and practically-minded objectives and limits for freshwater

Farm-Scale Modelling Process



Example Farms - Selection

- 40 farms contacted by phone initially, across Ruamahanga catchment
- Those interested in participating were emailed further information and “Frequently Asked Questions”
- Farms were assessed for suitability and ability to provide information with the required level of detail for modelling
- Farms were visited by BakerAg staff to collect data for FARMAX and Overseer

Example Farms - Data Collection

- 1 dairy and 5 sheep and beef farms had **no previous known** contact with BakerAg (40% of total no. of farms)

Those who had some previous contact with BakerAg:

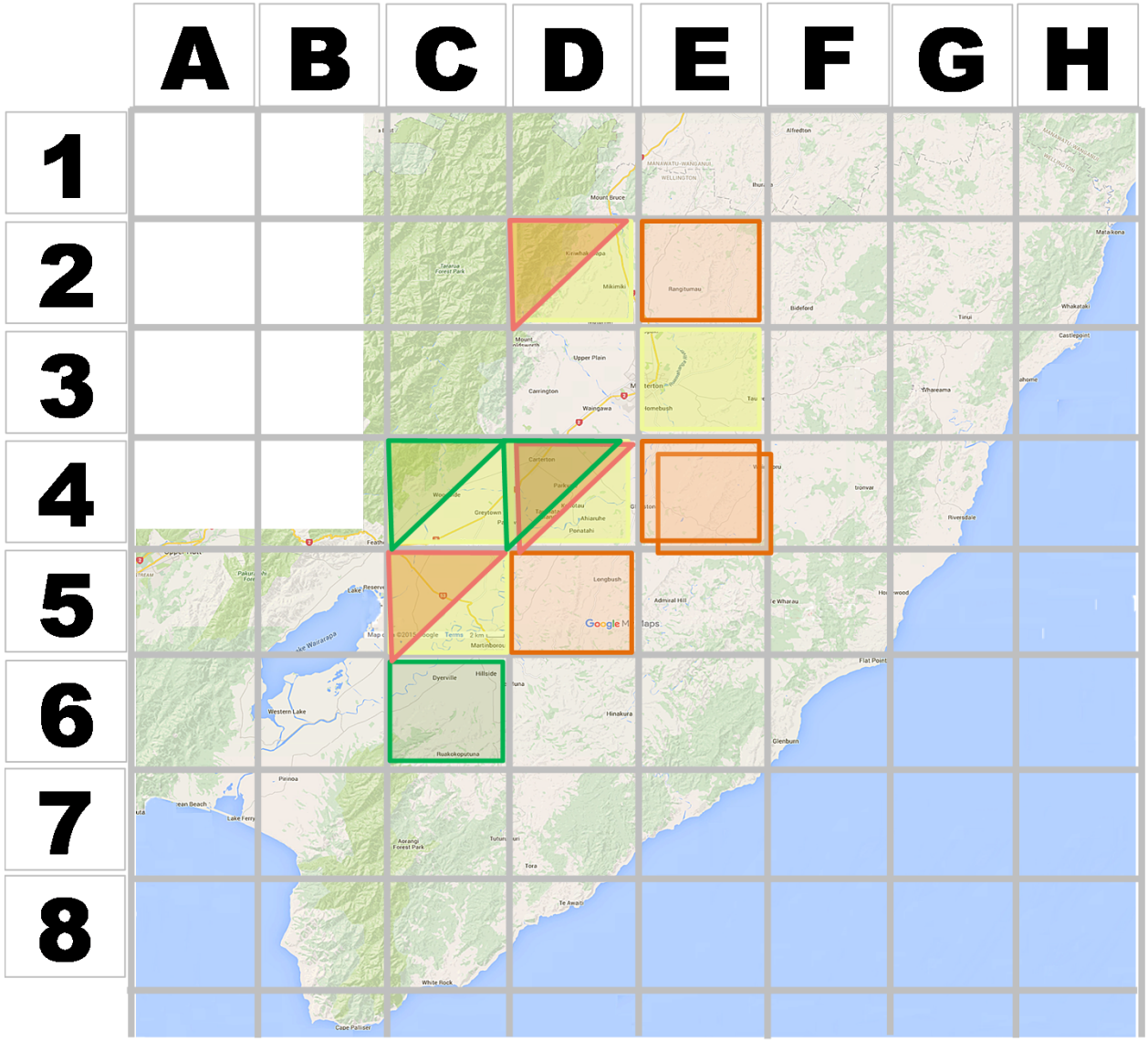
Dairy:

- 3 farms = No contact since prior to 2013
- 1 farm = Some employment services consultancy within last year but not prior to 2014

Sheep and Beef:

- 3 farms = FARMAX and management consultancy within last 18 months (after 2013-2014 season)
- 2 farms = Management consultancy prior to early 2014 (approx.)

Example Farms - General Locations



Dairy farms

Sheep & Beef farms

Dairy support and cropping farms

Example Farms - Systems

Example Dairy Farms	Area (ha)	Annual rainfall (mm)	Dominant soil order	Flat land %	Farming system intensity*				
					I	II	III	IV	V
Low rainfall, high production dairy	367	967	Pallic	100				●	
Low rainfall, moderate production dairy	171	1,356	Gley	100		●			
Moderate rainfall dairy	301	1,100	Pallic	100				●	
High rainfall dairy	204	1,546	Brown	61			●		
Irrigated dairy	427	915	Gley	100				●	
Organic Dairy	355	801	Recent	100		●			

*Farm systems classified using '5 Production Systems' definitions from Dairy NZ

Example Farms - Systems

Example Sheep and Beef Farms	Area (ha)	Annual rainfall (mm)	Dominant soil order	Flat land %	Farming system intensity*				
					1	2	3	4	5
Summer dry S & B finishing	585	825	Brown	30			●		
Summer wet S & B breeding	360	1340	Pallic	0		●			
Summer wet S & B finishing	450	1491	Pallic	0			●		
S & B and bulls	927	870	Pallic	65			●		
S & B and grazing	620	909	Brown	9		●			
S & B livestock trading, 20% cropping	93	880	Pallic	100				●	
Irrigated S & B livestock trading	360	778	Gley	47				●	
Finishing beef 65% cropping	380	910	Pallic	100			●		
Low rainfall dairy support 15% cropping	284	970	Gley	100				●	
High rainfall dairy support 48% cropping	315	1300	Gley	100				●	

*Farm systems classified using definitions that were confirmed by Beef + Lamb NZ as being reasonable

Response to Previous Feedback

Feedback from industry groups (early 2015)	**Action taken**
Reduce number of high rainfall dairy farms	Introduced an extra dairy farm with low rainfall but moderate production, and another dairy farm with moderate rainfall.
Include dairy support grazing on sheep and beef farms, as an alternative enterprise	Added two dairy support farms which also have cropping (15% and 48% cropping each)
Lamb finishing farm size originally suggested was too large; also too many farms in this category	Found example farms of smaller area (e.g. 93 ha), including one with irrigation
Include an irrigated cropping area on lamb finishing farm	Introduced lamb and bull trading farm, with 20% cropping area
Find a dry store lamb farm with cash crops as well as livestock	Lamb and bull trading farm with 20% cropping, plus also found a finishing beef farm with 65% cropping

Farm Financials and Feasibility

FARMAX
YOUR ADVANTAGE

- FARMAX (or FARMAX Dairy) was run by BakerAg for each example farm
- Adjusted to equilibrium
- Made **feasible** before starting Overseer

Farm Adjustments

FARMAX
YOUR ADVANTAGE

To achieve an equilibrium, each of the farm systems had to be adjusted for:

- Matching opening and closing livestock numbers
- Stable replacement and culling numbers
- Equal opening and closing supplementary feed in storage
- Matching forage and regrassing areas
- Balanced and repeating cash crop rotations
- Maintenance fertiliser applications (phosphate, potassium and sulphur)

Initial Overseer Modelling

OVERSEER®

- Determined baseline nutrient budgets for each representative farm type
  - Overseer Version 6.2.1 (2016)
- Adjusted farm financials to reflect the changes required to develop ‘equilibrium’ farm models

Farm ‘Equilibrium’ Adjustments

- Data collected from farms was for the 2013 – 2014 financial year
- Applied a long term average milk solids (MS) price of $6 kg MS per hectare, per year
- Adjustments were required prior to modelling in Overseer
  - Adjust farm data to reflect 30 year long-term average
- Final Overseer outputs reflect equilibrium state

Final Farm-Scale Modelling Results

Representative Farm Type	Farm Background				Leaching and losses to root zone					Runoff to surface water	
	Effective Area (ha)	Stocking Rate (RSU/ha)	Annual Rainfall (mm/year)	Economic Farm Surplus ($/ha/yr)	Average annual drainage depth (mm)	Average annual nitrate leached (kgN/ha/yr)	Average annual N concentration in drainage water (ppm)	N lost in urine (kgN/ha/yr)	Annual P loss (kg P/ha/yr)	Average annual N loss in runoff (kgN/ha/yr)	Average annual P loss in runoff (kgP/ha/yr)
Low rainfall, high production dairy	367	37	967	1,309	514*	42	7.7	37	1.0	0	0.6
Low rainfall, moderate production dairy	171	21	1,356	2,109	437*	34	3.3	13	1.5	0	0.9
Moderate rainfall dairy	301	28	1,100	1,441	356*	24	5.1	19	1.2	0	0.9
High rainfall dairy	204	28	1,546	2,413	739	47	5.3^	31	1.7	1	1.3
Irrigated dairy	426	27	915	1,492	510*	24	4.3^	17	0.9	0	0.6
Organic dairy	355	22	801	1,708	409*	35	6.1	30	0.8	0	0.5

Final Farm-Scale Modelling Results

Representative Farm Type	Farm Background				Leaching and losses to root zone					Runoff to surface water	
	Effective Area (ha)	Stocking Rate (RSU/ha)	Annual Rainfall (mm/year)	Economic Farm Surplus ($/ha/yr)	Average annual drainage depth (mm)	Average annual nitrate leached (kgN/ha/yr)	Average annual N concentration in drainage water (ppm)	N lost in urine (kgN/ha/yr)	Annual P loss (kg P/ha/yr)	Average annual N loss in runoff (kgN/ha/yr)	Average annual P loss in runoff (kgP/ha/yr)
Sheep and beef finishing, summer wet	450	11.7	1,491	522	696	20	2.3^	11	5.5	1	5.4
Sheep and bull finishing	927	11.5	870	459	282	9	3.0^	6	0.9	0	0.8
Irrigated sheep and beef trading	360	13.3	778	445	323	15	3.9^	8	0.9	0	0.8
Lamb and bull trading 20% cropping	93	17.3	880	1,229	153	20	6.3^	6	0.6	0	0.3
Sheep and beef breeding, summer dry	620	11.1	909	345	279	8	2.7^	6	0.2	0	0.1

Please see handout

Final Farm-Scale Modelling Results

Representative Farm Type	Farm Background				Leaching and losses to root zone					Runoff to surface water	
	Effective Area (ha)	Stocking Rate (RSU/ha)	Annual Rainfall (mm/year)	Economic Farm Surplus ($/ha/yr)	Average annual drainage depth (mm)	Average annual nitrate leached (kgN/ha/yr)	Average annual N concentration in drainage water (ppm)	N lost in urine (kgN/ha/yr)	Annual P loss (kg P/ha/yr)	Average annual N loss in runoff (kgN/ha/yr)	Average annual P loss in runoff (kgP/ha/yr)
Finishing beef 65% cropping	313	19.3	910	1,086	334	21	6.0	8	0.5	0	0.4
Dairy support 15% cropping	284	10.2	970	537	284	15	3.2	7	0.3	0	0.2
Dairy support 48% cropping	300	19.6	1300	1,107	617	93	14.3	19	1.0	0	1.0

Questions & Discussion