THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

POWDER

the milk **P**roduction **O**ptimiser incorporating **W**eather **D**ynamics and **E**conomic **R**isk

Oscar Dowson

Supervisors
Andy Philpott, Andrew Mason, Anthony Downward

Biggest El Nino in 18 years could be costly, based on history

RACHEL THOMAS
Last updated 16:19, October 2 2015

GETTY IMAGES

Farmers will be hoping to avoid a repeat of the dry conditions of previous El Ninos, especially those who suffered during last summer's drought.

The biggest El Nino since 1997-98 is picked to continue its grip on New Zealand and could cost the country's economy hundreds of millions of dollars.

Niwa says the weather pattern was "virtually certain" to continue over the next three months - with average to below average temperature and rainfall levels predicted for most parts of the country.

Biggest El Nino in 18 y based on history

RACHEL THOMAS
Last updated 16:19, October 2 2015

Farmers will be hoping to avoid a repeat of the dry condition during last summer's drought.

The biggest El Nino since 1997-98 is picked to continue its economy hundreds of millions of dollars.

Niwa says the weather pattern was "virtually certain" to cont average temperature and rainfall levels predicted for most

East coast farmers grumpy that forecasters got El Nino predictions so wrong

MARTY SHARPE
Last updated 17:07, March 8 2016

Where's the drought that was forecast? ask east coast farmers.

The El Nino weather pattern didn't bring drought to parts of the country as expected, and now there are some grumpy farmers wondering how forecasters got it so wrong

From early last year forecasters were talking about the impending El Nino and its possible effects.

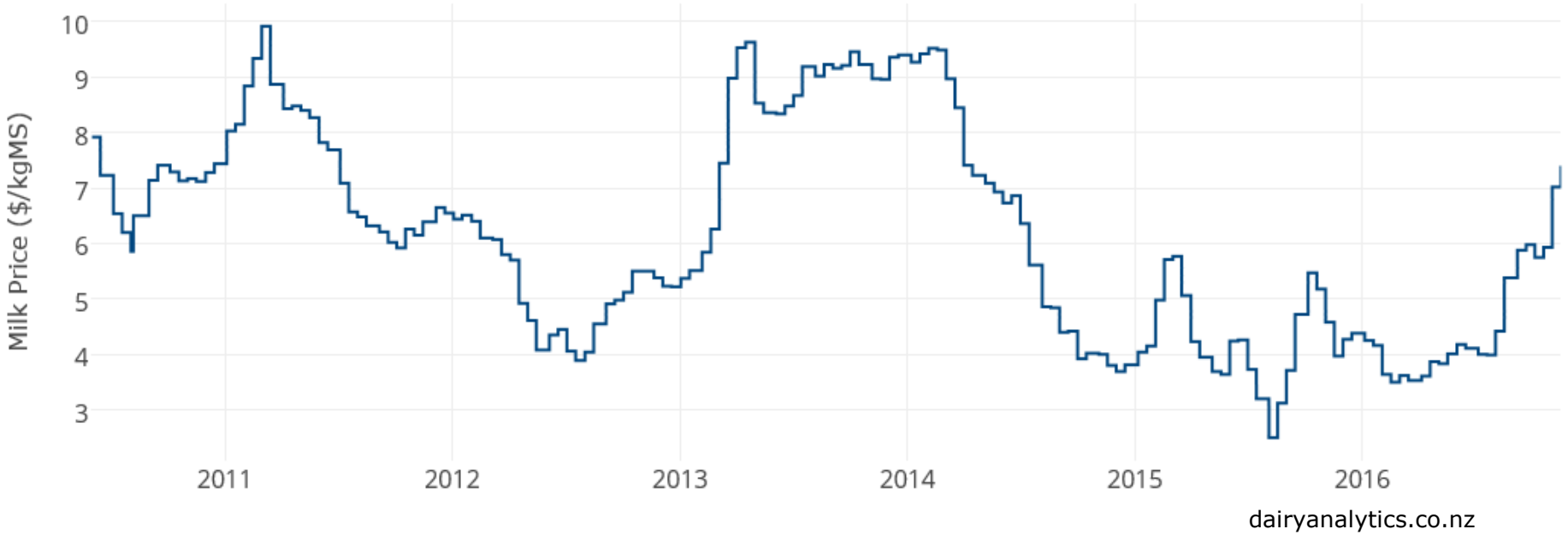
Early signs had it pegged to replicate conditions that brought severe widespread drought in 1997-98, especially in the east of the country.

But Hawke's Bay Federated Farmers spokesman Will Foley said it had not panned out that way, and now there were "lots of grumpy farmers around" because they had got rid of stock in preparation for the dry.

"There's some quite grumpy people around that made decisions based on the warnings and they feel that's cost them money, or a lost opportunity.

"They're wondering 'What can we do about it' or 'Should we take any notice next time'," Foley said.

Price is Volatile



Home About Photo Essays Rural Development The Fairfax Articles

← America's mega dairy farms EU ramps up dairy production again →

Dairy prices are not predictable

Posted on April 20, 2016

In recent weeks, the news media has been reporting wildly opposing views on short term dairy prices.

ASB's Nathan Penny has been predicting a 2016/17 payment that will start with a '6'. In contrast, Westland's Chair Matt O'Regan and CEO Rod Quinn are saying that they see ongoing gloom for up to two years. Rabobank see improvement but not until 2017. And Fonterra's John Wilson has almost apologised for past failures with his acknowledgement that predicting prices is indeed difficult.

keithwoodford.wordpress.com

dairyanalytics.co.nz

← America's mega dairy farms

EU ramps up dairy production again →

Dairy prices are not predictable

Posted on April 20, 2016

In recent weeks, the news media has been reporting wildly opposing views on short term dairy prices.

ASB's Nathan Penny has been predicting a 2016/17 payment that will start with a '6'. In contrast, W
ongoing gl
Fonterra's
that predic

Dairy price estimates are consistently wrong

Posted on May 31, 2016

As occurs each year, the media have focused on Fonterra's opening forecast for the coming year, predicted this year to be $4.25, as if it has significant meaning. To put that in perspective, here are Fonterra's opening forecasts and actual payments for the last five years.

Year	Opening Forecast ($)	Actual Payment ($)	Variation $)
2011/12	6.75	6.08	- 0.67
2012/13	5.50	5.84	+ 0.34
2013/14	7.00	8.40	+ 1.40
2014/15	7.00	4.40	- 2.60
2015/16	5.25	3.90 (not yet final)	- 1.35

https://mylankaproperty.com/oil-palm-plantations/

http://www.onegreenplanet.org/animalsandnature/outstanding-organizations-working-to-save-endangered-orangutans/

The hidden costs of bought-in feed

Bought-in feed is a loss-maker disguised within dairy farm accounting systems, Barrie Ridler explains.

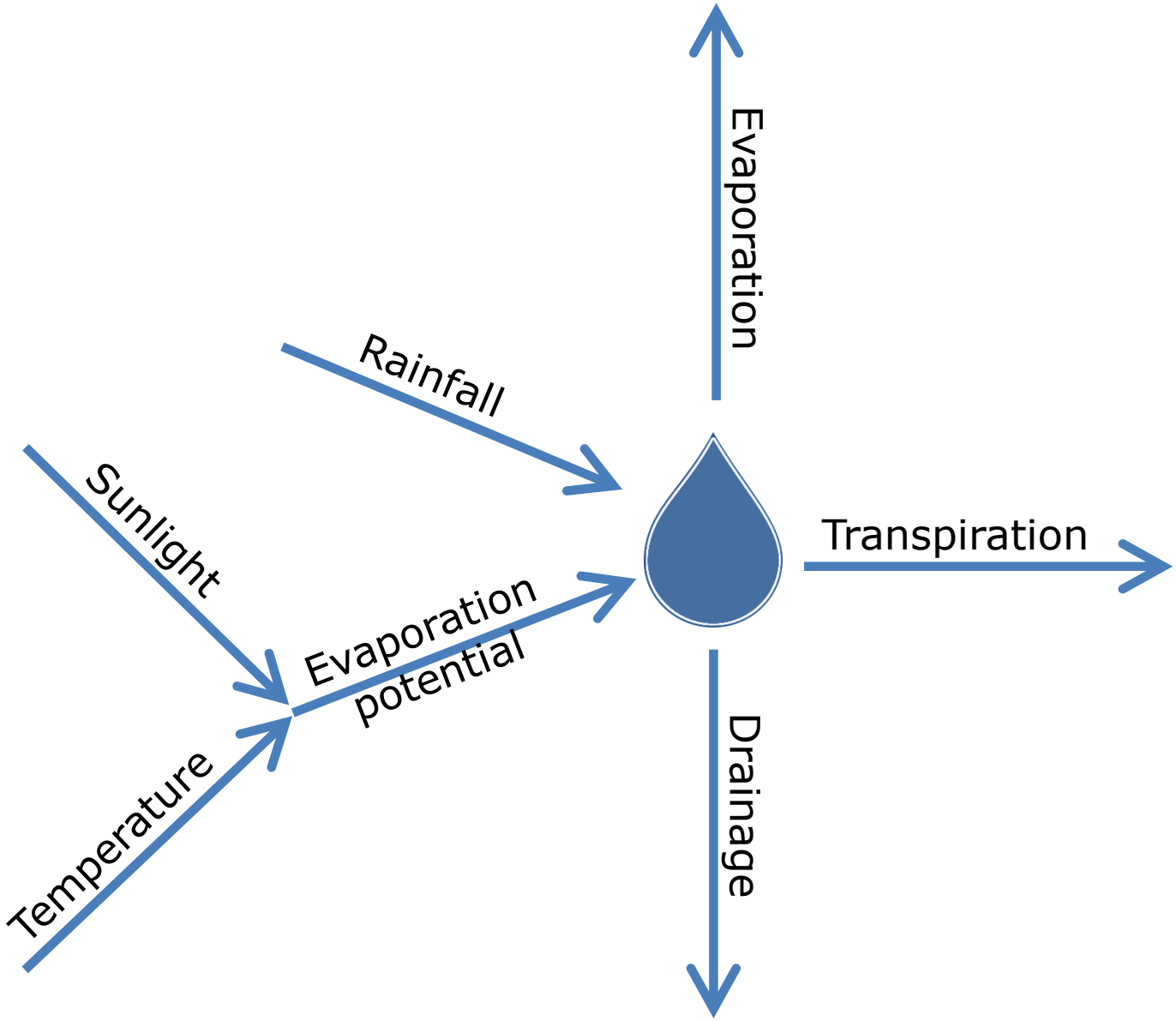
Last updated 13:34, March 8 2016

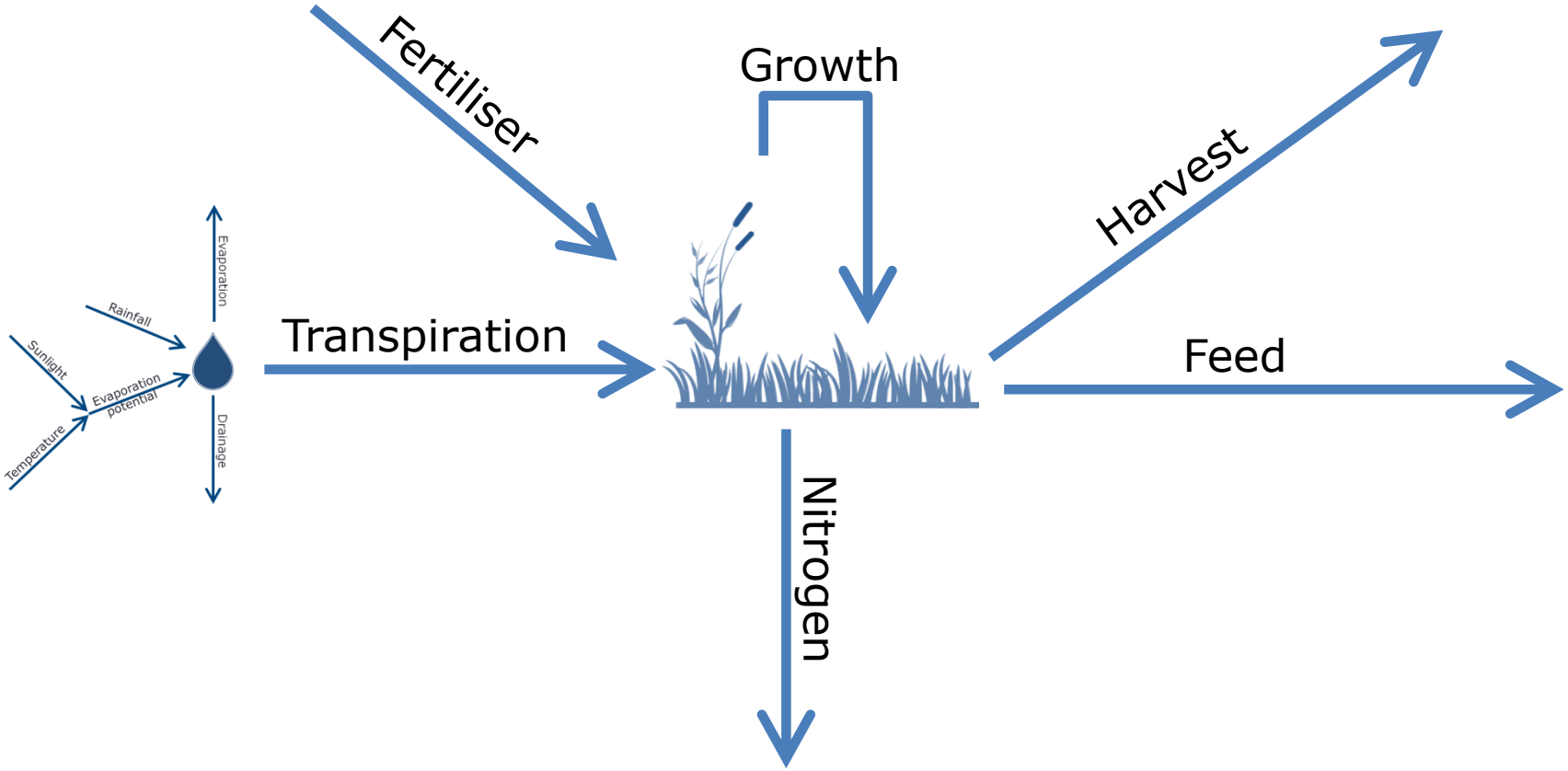
Widely used farm models use averages and therefore cannot answer "Which costs should be cut?" as they cannot identify where the additional costs of production are not covered by the additional production.

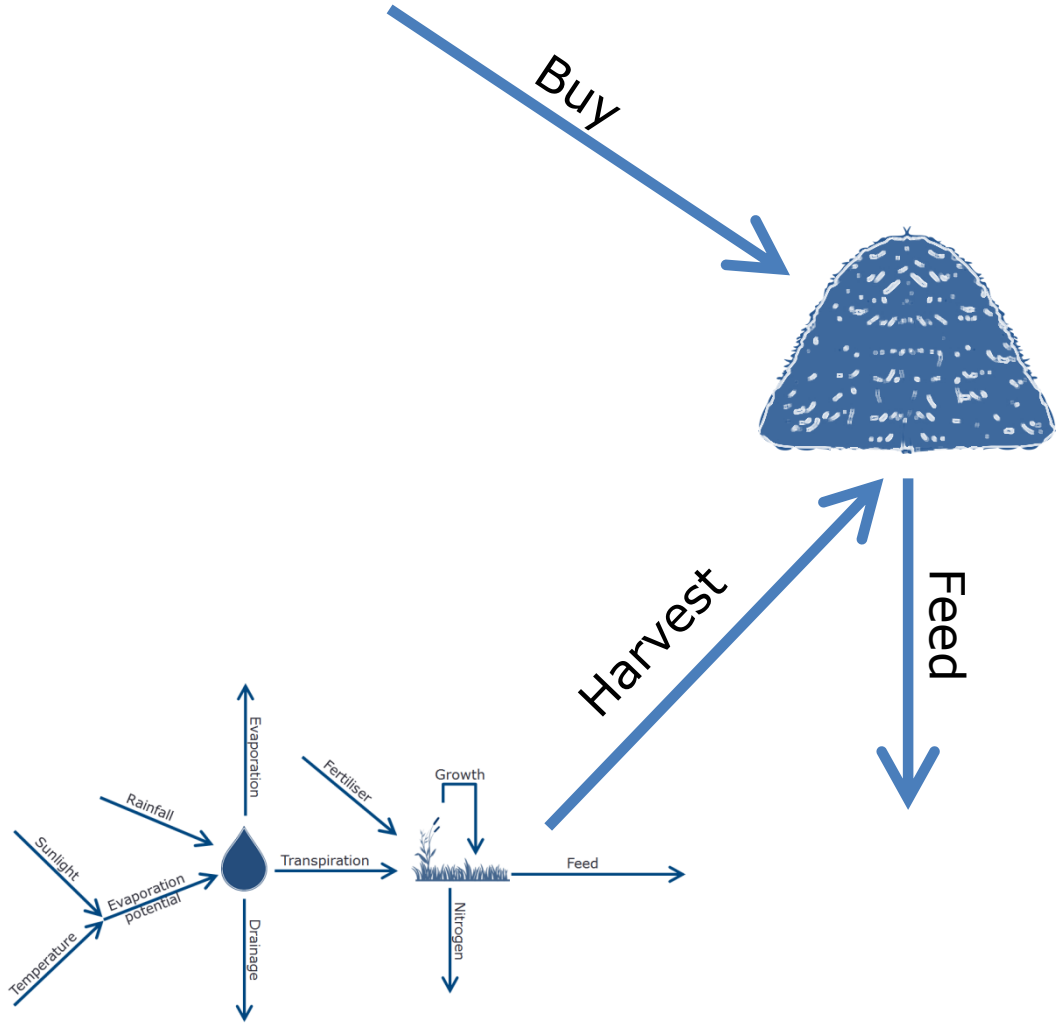
Averages and benchmark now obscure the detail required to identify the point where losses begin.

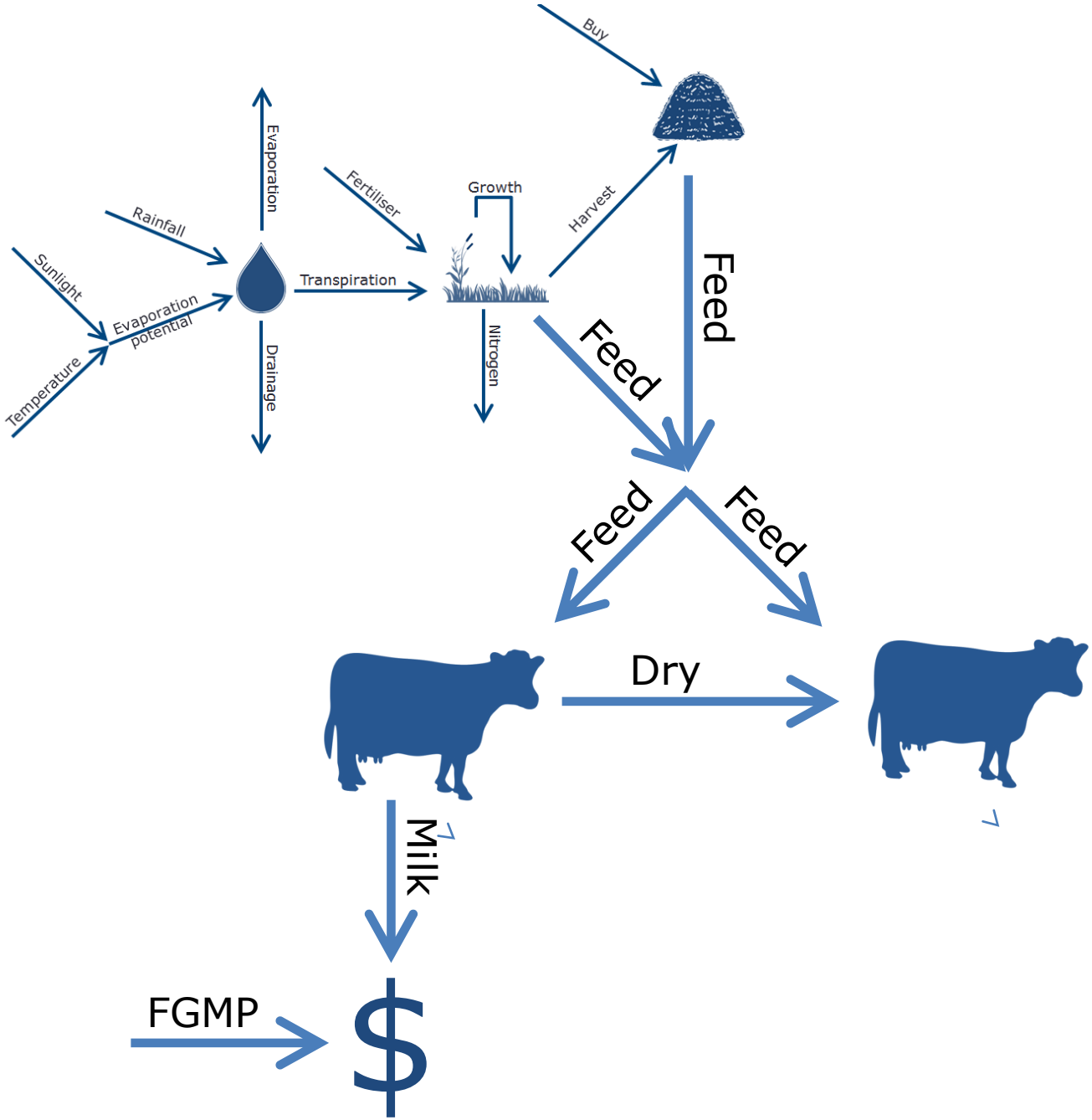
Basic maths has shown that the direction the dairy industry has encouraged has not been well thought out and many farmers now bear the consequences.

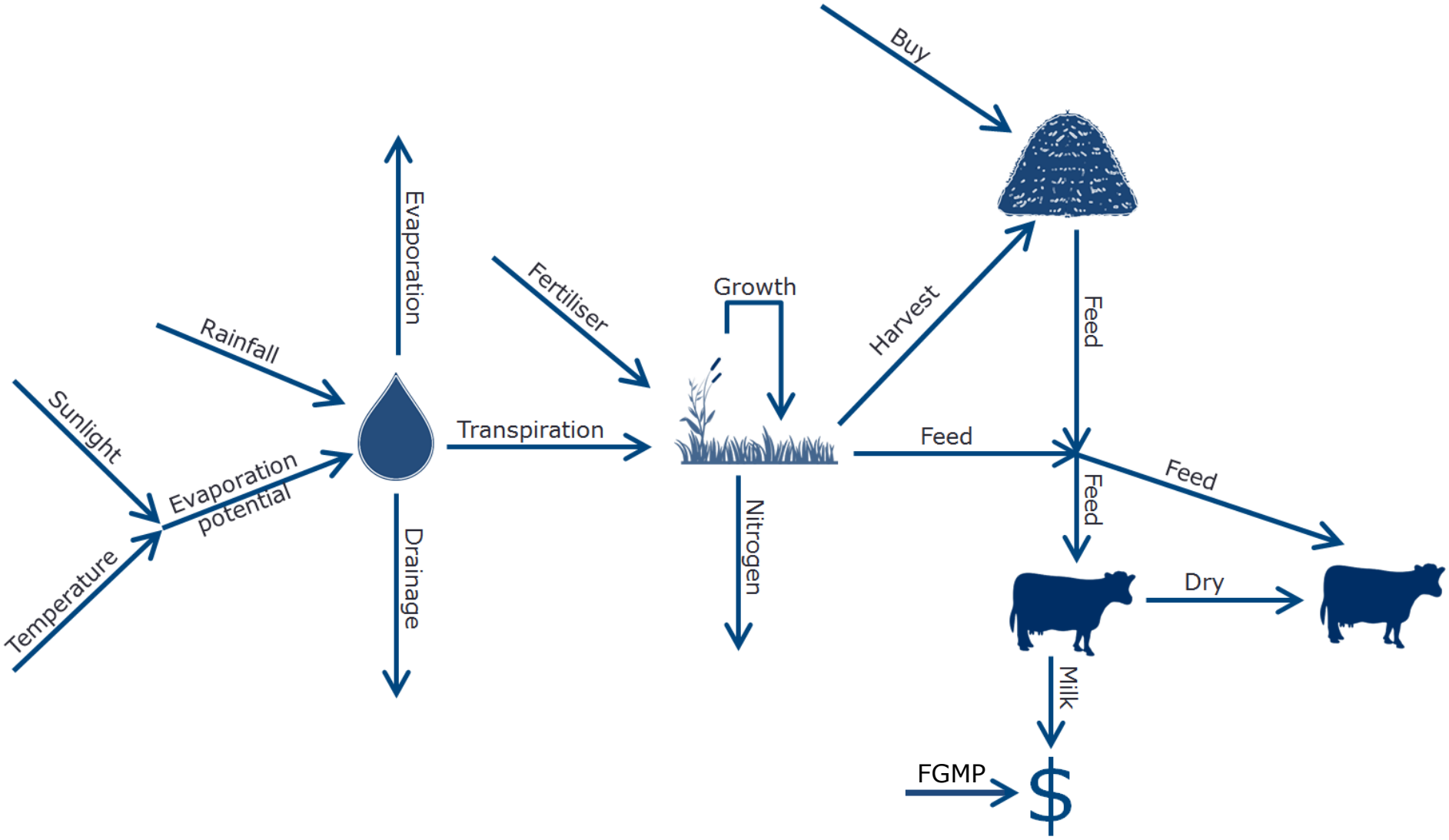
Stochastic Dual Dynamic Programming to the rescue!


Evaporation
Rainfall
Sunlight
Transpiration
Evaporation
potential
Temperature
Drainage


Fertiliser
Growth
Harvest
Rainfall
Evaporation
Sunlight
Evaporation potential
Temperature
Drainage
Transpiration
Feed
Nitrogen


Buy
Harvest
Feed
Evaporation
Rainfall
Fertiliser
Growth
Sunlight
Evaporation potential
Transpiration
Feed
Temperature
Drainage
Nitrogen


Buy
Evaporation
Rainfall
Fertiliser
Growth
Harvest
Sunlight
Evaporation potential
Transpiration
Feed
Temperature
Drainage
Nitrogen
Feed
Feed
Feed
Dry
Milk
FGMP
$


Buy
Evaporation
Rainfall
Fertiliser
Growth
Harvest
Feed
Sunlight
Evaporation potential
Transpiration
Feed
Feed
Feed
Temperature
Drainage
Nitrogen
Dry
Milk
FGMP
$

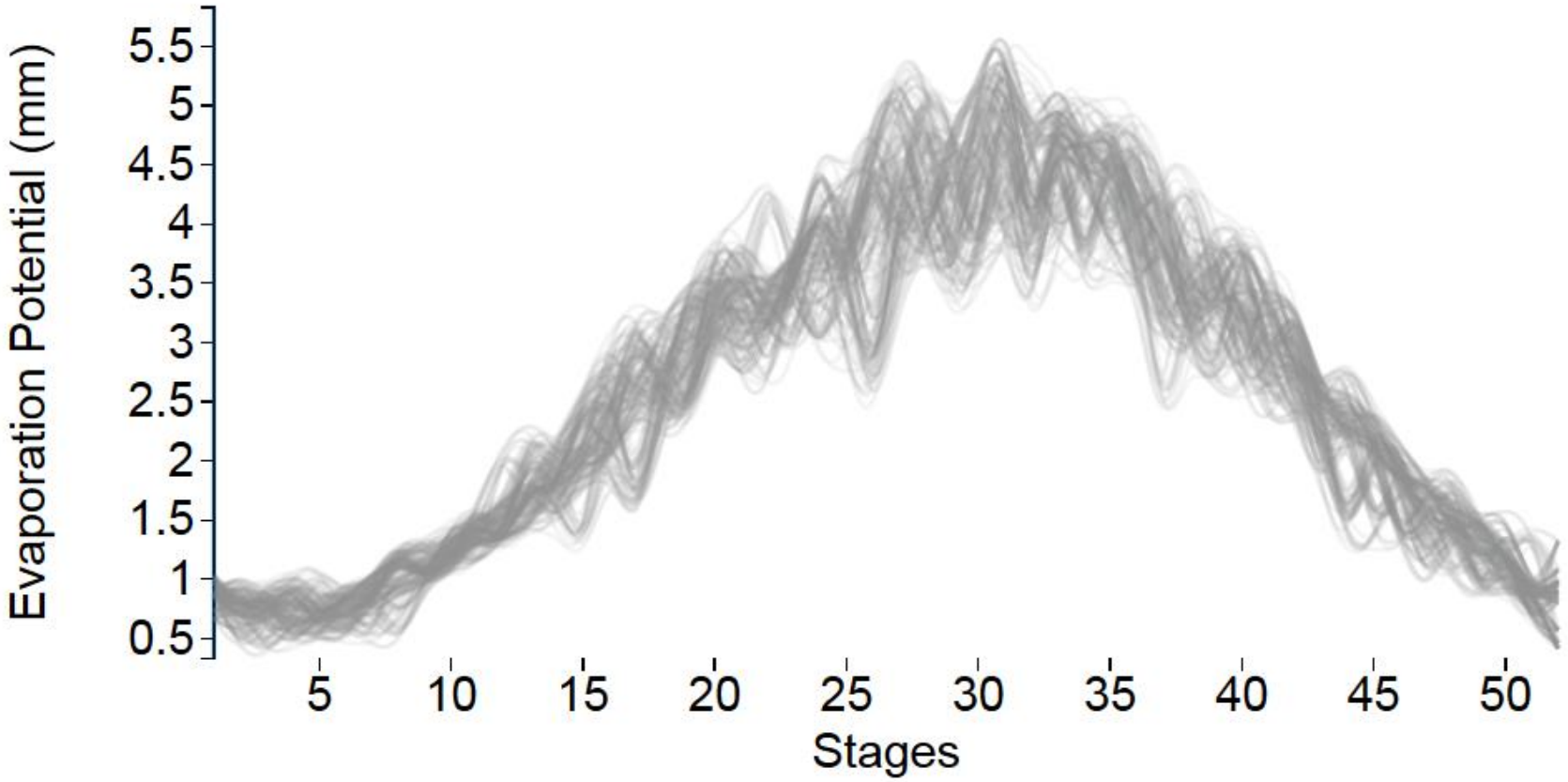
An illustrative example

- A farm in the Bay of Plenty
- Historical Weather from NIWA
- Supplement $300/Tonne DM rising to $600/Tonne (ingested)
- Stocking Rate 3.5 Cows/Ha

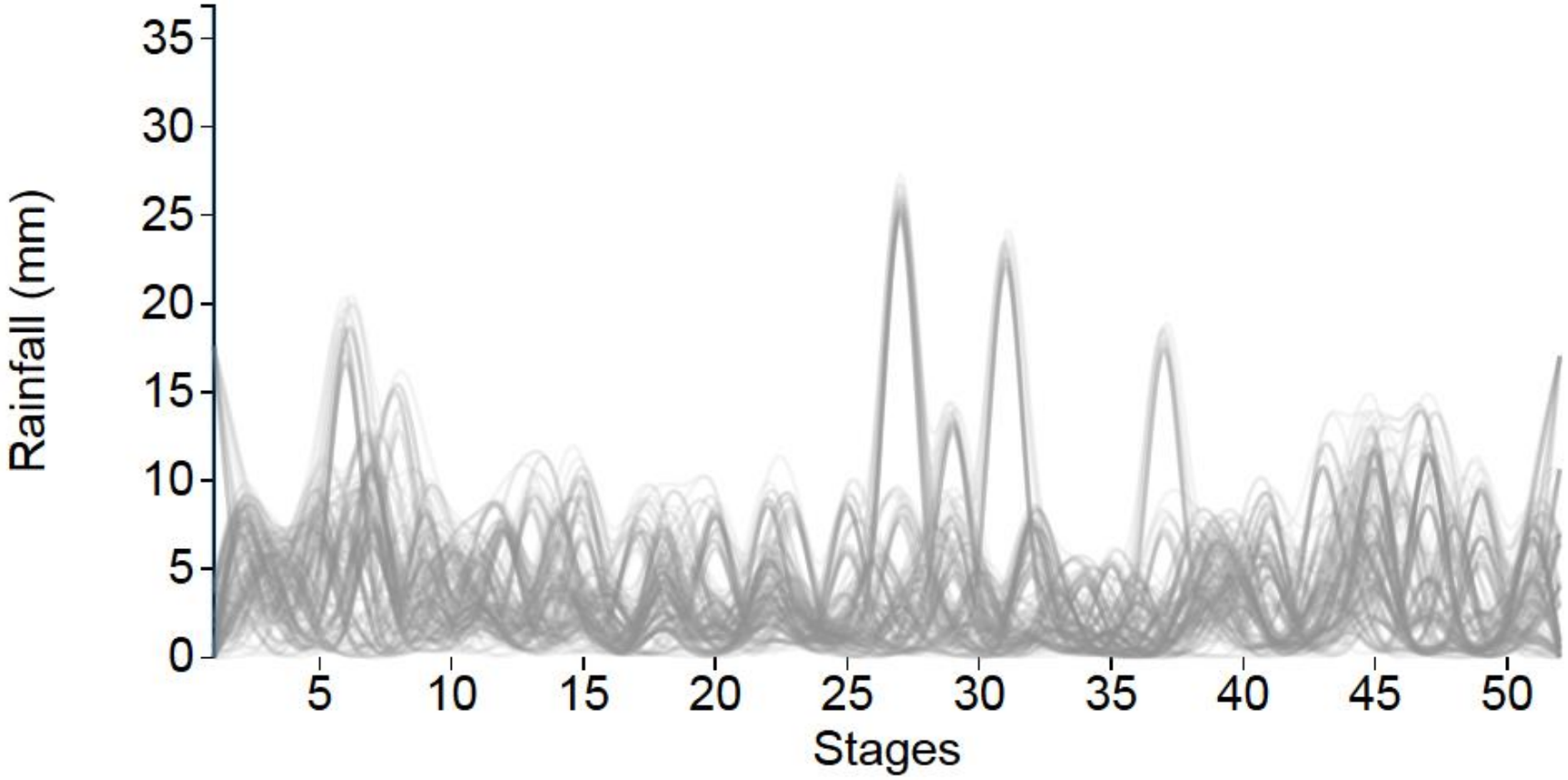
Solution

- Solve as a Stochastic Dual Dynamic Program
- Simulate the policy lots of different times
- Risk Neutral Farmer vs Risk Averse Farmer

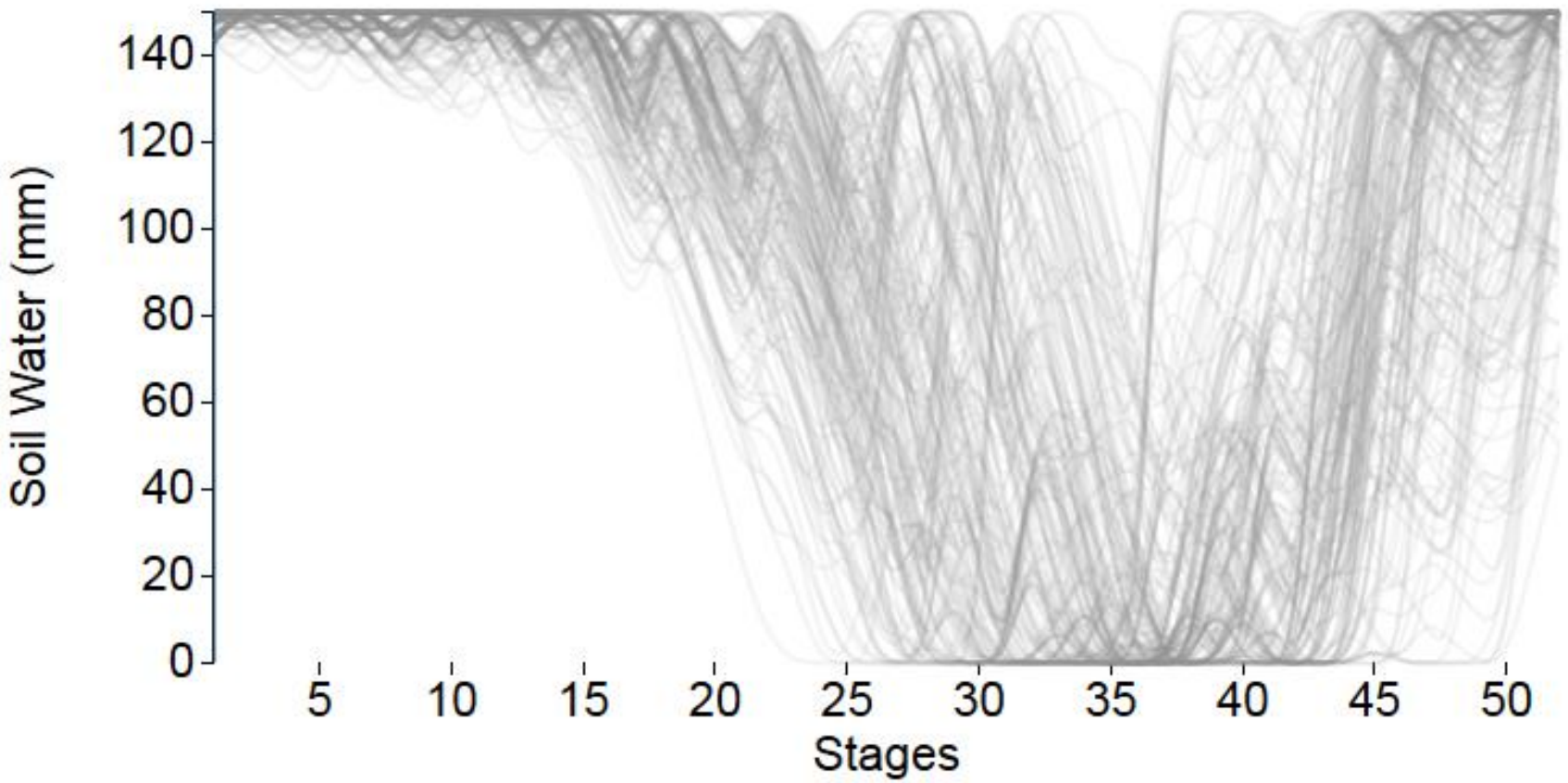
Evaporation Potential



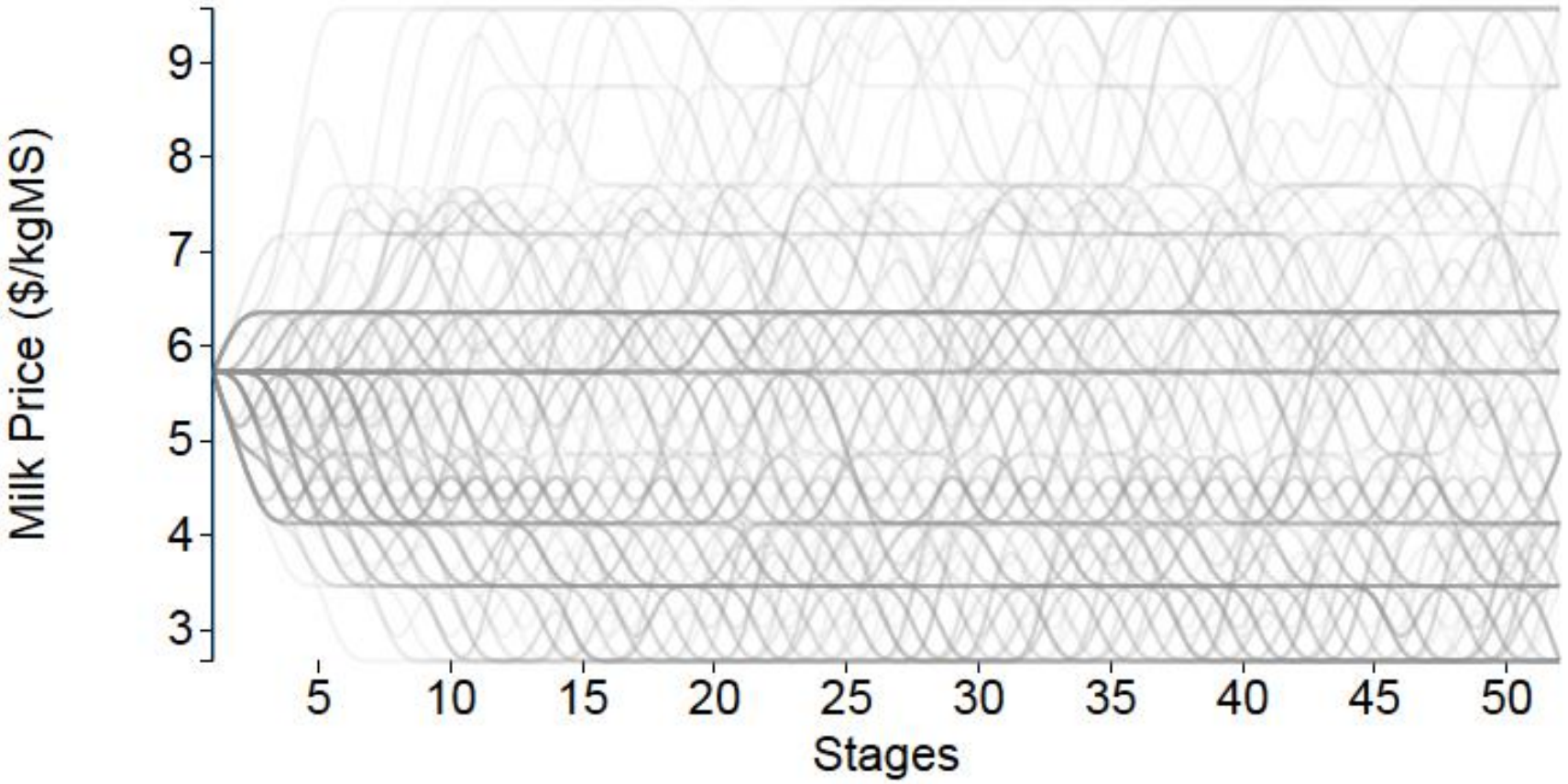
Rainfall



Soil Moisture

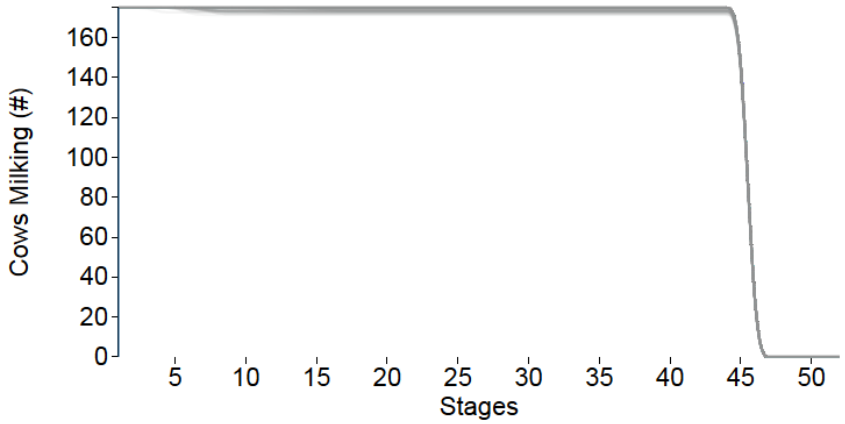


Milk Price

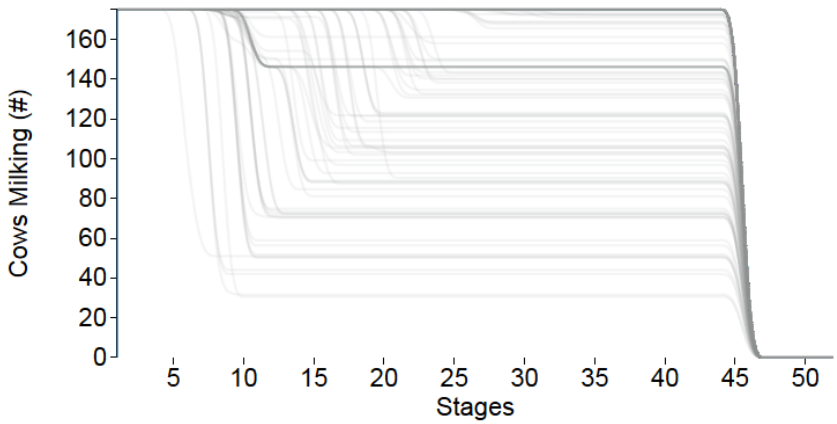


Dry off Decisions

Risk Neutral

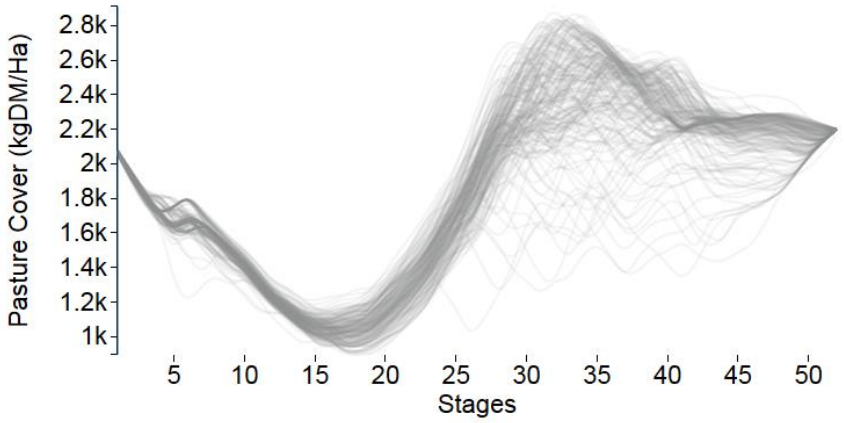


Risk Averse

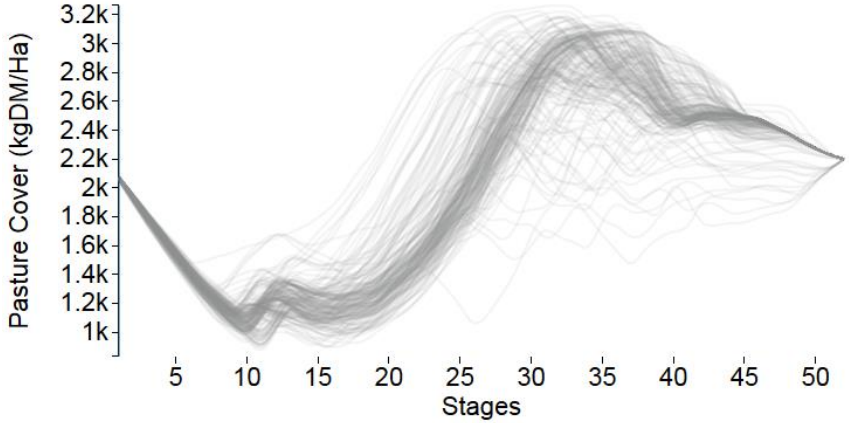


Pasture Management

Risk Neutral

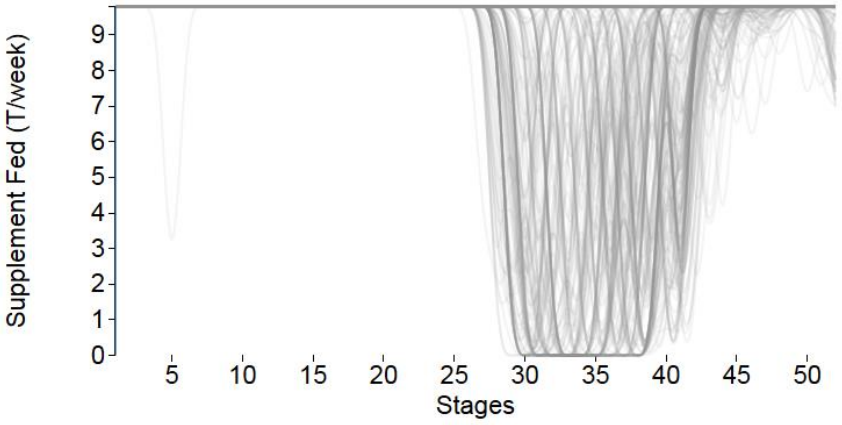


Risk Averse

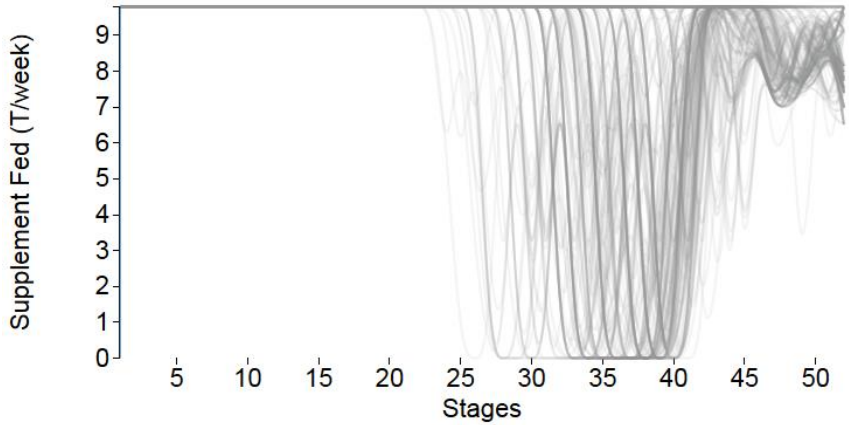


Supplementation

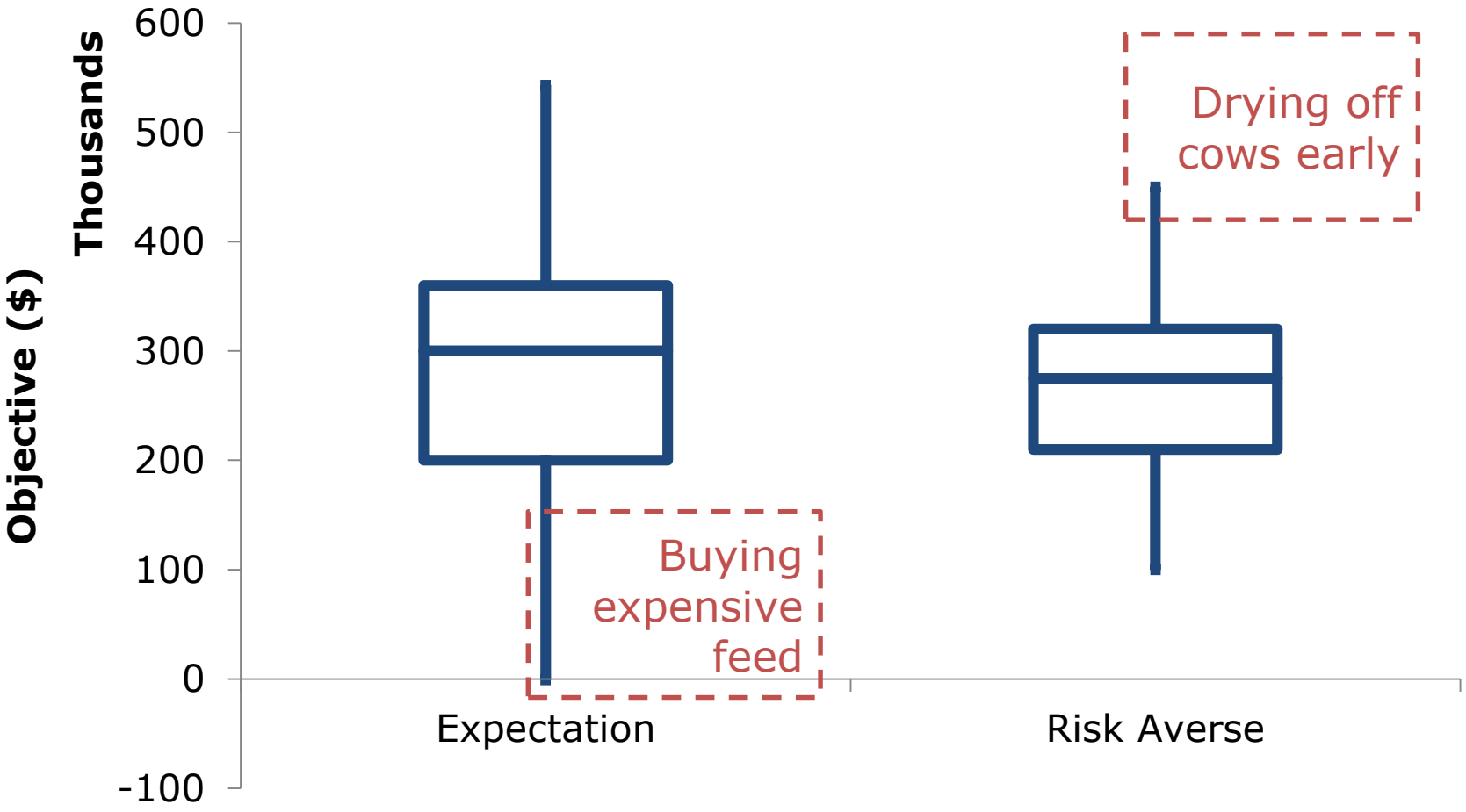
Risk Neutral



Risk Averse



Objective

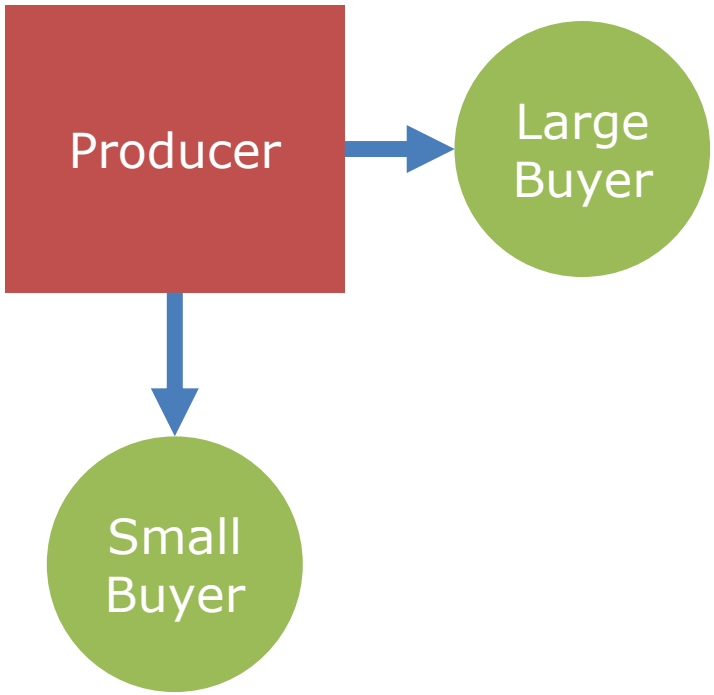

Objective ($)
Thousands
600
500
400
300
200
100
0
-100
Expectation
Risk Averse
Buying expensive feed
Drying off cows early

Conclusions

- We created a whole-farm stochastic optimisation model
- It incorporates weather as a dynamical system
- Management decisions depend on the risk appetite of the farmer

Questions

Help! An electricity related market design problem



Producers

- Creates a random quantity of milk over time
- Perishable product so all milk must be sold
- Can store some as inventory
- Can change product mix

Buyers

- Have demand for different products
- Want flexibility in contracting decisions
- Can shift demand between time periods

What is the “fair market price” for the milk?