Spotlight on OVERSEER®: approaches to addressing nutrient management using an integrated farm systems model

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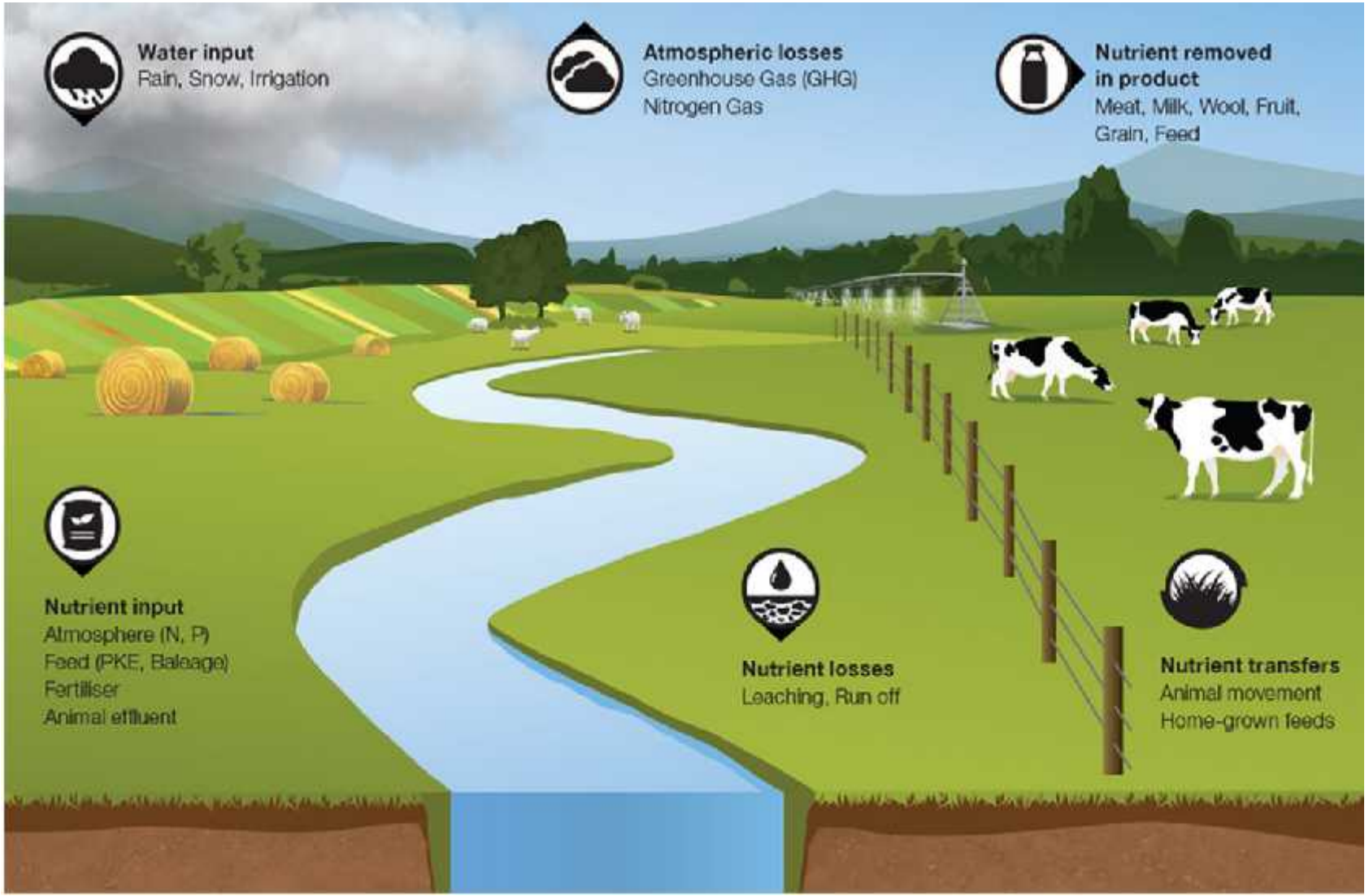
Water input
Rain, Snow, Irrigation
Atmospheric losses
Greenhouse Gas (GHG)
Nitrogen Gas
Nutrient removed in product
Meat, Milk, Wool, Fruit, Grain, Feed
Nutrient input
Atmosphere (N, P)
Feed (PKE, Baleage)
Fertiliser
Animal effluent
Nutrient losses
Leaching, Run off
Nutrient transfers
Animal movement
Home-grown feeds

Development Objectives

Created a tool that that farmers and consultants could use that captures farm management systems across New Zealand by:

- Capturing paths of nutrient transfers within a farm system
- Using a robust science process to capture the fate of nutrients at each transfer point
- Using data that the farmer knows, is readily available, or suitable defaults are available
- Focus on mitigation options

So that **outputs are farm-specific**

Nutrient budget | Nitrogen | Phosphorus | Graph - N pools | Graph - changes in N pools | Comments | Maintenance nutrients | Relative yield | Other values | Irrigation input data

Nutrient budget

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na	H+*
Nutrients added								
Fertiliser, lime & other	41	32	0	38	70	5	0	0.0
Rain/clover N fixation	190	0	2	5	2	5	25	0.2
Irrigation	12	0	8	12	45	11	46	0.0
Supplements fed on block	65	8	67	7	16	7	5	2.3
Nutrients removed								
As animal products	15	4	1	2	8	0	0	0.0
As supplements	0	0	0	0	0	0	0	0.0
Net transfer by animals	7	1	6	0	1	0	0	-0.1
To atmosphere	84	0	0	0	0	0	0	0.0
To water	33	0.1	13	60	51	4	16	-1.9
Change in block pools								
Organic pool	169	10	0	0	0	0	0	-0.1
Inorganic mineral	0	0	-4	0	-1	-1	-2	0.0
Inorganic soil pool	0	26	61	0	74	24	61	4.7

* Acidity - used in calculation of maintenance lime requirements. A gain in acidity indicates that soil pH will decrease

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Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy

Footprint units | Footprint product | Pasture production | Other values | Full parameter report

Based on total farm area CO_2 equivalents (kg/ha/yr)	Current farm
Methane	**9,584**
Enteric	9,463
Dung	120
Effluent	1
N_2O emissions	**5,219**
Excreta paddock	4,502
Excreta effluent	0
N fertiliser	102
Crops	0
InDirect	616
CO_2 emissions	**871**
Electricity	306
Fuel	81
N fertiliser	108
Fertiliser and organic inputs	78
Lime	0
Supplements	283
Animal transport	14
Other	1

This report has been developed using IPCC global warming potentials.

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Value of benefit to NZ agriculture

- Research tool

  $51 (26-102) million/year
- To assist in the efficiency of fertiliser use

  $161 (54-161) million/year
- Nutrient management on farm

  $113 (73-137) million/year

Effluent management

- Most effluent re-applied to pasture
- Fertiliser requirements

Nutrient budget

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na	H+*
Effluent added	122	15	146	11	26	18	5	-3.2

Effluent management

- Most effluent re-applied to pasture
- Fertiliser requirements
- Animal health

Nutrient budget

	(kg/ha/yr)	N	P	K	S	Ca	Mg	Na	H+*
No feed pad	Effluent added	122	15	146	11	26	18	5	-3.2

Effluent management

- Most effluent re-applied to pasture
- Fertiliser requirements
- Animal health
- Effluent block size - target of 150 kg N

Nutrient budget

	(kg/ha/yr)	N	P	K	S	Ca	Mg	Na	H+*
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Effluent management

- Most effluent re-applied to pasture
- Fertiliser requirements
- Animal health
- Effluent block size - target of 150 kg N
- Pads and supplements

Nutrient budget

	(kg/ha/yr)	N	P	K	S	Ca	Mg	Na	H+*
No feed pad	Effluent added	122	15	146	11	26	18	5	-3.2
Feed pad	Effluent added	228	26	264	21	46	31	9	-5.9

Urine N leached

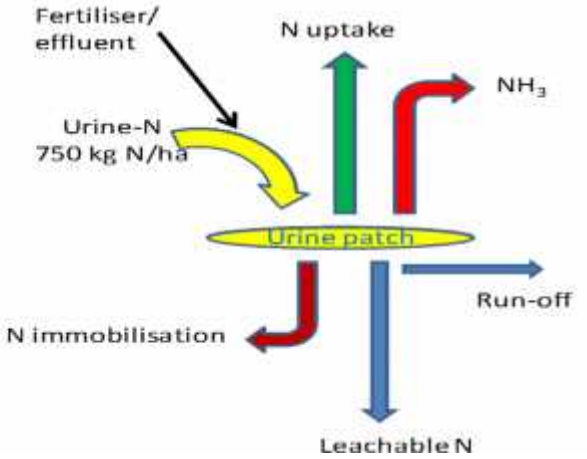
Balancing the rate of N in urine patch and rate of N removal against the transport mechanism

- If N removal is slow, then there is time for the N to be transported below the root zone

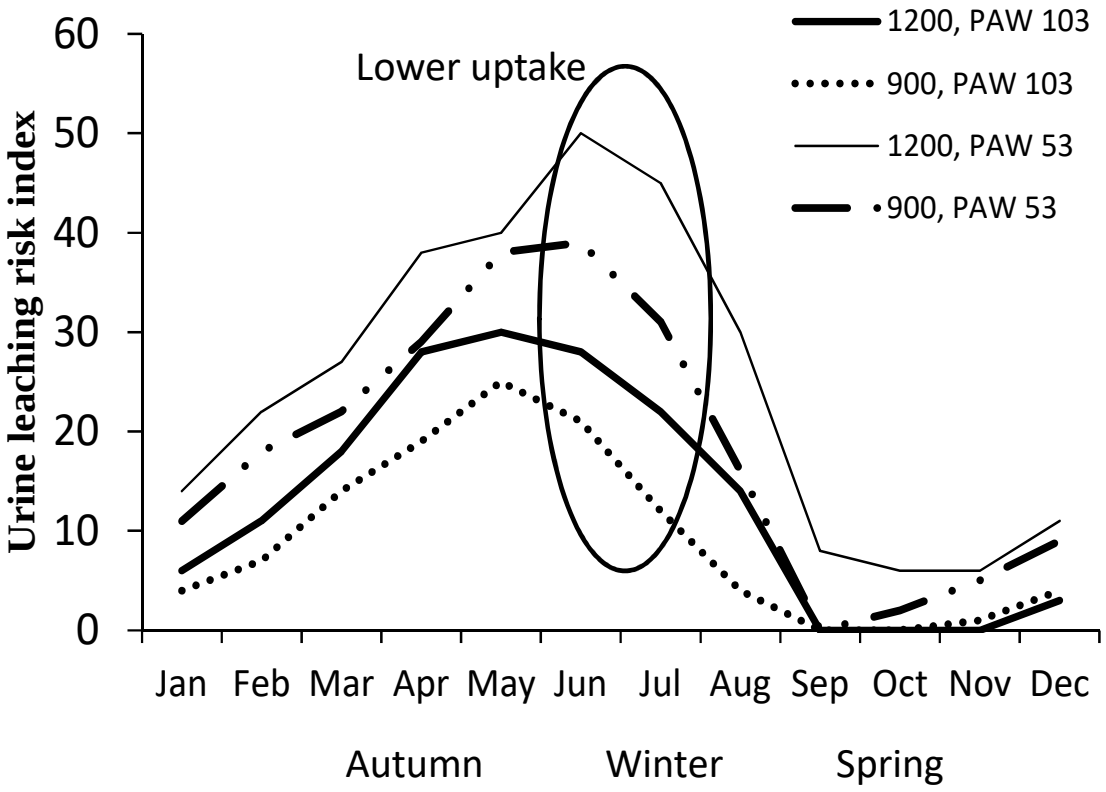
Each month:

N leached = N added per ha * proportion N leached

Excreta (N intake less product) animal numbers, production animal feeding Excreta distribution (pads, lanes etc)	Climate (rainfall, temperature) Soil water properties Growth rates, Drainage Break through curves



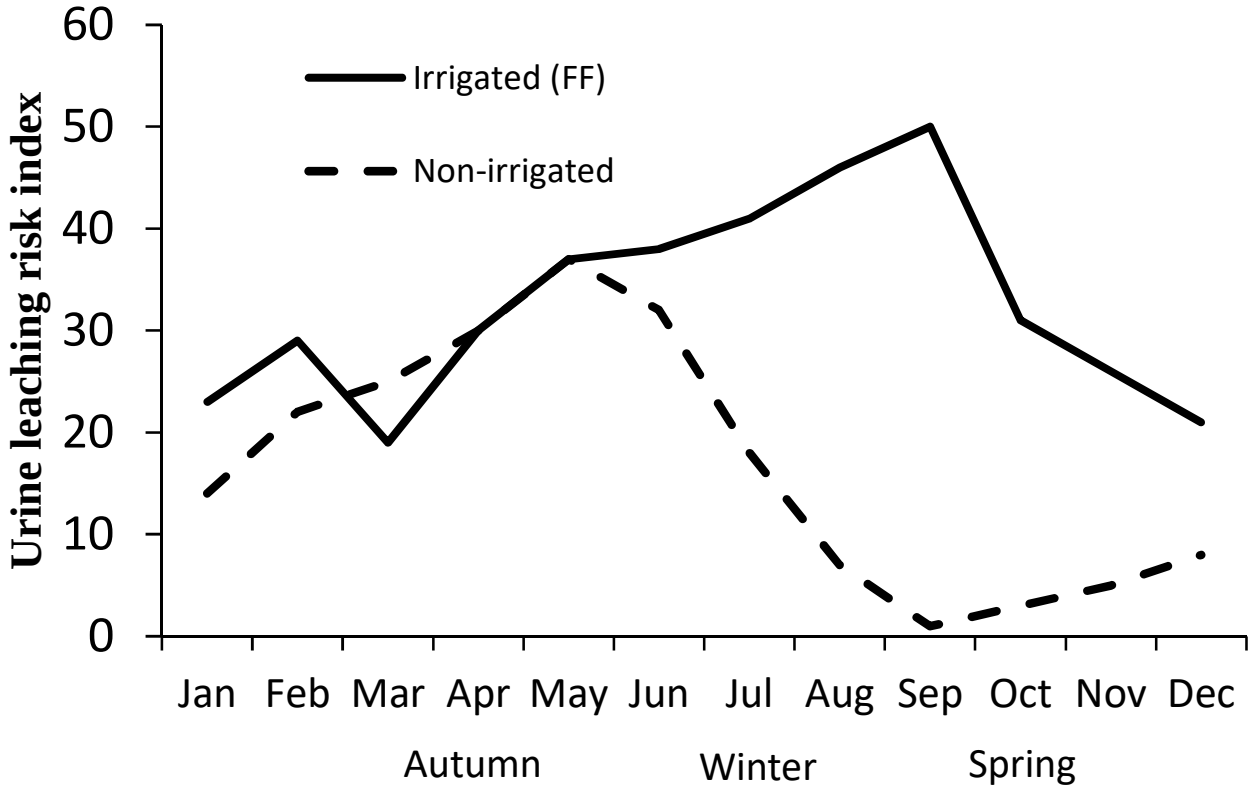
Urine leaching risk



N leached = N added per ha * proportion N leached

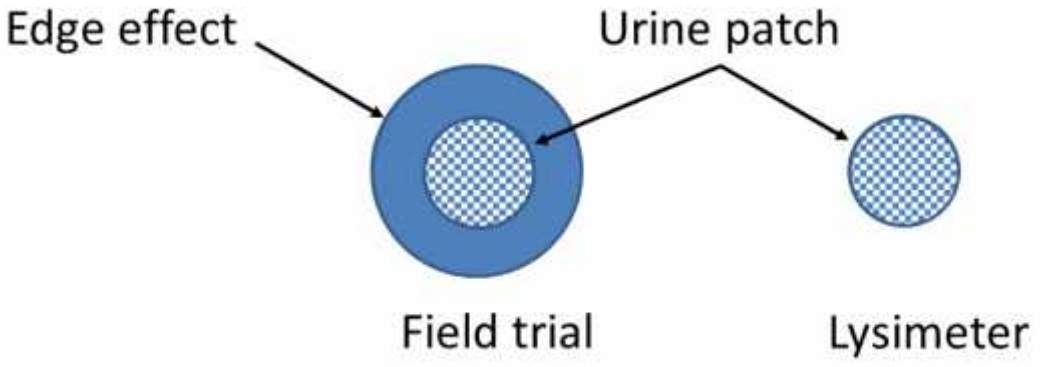
Mitigation options
Remove animals
Reducing intake

Irrigated pastures

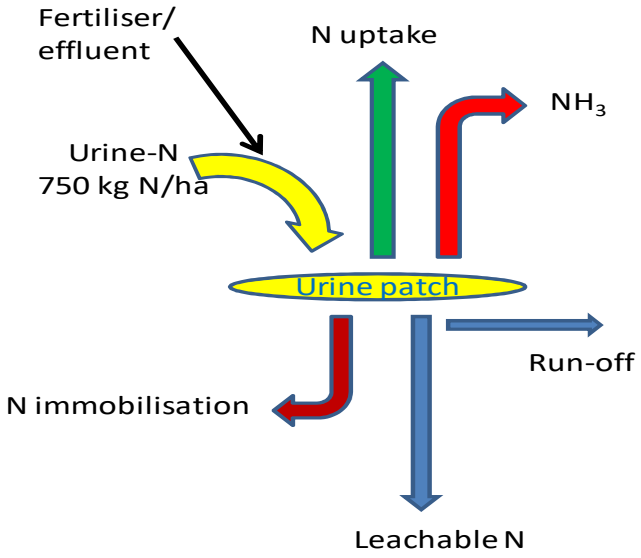


N uptake

- When trying to model lysimeter and field trial results,
  - led to research on edge effects



Buckthought
Shepherd



Conclusion

- Creating a model that describes the farm from the farmer perspective
- NZ agriculture has benefited from the model
- Close association between science, industry, and regional councils