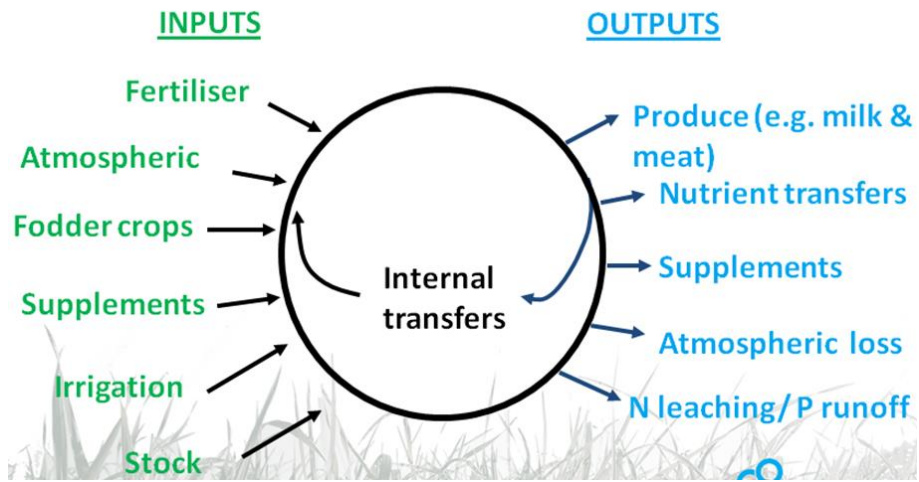


# OVERSEER® Development, and Drivers of Nutrient Loss

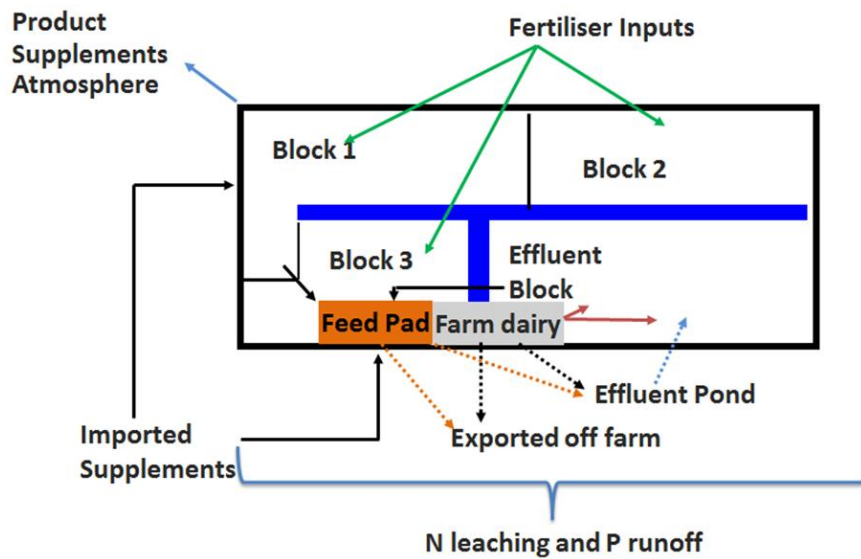
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OVERSEER® is a computer modelling tool jointly owned by MPI, Fertiliser Association of NZ and AgResearch. It tracks nutrient flows into, out of, and within a farm system. It can estimate off-farm losses such as nitrogen leaching, phosphate run-off and greenhouse gas emissions. It also calculates maintenance fertiliser nutrient and lime requirements and can identify nutrient hotspots “i.e. high loss blocks”. Being a modelling tool it can also run “what if” scenarios at a farm and block level.

**How does OVERSEER® work?**



**Overseer’s strength is in tracking nutrients around the farm**



## **OVERSEER® main assumptions**

- The user supplies actual and real farm data.
- Model uses long-term annual averages for climate data.
- Assumes any management practice implemented on the farm follows best practice e.g. fertiliser spread rates over the whole block are at the rate specified, that best practice effluent management is followed.

## **OVERSEER® strengths**

Overseer's key strengths are the ability to calculate how much nutrient comes onto the farm from a variety of sources (e.g. fertiliser, supplements, rainfall) and to apportion these nutrients to specified blocks or Land Management Units within the farm boundary or off farm.

Overseer can form the basis of fertiliser recommendations (sub maintenance, maintenance and capital scenarios) that can be included in a farm's Nutrient Management Plan. It can also easily run scenario analyses to test mitigation techniques aimed at reducing losses or improving nutrient use efficiency.

Effective use of Overseer requires the user to enter actual and reasonable input values that are representative of the farm. The old adage of "rubbish in = rubbish out" applies to Overseer.

A reasonable level of understanding of farm systems and of the particular farm is required to be able to do this.

## **What are some of the key drivers of OVERSEER®?**

The table below lists the key drivers of Overseer and the degree of influence they have. Additionally they include:

- Animals (numbers, liveweight, winter grazing, species, gender).
- Effluent management (farm dairy, pads/animal shelters).
- Fertiliser (type, amount and timing).
- Fodder crops (winter or forage crops).
- Imported feed (type and amount).

Input Variable	Impact on N loss	Ability to Influence
Soil type and soil properties and slope	High	No
Stocking rate	Moderate to high Depending on extent of change	Yes
Animal species	Moderate to high	Yes except on dairy
Wintering cows off farm	Moderate to high	Yes
Gender of Cattle	Moderate	Yes except on dairy
Rainfall	Moderate to high	No
Irrigation	Moderate to high	Yes
Amount of supplement imported	Low to moderate	Yes
Type of supplement imported	Low to moderate Low N v High N supplements	Yes
Effluent management/system	Low to moderate to high	Yes/No
Effluent N	Generally a low to moderate Dependent on timing and rate	Yes
Fertiliser N	Generally a low to moderate Dependent on timing and rate	Yes

### How does nitrogen leaching occur?

Nitrogen leaching occurs when there is nitrate N in the soil and drainage is occurring. Drainage occurs when rainfall and/or irrigation exceeds evapotranspiration. Animal urine is the greatest source of N as it contains high concentrations of urea N (cows, 600-1000 kg N/ha equivalent; sheep 300-400 kg N/ha equivalent). Animals also deposit a high volume (17-45 L/day) of urine which can lead to drainage and leaching in hotspots. The amount of N in urine can be influenced by the amount of protein in the diet. Nitrogen fertilisers have only a modest direct influence but a more significant indirect influence by increasing pasture growth = higher stocking rate = more stock urine N.

### Nitrogen Use Efficiency (NUE)

Sometimes called Nitrogen Conversion Efficiency, NUE is defined in Overseer as the amount of N in products (e.g. milk, meat) divided by the amount of N in inputs (e.g. fertiliser N, supplement N, clover fixation).  $NUE = \text{product N} / \text{N inputs}$ . There is a weak relationship between N loss to water and NUE as demonstrated by trial work conducted by Wheeler, Power and Shepherd (reported at the Fertiliser and Lime Research Conference in 2012). Having a high NUE does not mean that you necessarily have a low N loss to water.



Effectively no relationship between N use efficiency and N leached for dairy (top) or non-dairy (bottom)

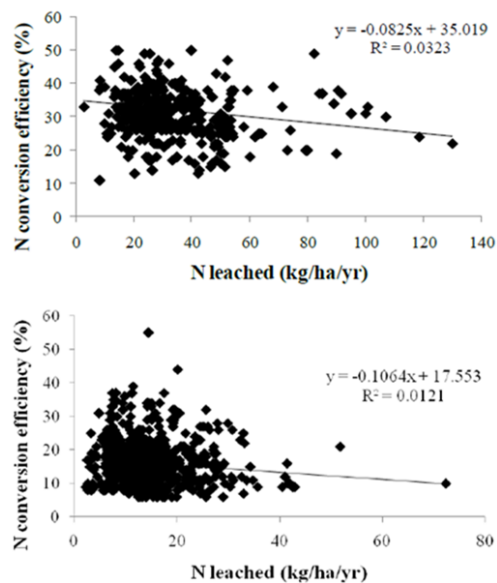


Figure 2. Relationship between N leached and N conversion efficiency for dairy (top graph) and non-dairy (bottom graph) farms.

### Managing NUE

Increasing the conversion rate of N inputs to product N will increase NUE. Examples of actions that can be taken include:

- Increasing production without any additional inputs (general farm efficiency gains).
- Effective winter pasture management increasing utilisation.
- Using less nitrogen and reducing the application rate (little and often).
- Reducing wastage in supplementary feeding thus reducing the need for nitrogen grown pasture.
- Optimising stocking rate.
- Strategic use of a low protein (low N) supplementary feed instead of fertiliser N.
- Exporting effluent N (to run-off maize block or similar).
- Increasing the effluent block area on farm.
- More efficient use of captured effluent by:
  - avoiding late autumn and winter applications,
  - using a low rate effluent application system, and
  - ensuring there is adequate effluent storage.

### How do we lose phosphorus to the environment?

Phosphate loss occurs with water runoff and soil erosion as sediment P and water soluble P. Runoff occurs when excessive rainfall and/or irrigation occurs and water infiltration through the soil is poor. e.g. poorly structured soils. P runoff is strongly linked to Olsen P levels as sediments carry the P bound to them. Slope and proximity to waterways can also influence the rate of runoff and soil erosion potential. Phosphate fertiliser type and the amount, timing and solubility can affect the potential for losses.

## Life without OVERSEER®

Overseer for regulatory compliance is currently an output based system. This means that we may still have to meet a nutrient loss limit (e.g. Taupo), BUT

- We are measured on outputs NOT inputs.
- Our inputs are not limited (within reason).
- We have flexibility to farm.
- Allows for innovation.

Without Overseer we would likely have an input based regulatory system. This may mean we would have limits or restrictions to inputs such as:

- Fertiliser type, amount and timing.
- Stocking rates, sheep/cattle ratios.
- Type and amount of supplements imported.

And it could:

- Restrict flexibility and innovation in farming.
- Place limits on production.

## Sustainable Dairying Water Accord

- The Accord outlines a commitment to good management practices which are expected of all dairy farmers in New Zealand, and records a pledge by the dairy sector and supporting partners to assist dairy farmers to adopt those good management practices and to monitor and report progress.
- Farm specific results will not be shared with any third party outside of Ballance and your dairy company. The intention is to use the collective data to look at trends at a regional and national level.
- Target: Data collected and performance benchmarked for 85% of dairy farms by 30 November 2014; 100% of dairy farms by 30 November 2015.

## How can Ballance Agri-Nutrients help?

- Ballance field staff are trained in nutrient management via participation in the Sustainable Nutrient Management courses held at Massey University. These improve our understanding of nutrients in farm systems. Our Agro-science extension team provide in-house training and Ballance Field Consultants are undergoing Certified Nutrient Management Advisor accreditation.
- We produce farm Nutrient Budgets and Nutrient Management Plans and give advice on fertiliser recommendations, identifying high nutrient loss areas and running “what if” scenario analyses.
- We also develop innovative products which aim to assist farmers to meet the evolving expectations of the New Zealand dairy and drystock industries.