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

Milk **POWDER**

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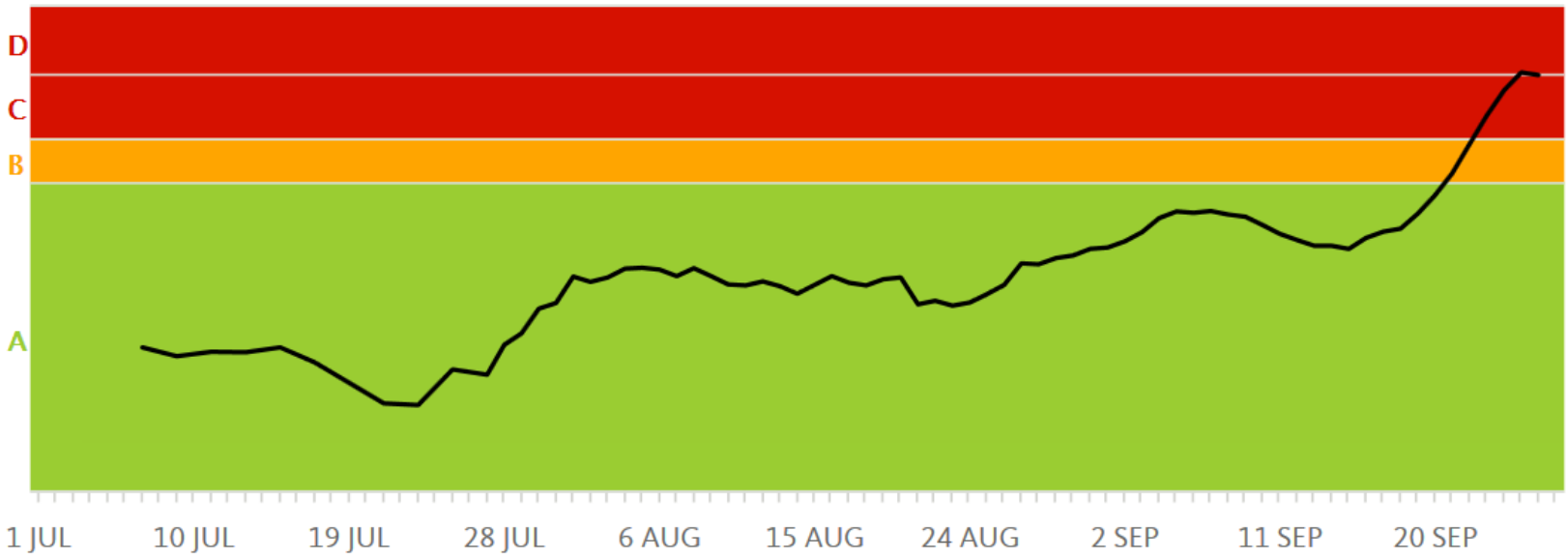
Andy Philpott, Andrew Mason, Anthony Downward


FOR SALE


In my opinion,
all palm oil
should be banned.

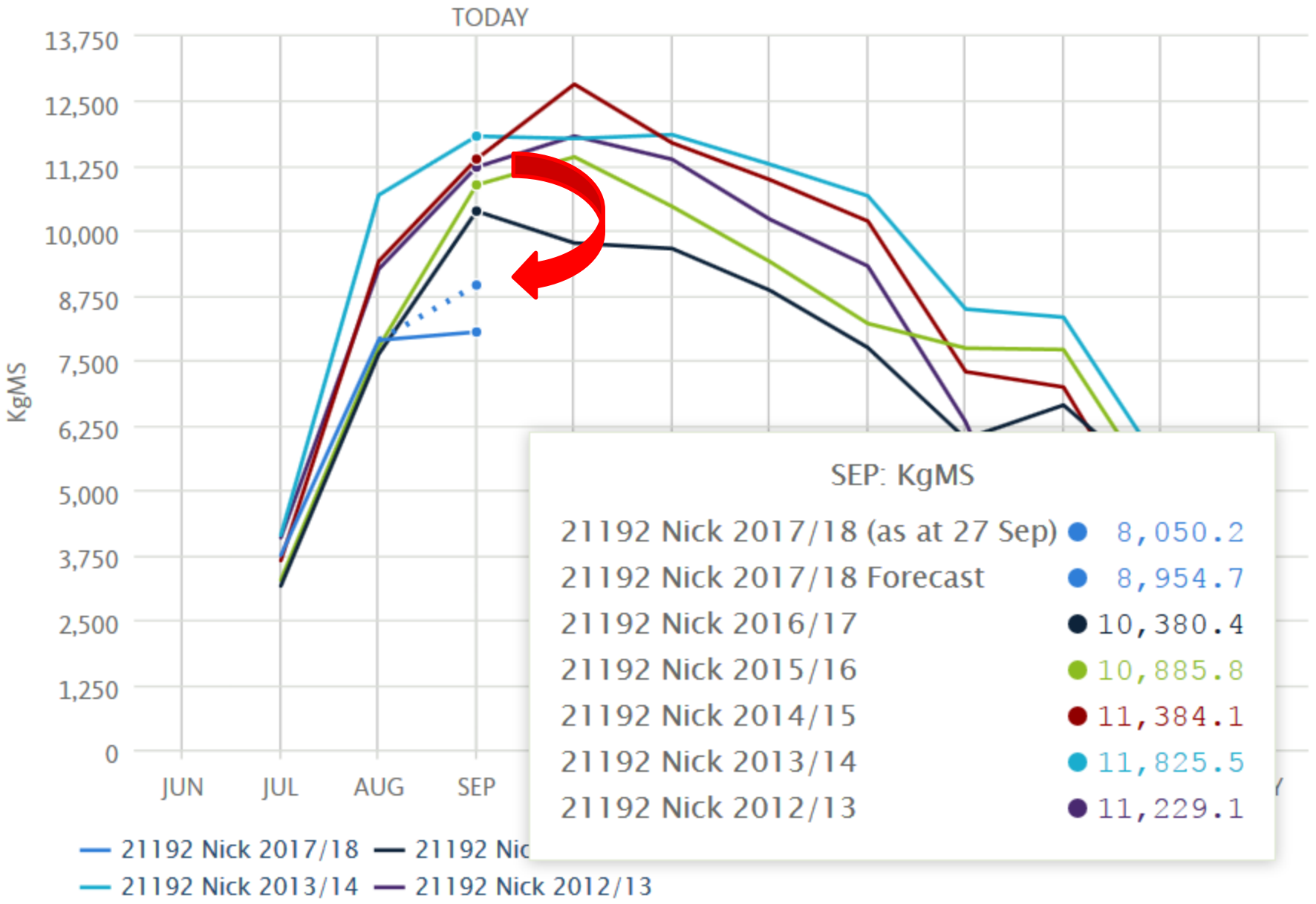
01/07/17 - 27/09/17 | 2017/18 | Last 10 Days

FEI : **This Season**

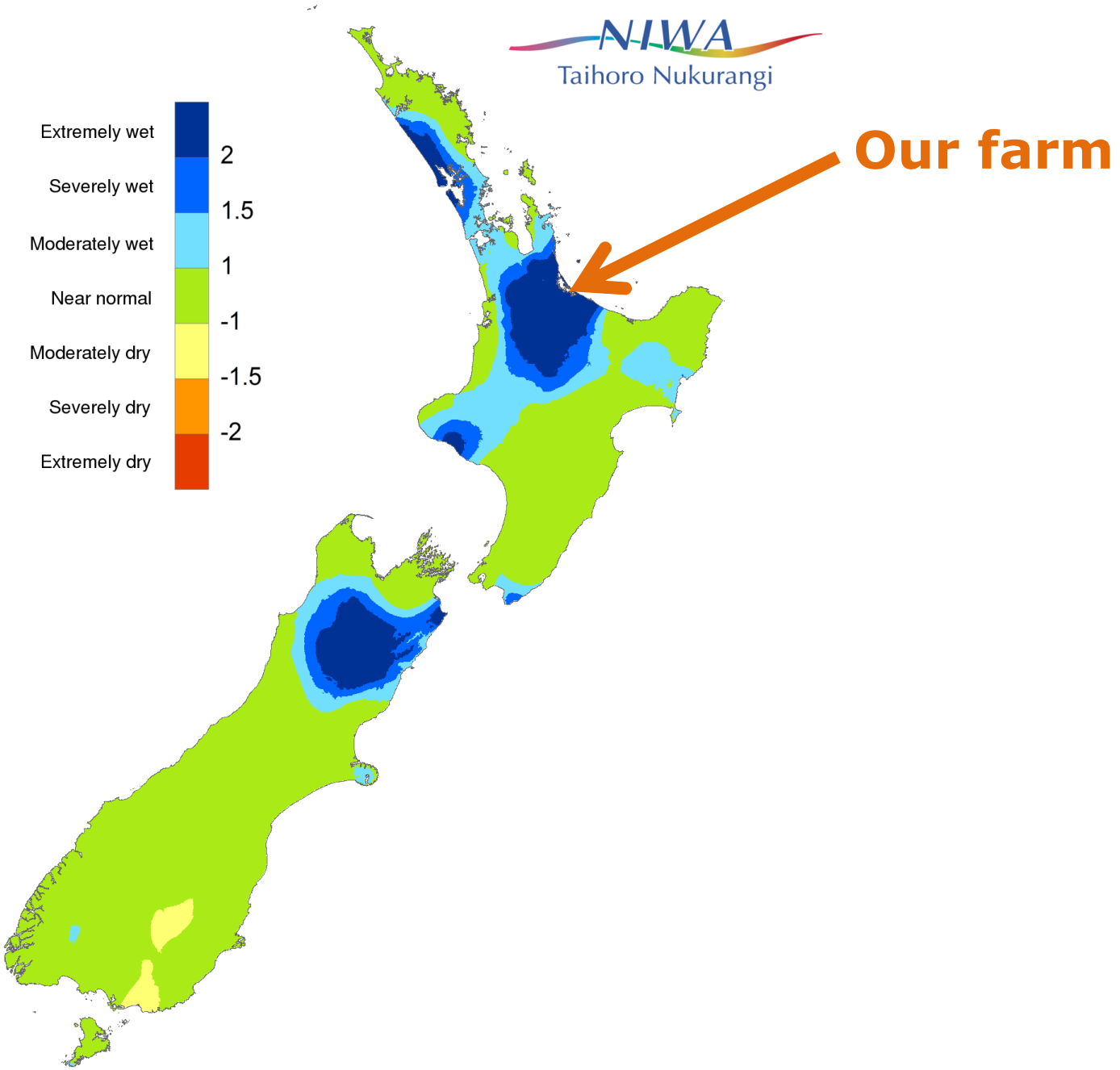


Kg/
Litr
SC
Kg/
Fat
Mil
Pro
FEI

KgMS : **1 June – 31 May**



SPI Drought Index for 9am 27/08/2017 to 9am 26/09/2017



What went wrong?

- Good payout forecast
- So maintained high stocking rate
- Reasonable feed stocks on hand so didn’t buy more
- Wet year (2x avg. rainfall) left paddocks damaged
- Experience said: can’t have bad Summer, Autumn, Winter AND Spring right… the sun will come
- Farm consultant’s advice: “don’t blink”

The **Milk**

Production

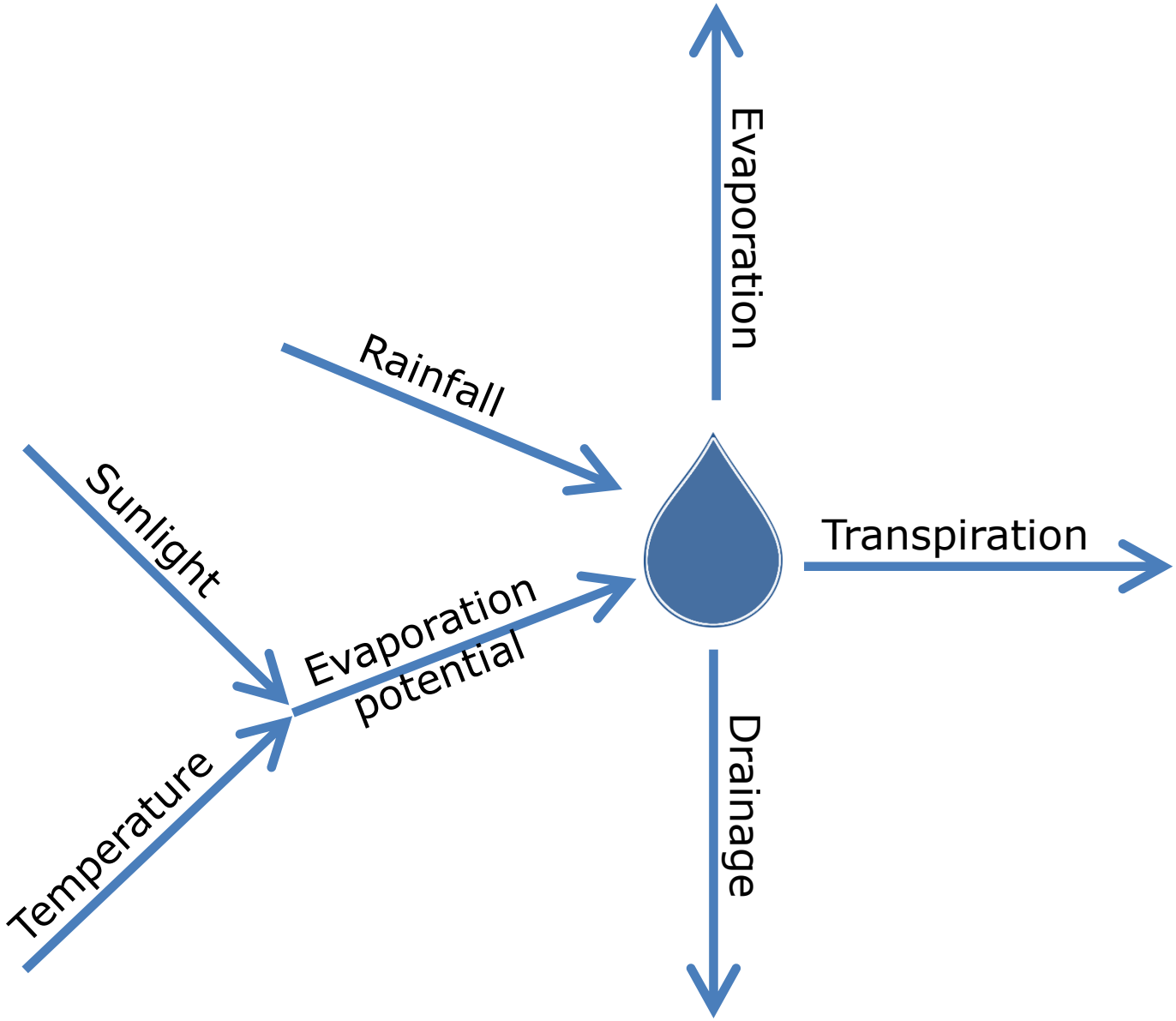
Optimiser incorporating

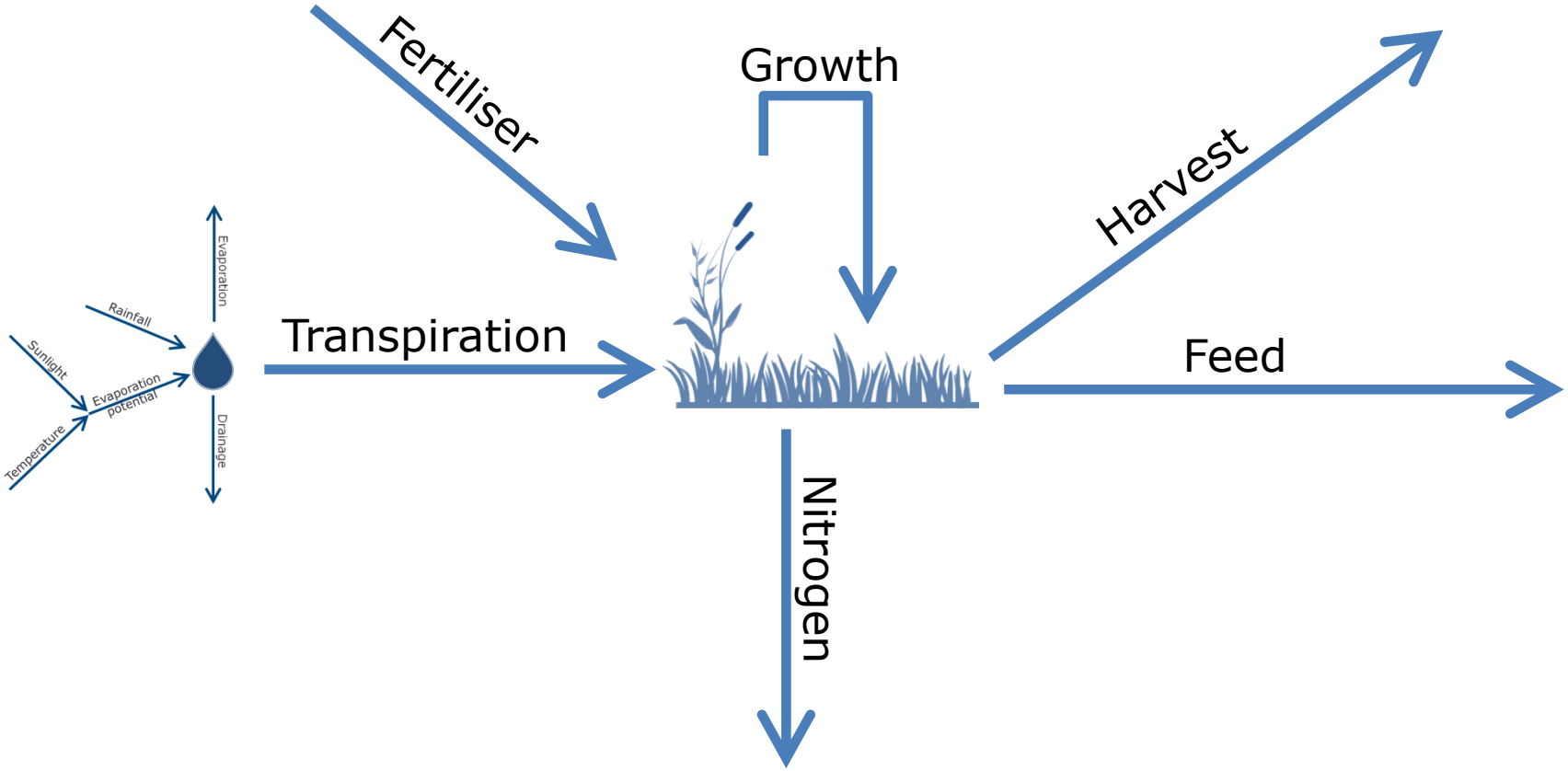
Weather

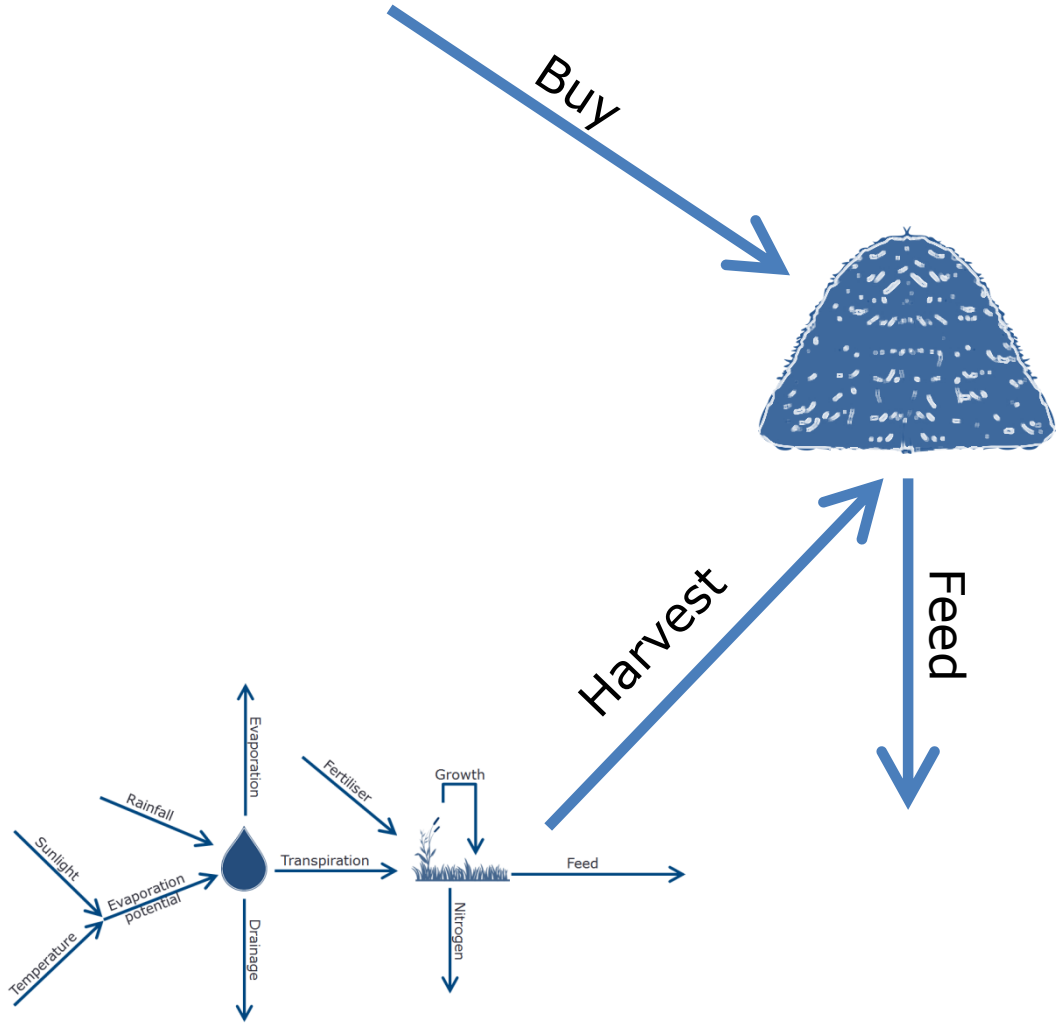
Dynamics and

Economic

Risk


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
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Sunlight
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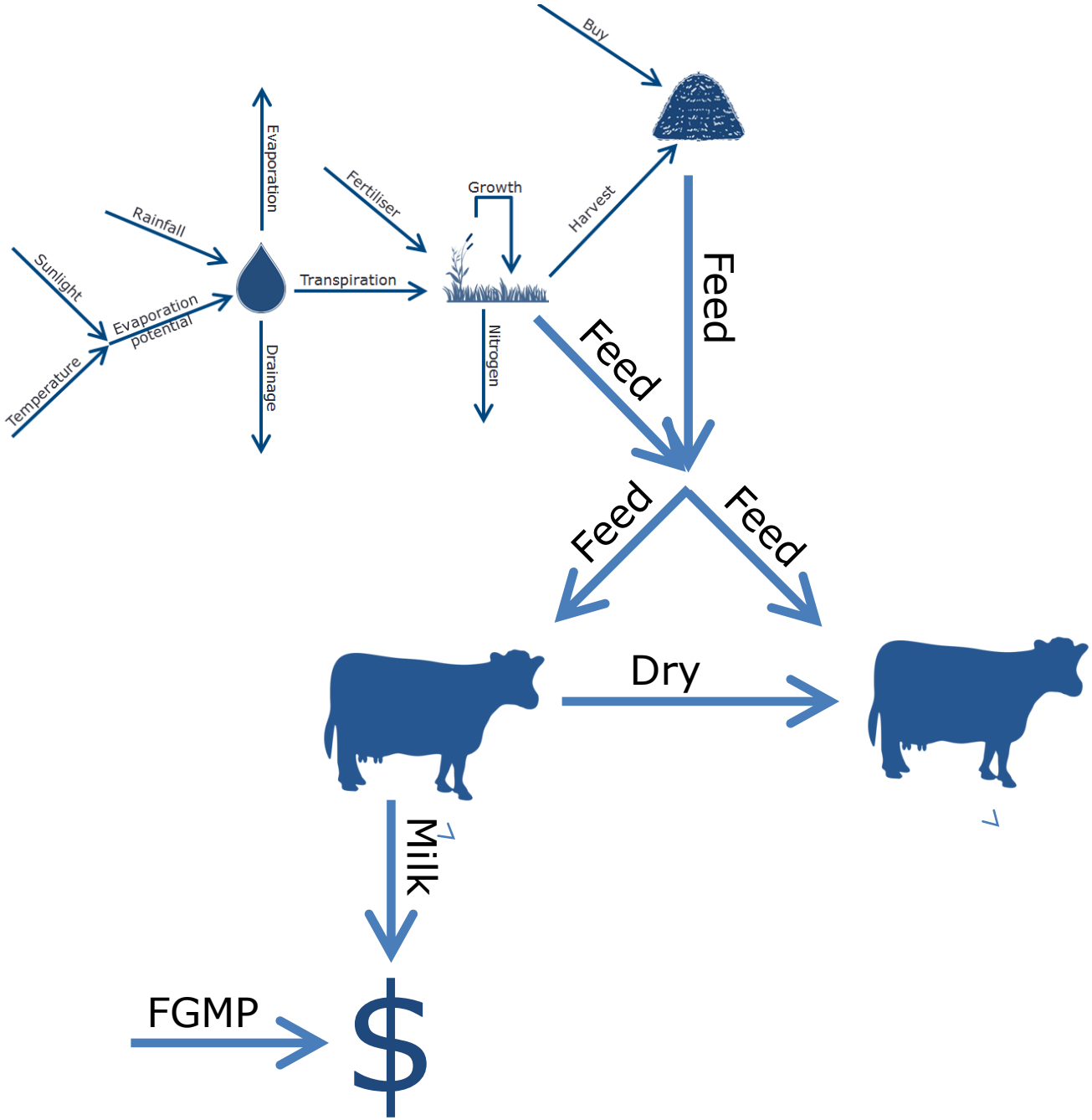
Feed
Temperature
Drainage
Nitrogen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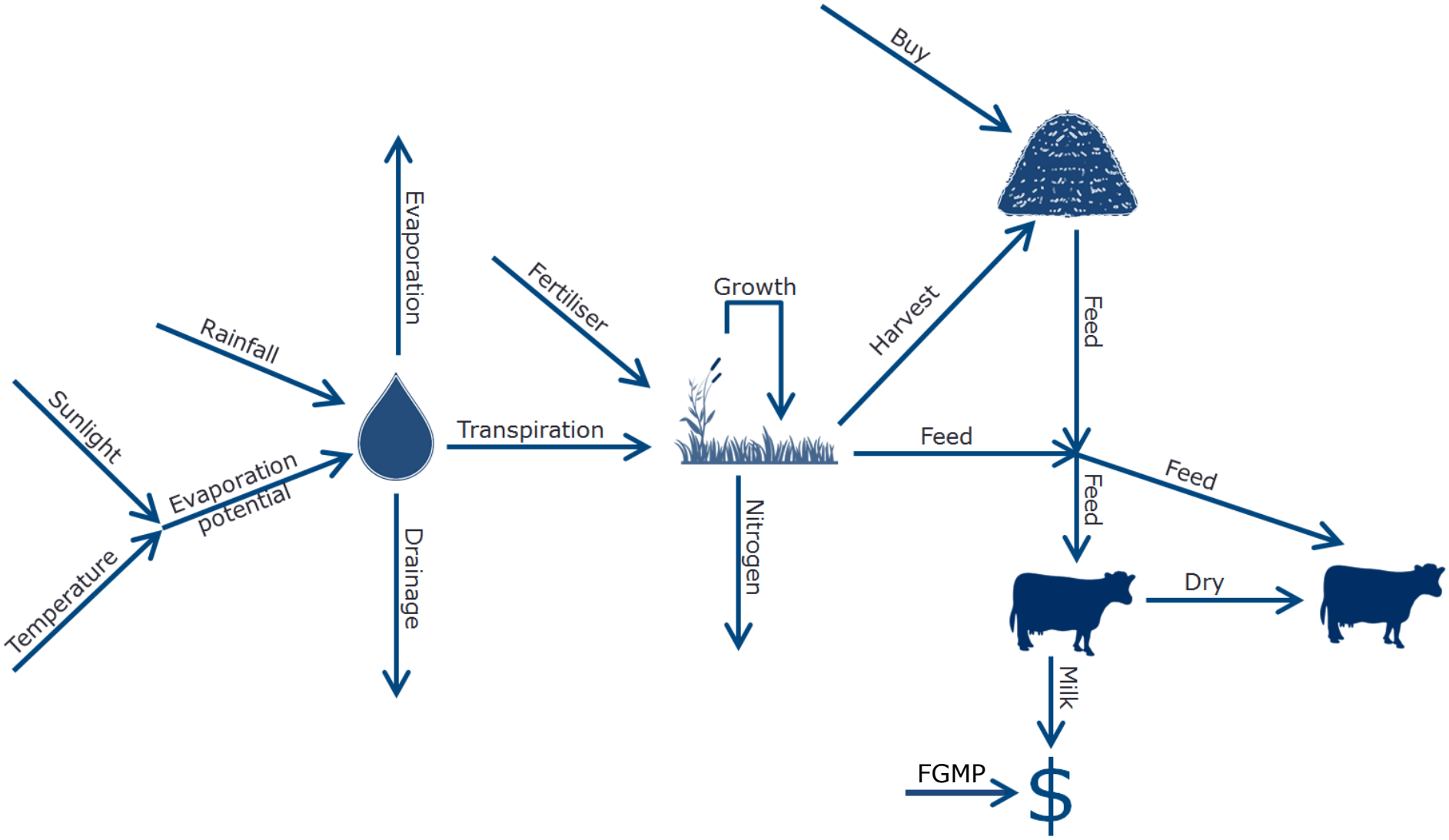
Feed
Feed
Feed
Dry
Milk
FGMP
$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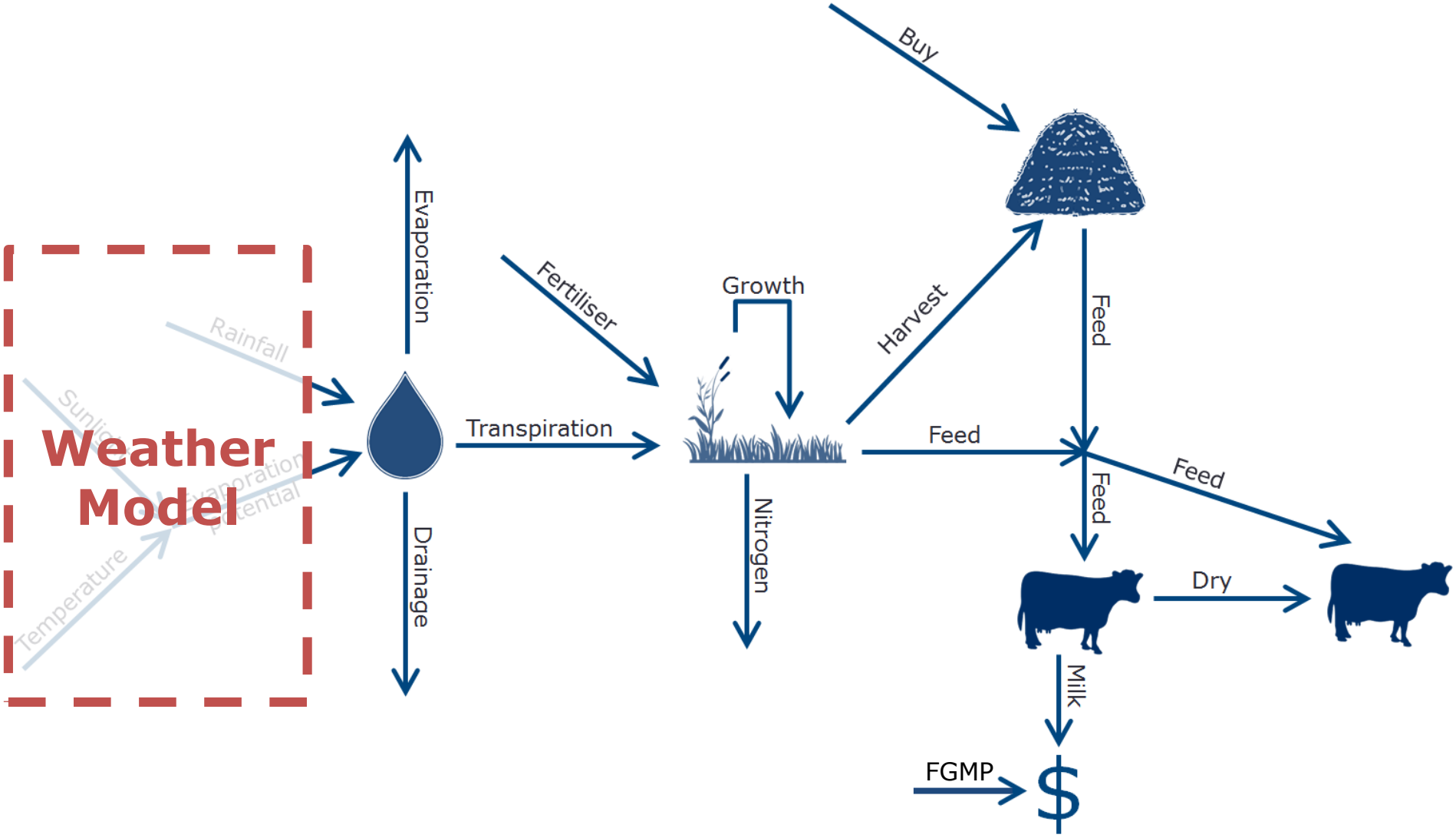
Weather Model
Rainfall
Sunlight
Evaporation potential
Temperature
Evaporation
Drainage
Fertiliser
Transpiration
Growth
Nitrogen
Buy
Harvest
Feed
Feed
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Feed
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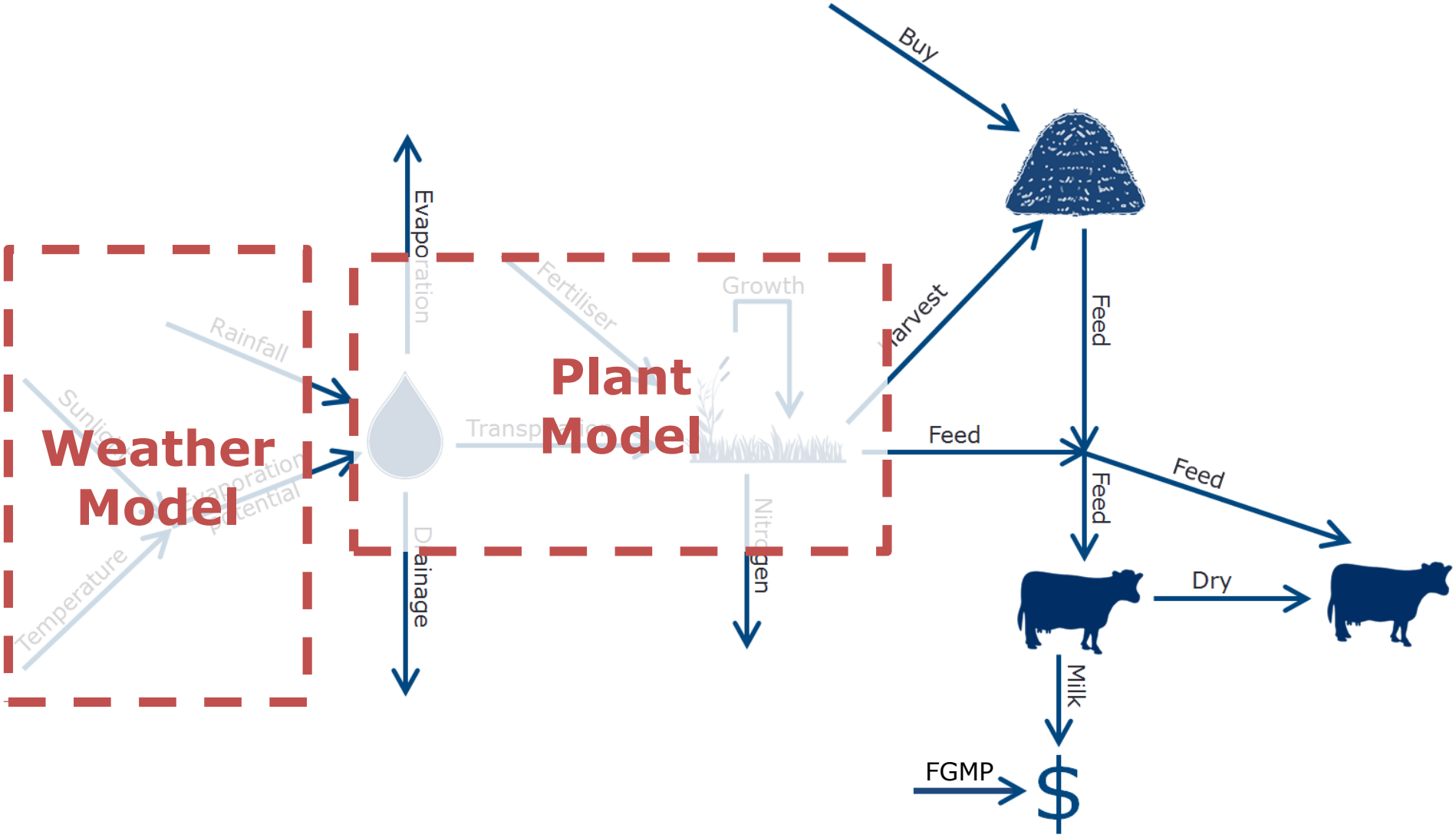
Buy
Evaporation
Fertiliser
Growth
Rainfall
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Harvest
Feed
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Transpiration
Drainage
Nitrogen
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Milk
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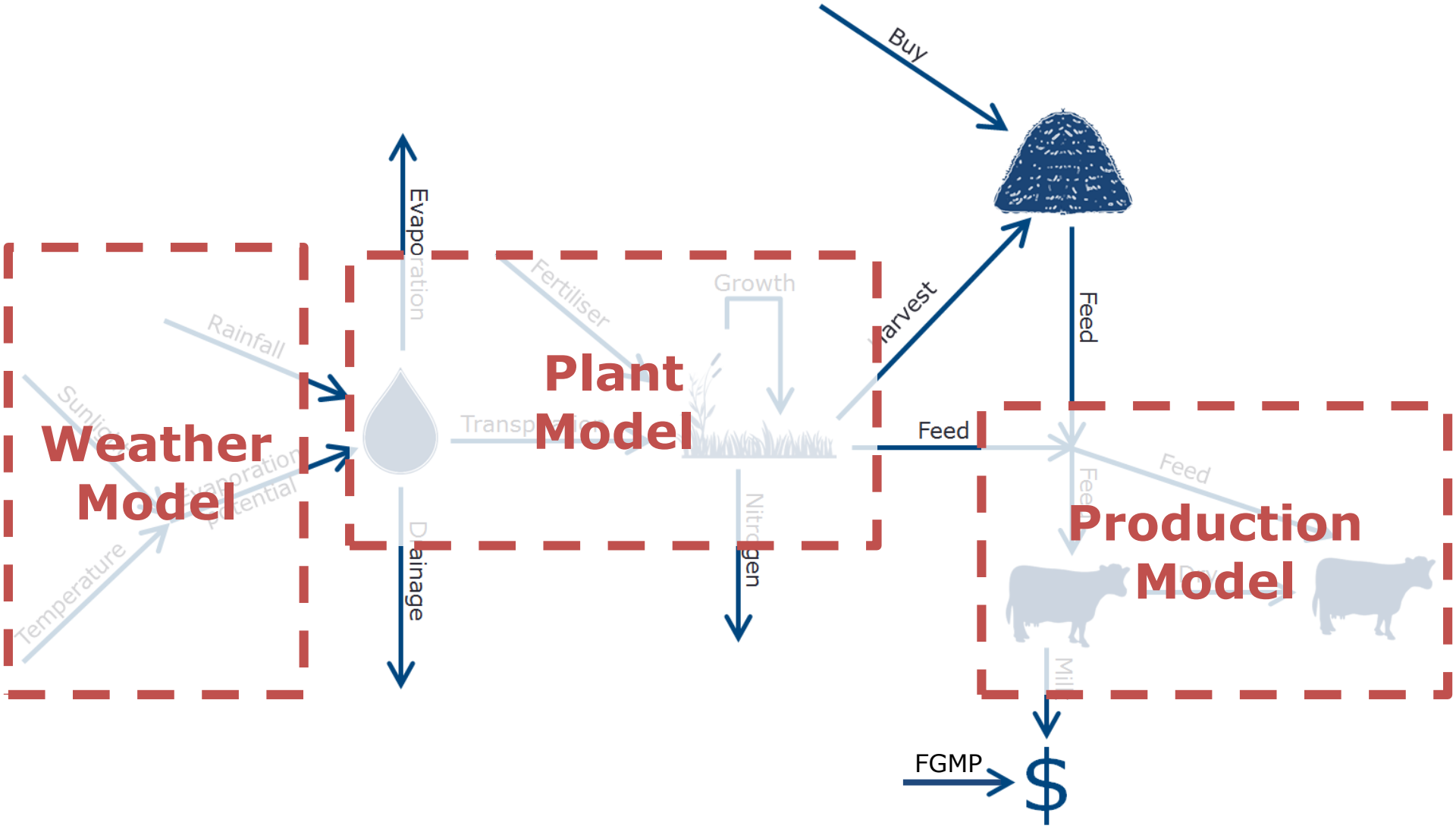
Buy
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Fertiliser
Growth
Harvest
Feed
Rainfall
Weather Model
Plant Model
Transpiration
Feed
Feed
Feed
Nitrogen
Production Model
Drainage
Temperature
FGMP
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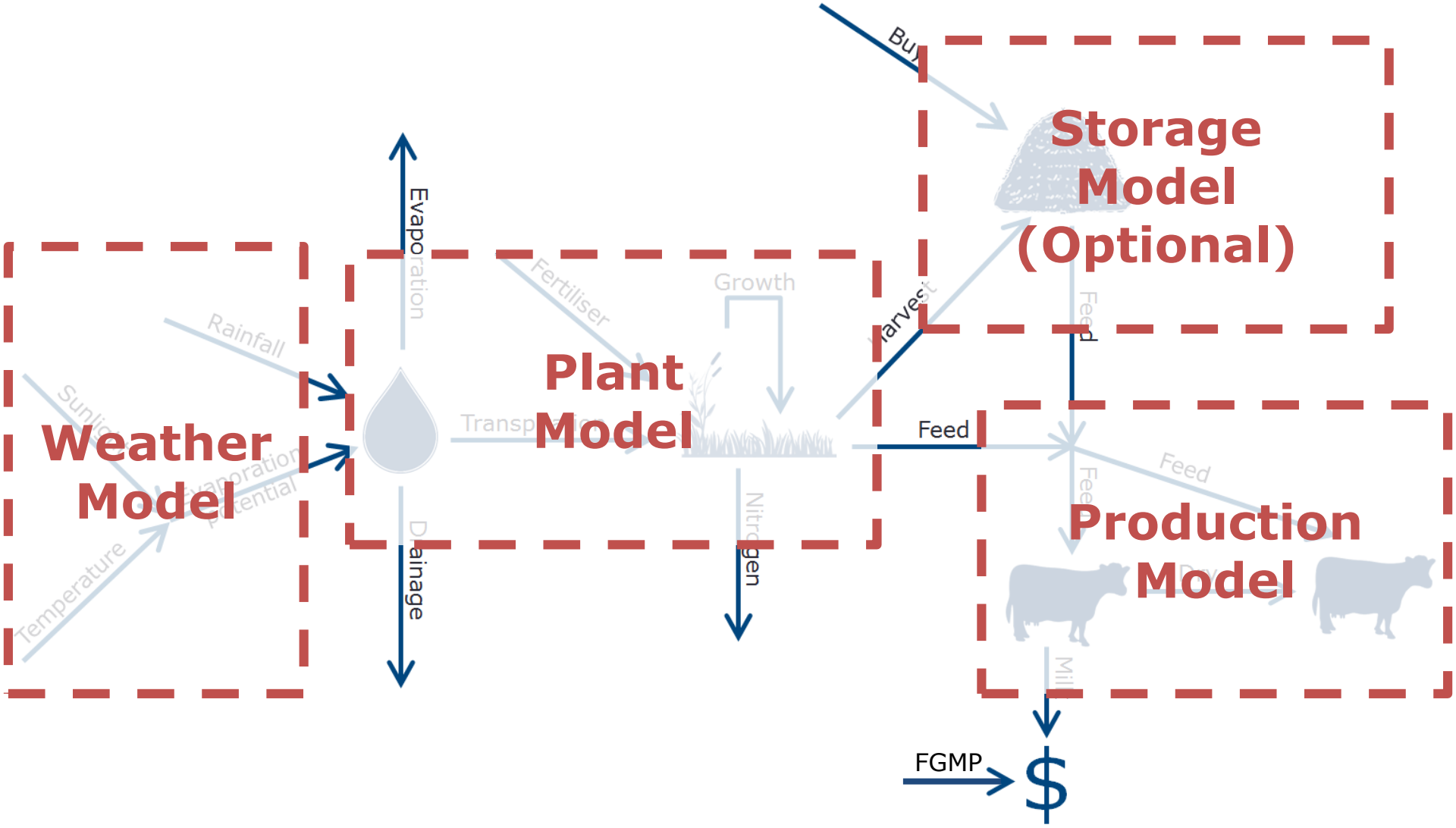
Storage Model (Optional)
Plant Model
Weather Model
Production Model
Evaporation
Rainfall
Fertiliser
Growth
Harvest
Feed
Feed
Feed
Feed
Transpiration
Drainage
Nitrogen
Temperature
FGMP
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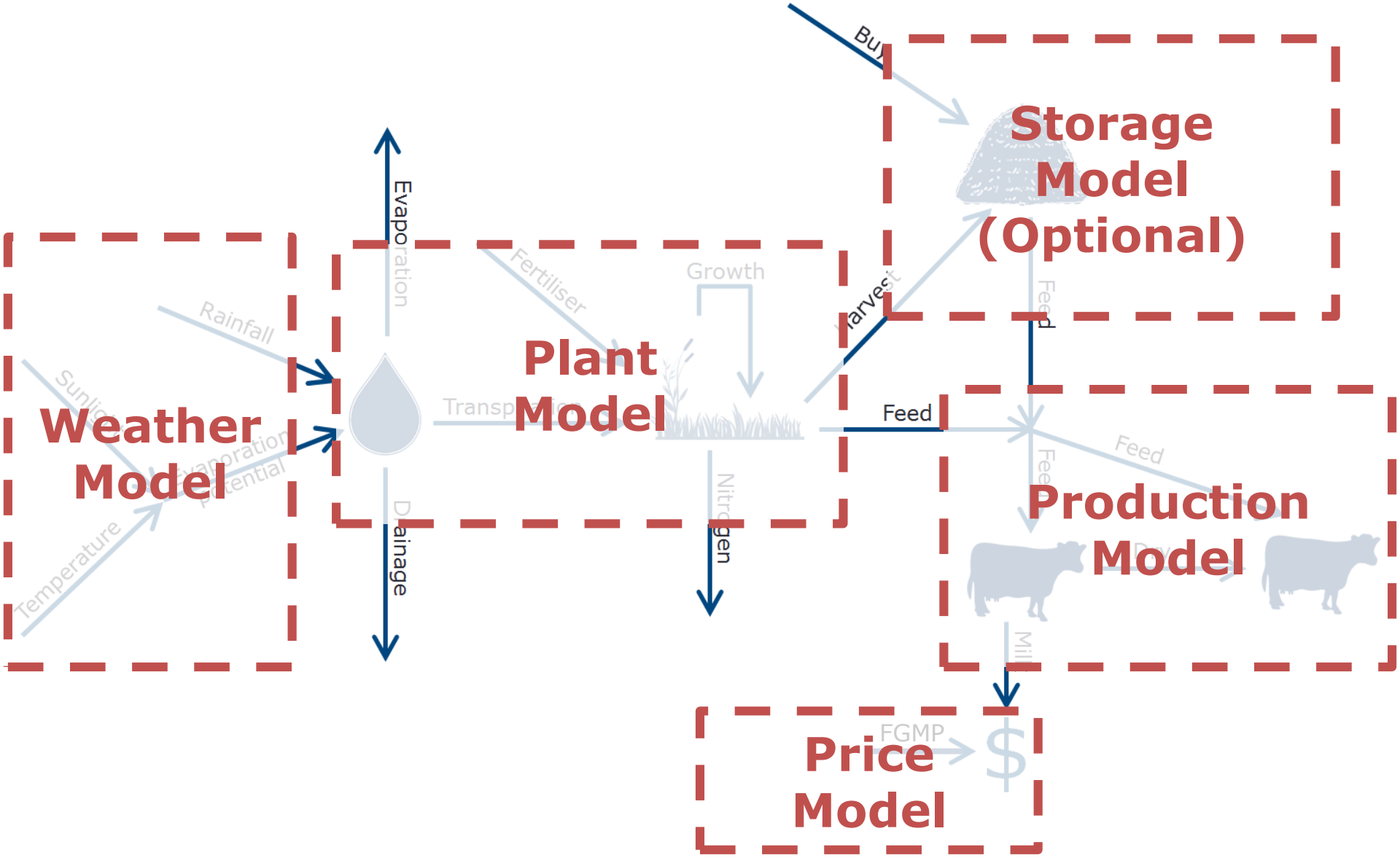
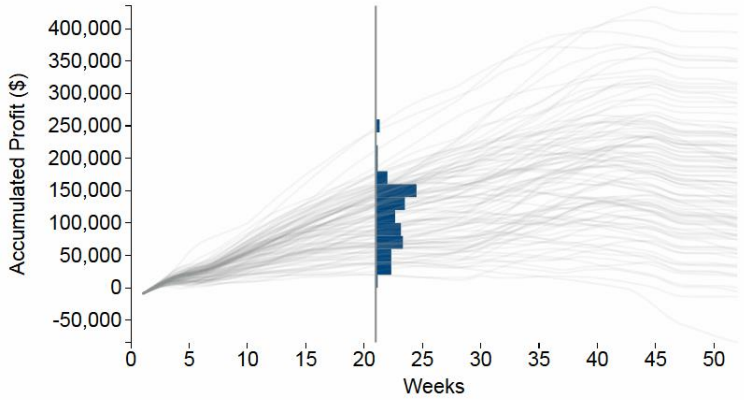

Weather Model
Plant Model
Storage Model (Optional)
Production Model
Price Model
Evaporation
Rainfall
Fertiliser
Growth
Harvest
Feed
Feed
Feed
Feed
Nitrogen
Drainage
Temperature
FGMP

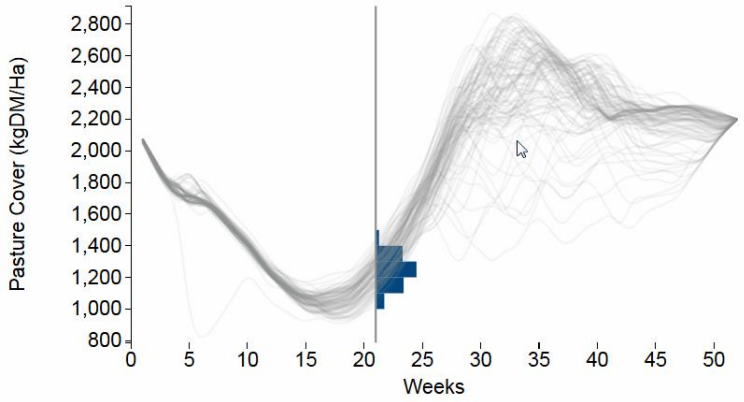
SDDP.jl

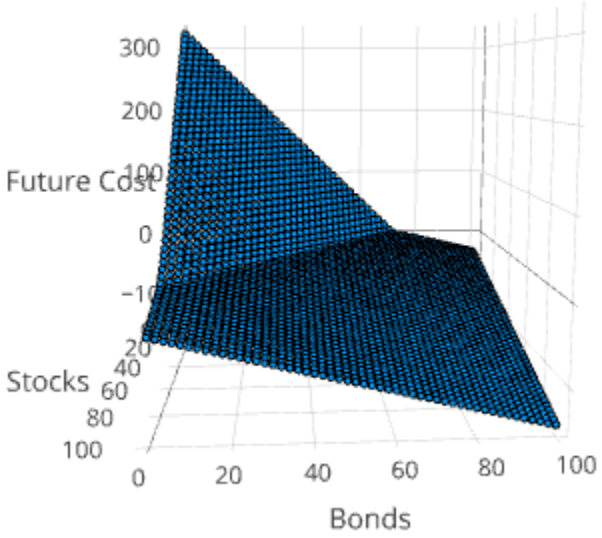
An open-source Julia library for solving multi-stage stochastic programs using SDDP:

- **simple**
- **easy to use**
- **fast**
- **lots of examples**
- **pretty pictures**

github.com/odow/SDDP.jl

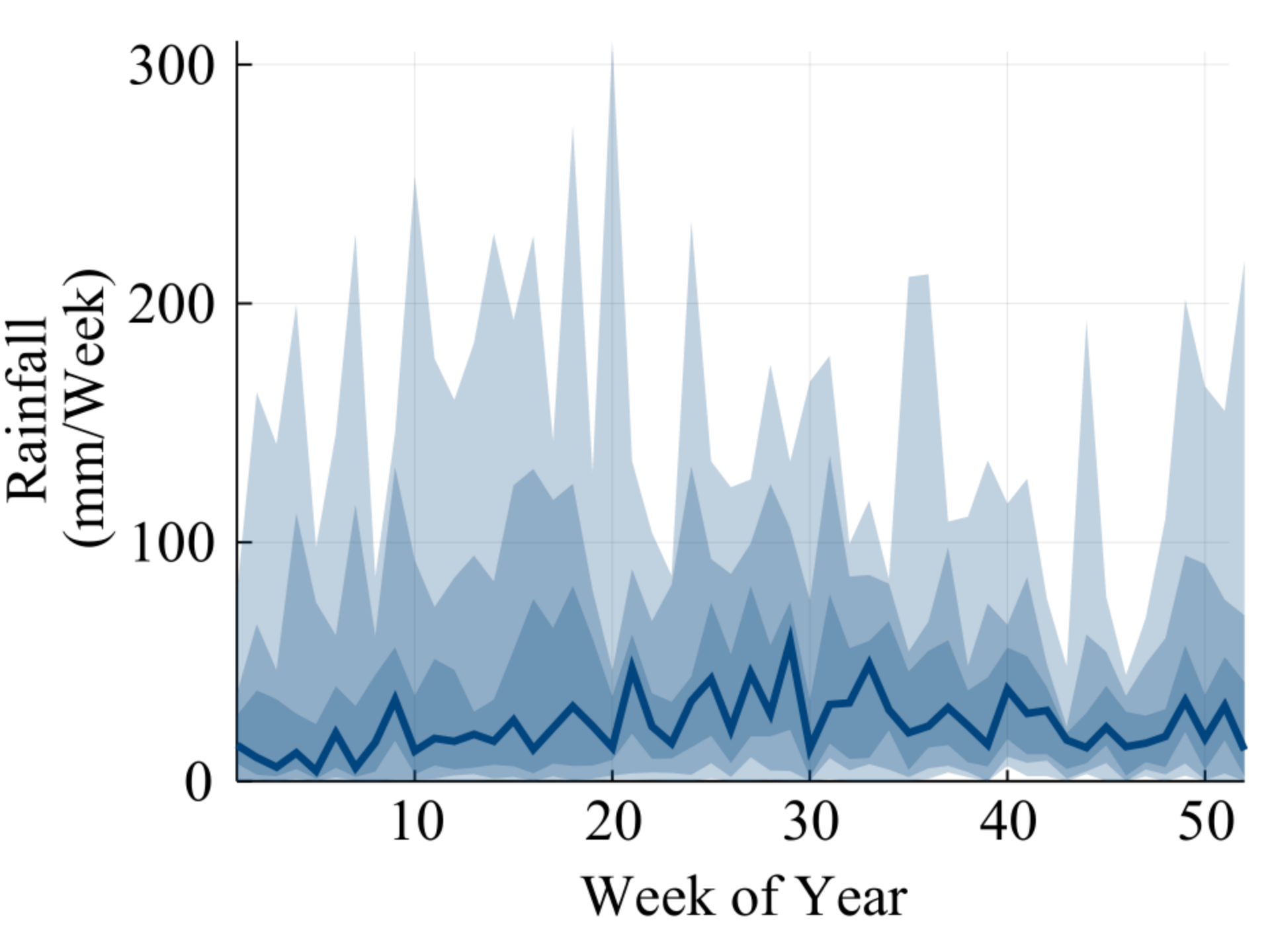


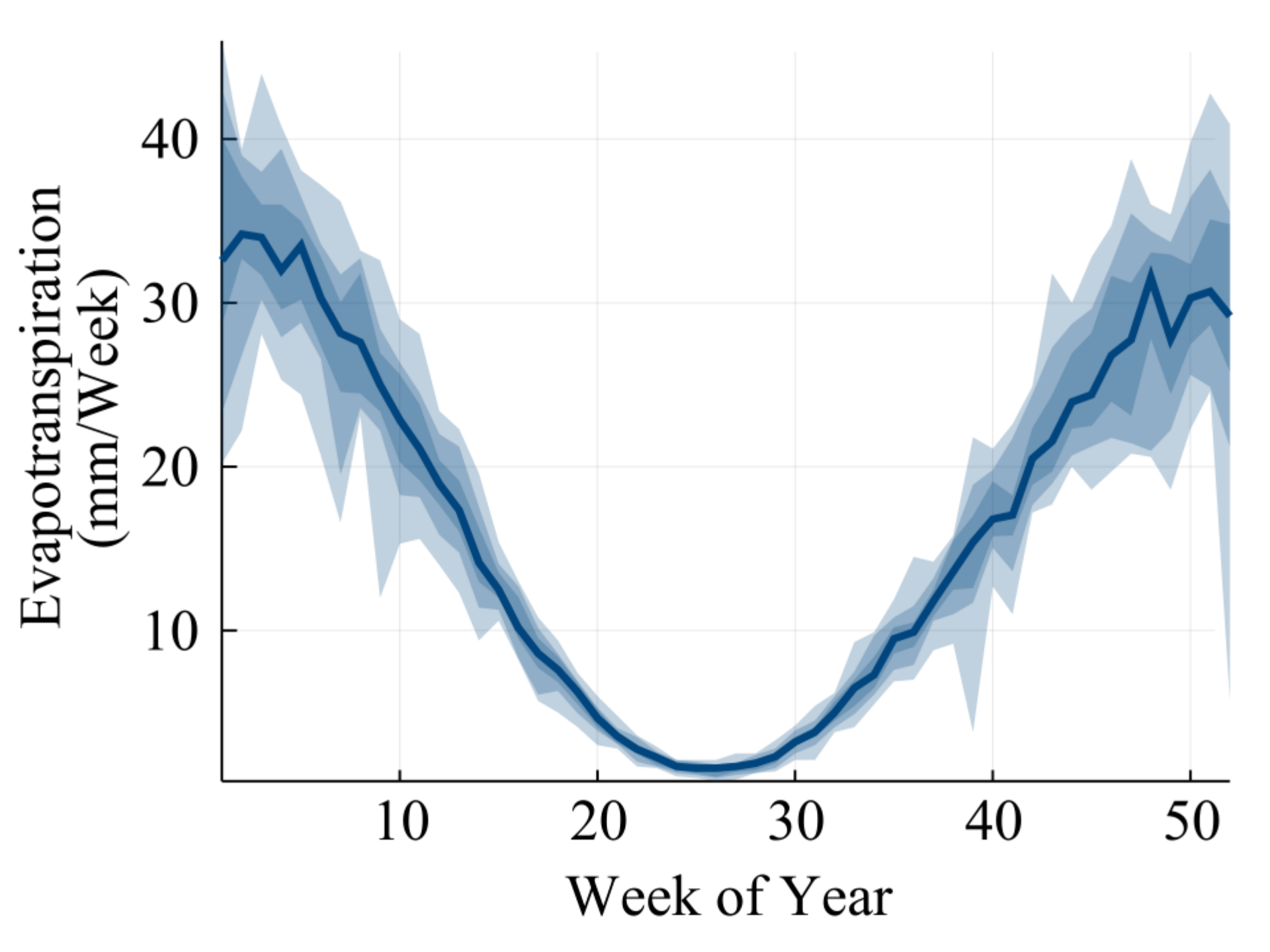




DOWSON-FARMS
A CASE STUDY

HISTORICAL WEATHER DATA


300
200
100
0
Rainfall
(mm/Week)
10
20
30
40
50
Week of Year


Evapotranspiration
(mm/Week)
40
30
20
10
10
20
30
40
50
Week of Year

HISTORICAL FARM DATA

DairyBase

Financial Detail

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
Benchmark Group Ranked by:
Farm business type : 1- Owner operator

	Total $		$ Per kg MS		$ Per Ha		$ Per Cow	
GROSS FARM REVENUE (GFR)	**Farm**	**% of GFR**	**Farm**	**Benchmark**	**Farm**	**Benchmark**	**Farm**	**Benchmark**
Net Milk Sales	312,402	81.1%	3.79	3.87	4,057	4,592	1,488	1,498
Net Dairy Livestock Sales	69,303	18.0%	0.84	0.69	900	814	330	265
Value of Change in Dairy Livestock	-358	-0.1%	-0.00	-0.08	-5	-91	-2	-30
Other Dairy Revenue	3,975	1.0%	0.05	0.04	52	44	19	14
DAIRY GROSS FARM REVENUE	385,322	100.0%	4.68	4.51	5,004	5,359	1,835	1,748
Non-Dairy Cash Income	0	0.0%	0.00		0		0	
Value of Change in Non-dairy livestock	0	0.0%	0.00		0		0	
Total Gross Farm Revenue	385,322	100.0%	4.68		5,004		1,835	
OPERATING EXPENSES								
Labour Expenses								
Wages	45,824	11.9%	0.56	0.59	595	697	218	227
Labour Adjustment - Unpaid	3,750	1.0%	0.05	0.09	49	104	18	34
Labour Adjustment - Management	49,650	12.9%	0.60	0.28	645	330	236	108
Total Labour Expenses	99,224	25.8%	1.21	0.95	1,289	1,131	472	369
Stock Expenses								
Animal Health	16,199	4.2%	0.20	0.20	210	242	77	79
Breeding & Herd Improvement	6,812	1.8%	0.08	0.12	88	139	32	45
Farm Dairy	4,148	1.1%	0.05	0.04	54	53	20	17
Electricity (Farm Dairy, Water Supply)	9,595	2.5%	0.12	0.11	125	132	46	43
Total Stock Expenses	36,754	9.5%	0.45	0.48	477	566	175	185
Feed Expenses								
Supplement Expenses								
Net Made,Purchased,Cropped	37,541	9.7%	0.46	0.61	488	720	179	235
Less Feed Inventory Adjustment	18,328	4.8%	0.22	0.04	238	46	87	15
Calf Feed	5,153	1.3%	0.06	0.03	67	34	25	11
Total Supplement Expenses	24,366	6.3%	0.30	0.60	316	709	116	231
Grazing & Run Off Expenses								
Young & Dry Stock Grazing	0	0.0%	0.00	0.23	0	276	0	90
Winter Cow Grazing	0	0.0%	0.00	0.03	0	32	0	10
Support block Lease	16,429	4.3%	0.20	0.08	213	92	78	30
Owned Support block Adjustment	11,250	2.9%	0.14	0.06	146	73	54	24
Total Grazing & Support block expenses	27,679	7.2%	0.34	0.40	359	473	132	154
Total Feed Expenses	52,045	13.5%	0.63	0.99	676	1,182	248	385
Other Working Expenses								
Fertiliser	15,903	4.1%	0.19	0.36	207	423	76	138
Nitrogen	0	0.0%	0.00	0.03	0	40	0	13
Irrigation	0	0.0%	0.00	0.02	0	20	0	6
Regrassing	6,919	1.8%	0.08	0.04	90	47	33	15
Weed & Pest	624	0.2%	0.01	0.02	8	21	3	7
Vehicles	13,306	3.5%	0.16	0.10	173	124	63	40
Fuel	0	0.0%	0.00	0.04	0	51	0	17
R & M - land & buildings	12,526	3.3%	0.15	0.18	163	211	60	69
R & M - plant and equipment	11,964	3.1%	0.15	0.08	155	97	57	31
Freight and General	8,382	2.2%	0.10	0.05	109	64	40	21
Total Other Working Expenses	69,624	18.1%	0.85	0.92	904	1,098	332	358
Overheads								
Administration	9,140	2.4%	0.11	0.11	119	128	44	42
Insurance	7,512	1.9%	0.09	0.07	98	79	36	26
ACC	1,946	0.5%	0.02	0.03	25	38	9	12
Rates	16,858	4.4%	0.20	0.18	219	216	80	70
Depreciation	27,947	7.3%	0.34	0.29	363	347	133	113
Total Overheads	63,403	16.5%	0.77	0.68	823	808	302	263
TOTAL DAIRY OPERATING EXPENSES	321,050	83.3%	3.90	4.03	4,169	4,784	1,529	1,560
Non-Dairy Operating Expenses	0	0.0%	0		0		0	
Total Operating Expenses	321,050	83.3%	3.90		4,169		1,529	
OPERATING PROFIT								
DAIRY OPERATING PROFIT	64,272	16.7%	0.78	0.48	835	575	306	188
Non-Dairy Operating Profit	0	0.0%	0.00		0		0	
Total Operating Profit	64,272	16.7%	0.78		835		306	

DairyBase

Physical Detail A

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
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Farm business type : 1- Owner operator

		2015-16		2014-15	2013-14
Physical Description	**Units**	**Farm**	**Benchmark**	**Farm**	**Farm**
Milking area	ha	77.0	138.6	77.0	77.0
Support block effective area	ha	32.0	38.2	32.0	32.0
Percent of farm at different height to dairy		0%	10%	0%	0%
Peak cows milked		210	425	229	233
Stocking rate	cows/ha	2.7	3.1	3.0	3.0
Cow breed		Friesian	Friesian	Friesian	Friesian
Cow liveweight	kg	480	474	480	480
Liveweight/ha	kg/ha	1,309	1,452	1,428	1,452
BW reliability		123 / 55 LIC		125 / 50 LIC	131 / 55 L
PW reliability		139 / 75 LIC		143 / 49 LIC	155 / 69 L
Season's rainfall	mm	1329 NIWA	1100	1250	1250
					1,710
					4
					pring or
Milksolids (MS) Production to factory - (Seasonal year)					
Milksolids/ha	kg/ha	1,069	1,189	1,146	1,240
Milksolids/cow	kg/cow	392	388	385	410
MS/ha to 31st Dec					
MS as % of liveweight		82%	82%	80%	85%
10 day peak per cow	kg/day	2.03	1.94	1.82	1.83
Average Milksolids/cow/day	kg/day	1.4	1.5	1.5	1.5
Monthly production drop: Peak to 31Dec		13.2%	9.5%	5.0%	3.8%
Days in Milk per cow		275	261	256	275
Feed Eaten					
feed KPIs based on 11.0 ME Pasture.					
Pasture & Crop eaten	MJME/ha	151,603	151,395	128,580	138,868
Pasture & Crop eaten	t DM/ha	13.8	13.8	11.7	12.6
Imported supplements eaten	t DM/ha	0.9	2.0	2.9	2.8
Grazing off dry cows eaten	t DM/ha	0.5	0.4	0.5	0.5
Total feed eaten	t DM/ha	14.7	15.8	15.0	15.9
Feed exported	t DM/ha	0.6	0.4	0.1	0.0
Imported supplements eaten	kg DM/cow	339	640	972	927
Imported supplements & grazing eaten	kg DM/cow	534	782	1137	1099
Average utilisation imported supplement		85%	82%	87%	81%
Average ME imported supplements	MJ/kgDM	10.8	10.7	10.9	10.8
Crops Grazed & Harvested					
Farm area in grazed winter crop	ha	4.0	0.2	0.0	4.0
Farm area in grazed summer crop	ha	5.0	1.5	4.5	4.7
Farm area in harvest crop	ha	0.0	2.1	1.8	0.0
Percent of farm harvested for hay & silage		7%	15%	11%	15%
People					
Cows/Labour unit	cows/FTE	100	147	109	101
Milksolids/Labour unit	kg/FTE	39,200	56,822	42,029	41,530

How much milk was produced

DairyBase

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DAIRY OPERATING PROFIT	64,272	16.7%	0.78	0.48	835	575	306	188
Non-Dairy Operating Profit	0	0.0%	0.00		0		0	
Total Operating Profit	64,272	16.7%	0.78		835		306	

DairyBase

Physical Detail A

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
Benchmark Group Ranked by:
Farm business type : 1- Owner operator

		2015-16		2014-15	2013-14
Physical Description	**Units**	**Farm**	**Benchmark**	**Farm**	**Farm**
Milking area	ha	77.0	138.6	77.0	77.0
Support block effective area	ha	32.0	38.2	32.0	32.0
Percent of farm at different height to dairy		0%	10%	0%	0%
Peak cows milked		210	425	229	233
Stocking rate	cows/ha	2.7	3.1	3.0	3.0
Cow breed		Friesian	Friesian	Friesian	Friesian
Cow liveweight	kg	480	474	480	480
Liveweight/ha	kg/ha	1,309	1,452	1,428	1,452
BW reliability		123 / 55 LIC		125 / 50 LIC	131 / 55 L
PW reliability		139 / 75 LIC		143 / 49 LIC	155 / 69 L
Season's rainfall	mm	1329 NIWA	1100	1250	1250
					1,710
					4
					pring or
Milksolids (MS) Production to factory - (Seasonal year)					
Milksolids/ha	kg/ha	1,069	1,189	1,146	1,240
Milksolids/cow	kg/cow	392	388	385	410
					85%
					1.83
					3.8%
Days in Milk per cow		275	261	256	275
Feed Eaten					
Pasture & Crop eaten	MJME/ha	151,603	151,395	128,580	138,868
Pasture & Crop eaten	t DM/ha	13.8	13.8	11.7	12.6
Imported supplements eaten	t DM/ha	0.9	2.0	2.9	2.8
Grazing off dry cows eaten	t DM/ha	0.5	0.4	0.5	0.5
Total feed eaten	t DM/ha	14.7	15.8	15.0	15.9
Feed exported	t DM/ha	0.6	0.4	0.1	0.0
Imported supplements eaten	kg DM/cow	339	640	972	927
Imported supplements & grazing eaten	kg DM/cow	534	782	1137	1099
Average utilisation imported supplement		85%	82%	87%	81%
Average ME imported supplements	MJ/kgDM	10.8	10.7	10.9	10.8
Crops Grazed & Harvested					
Farm area in grazed winter crop	ha	4.0	0.2	0.0	4.0
Farm area in grazed summer crop	ha	5.0	1.5	4.5	4.7
Farm area in harvest crop	ha	0.0	2.1	1.8	0.0
Percent of farm harvested for hay & silage		7%	15%	11%	15%
People					
Cows/Labour unit	cows/FTE	100	147	109	101
Milksolids/Labour unit	kg/FTE	39,200	56,822	42,029	41,530

How much milk was produced

How long the cows were milked for

DairyBase

Financial Detail

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
Benchmark Group Ranked by: Farm business type : 1- Owner operator

	Total $		$ Per kg MS		$ Per Ha		$ Per Cow	
GROSS FARM REVENUE (GFR)	**Farm**	**% of GFR**	**Farm**	**Benchmark**	**Farm**	**Benchmark**	**Farm**	**Benchmark**
Net Milk Sales	312,402	81.1%	3.79	3.87	4,057	4,592	1,488	1,498
Net Dairy Livestock Sales	69,303	18.0%	0.84	0.69	900	814	330	265
Value of Change in Dairy Livestock	-358	-0.1%	-0.00	-0.08	-5	-91	-2	-30
Other Dairy Revenue	3,975	1.0%	0.05	0.04	52	44	19	14
DAIRY GROSS FARM REVENUE	385,322	100.0%	4.68	4.51	5,004	5,359	1,835	1,748
Non-Dairy Cash Income	0	0.0%	0.00		0		0	
Value of Change in Non-dairy livestock	0	0.0%	0.00		0		0	
Total Gross Farm Revenue	385,322	100.0%	4.68		5,004		1,835	
OPERATING EXPENSES								
Labour Expenses								
Wages	45,824	11.9%	0.56	0.59	595	697	218	227
Labour Adjustment - Unpaid	3,750	1.0%	0.05	0.09	49	104	18	34
Labour Adjustment - Management	49,650	12.9%	0.60	0.28	645	330	236	108
Total Labour Expenses	99,224	25.8%	1.21	0.95	1,289	1,131	472	369
Stock Expenses								
Animal Health	16,199	4.2%	0.20	0.20	210	242	77	79
Breeding & Herd Improvement	6,812	1.8%	0.08	0.12	88	139	32	45
Farm Dairy	4,148	1.1%	0.05	0.04	54	53	20	17
Electricity (Farm Dairy, Water Supply)	9,595	2.5%	0.12	0.11	125	132	46	43
Total Stock Expenses	36,754	9.5%	0.45	0.48	477	566	175	185
Feed Expenses								
Supplement Expenses								
Net Made,Purchased,Cropped	37,541	9.7%	0.46	0.61	488	720	179	235
Less Feed Inventory Adjustment	18,328	4.8%	0.22	0.04	238	46	87	15
Calf Feed	5,153	1.3%	0.06	0.03	67	34	25	11
Total Supplement Expenses	24,366	6.3%	0.30	0.60	316	709	116	231
Grazing & Run Off Expenses								
Young & Dry Stock Grazing	0	0.0%	0.00	0.23	0	276	0	90
Winter Cow Grazing	0	0.0%	0.00	0.03	0	32	0	10
Support block Lease	16,429	4.3%	0.20	0.08	213	92	78	30
Owned Support block Adjustment	11,250	2.9%	0.14	0.06	146	73	54	24
Total Grazing & Support block expenses	27,679	7.2%	0.34	0.40	359	473	132	154
Total Feed Expenses	52,045	13.5%	0.63	0.99	676	1,182	248	385
Other Working Expenses								
Fertiliser	15,903	4.1%	0.19	0.36	207	423	76	138
Nitrogen	0	0.0%	0.00	0.03	0	40	0	13
Irrigation	0	0.0%	0.00	0.02	0	20	0	6
Regrassing	6,919	1.8%	0.08	0.04	90	47	33	15
Weed & Pest	624	0.2%	0.01	0.02	8	21	3	7
Vehicles	13,306	3.5%	0.16	0.10	173	124	63	40
Fuel	0	0.0%	0.00	0.04	0	51	0	17
R & M - land & buildings	12,526	3.3%	0.15	0.18	163	211	60	69
R & M - plant and equipment	11,964	3.1%	0.15	0.08	155	97	57	31
Freight and General	8,382	2.2%	0.10	0.05	109	64	40	21
Total Other Working Expenses	69,624	18.1%	0.85	0.92	904	1,098	332	358
Overheads								
Administration	9,140	2.4%	0.11	0.11	119	128	44	42
Insurance	7,512	1.9%	0.09	0.07	98	79	36	26
ACC	1,946	0.5%	0.02	0.03	25	38	9	12
Rates	16,858	4.4%	0.20	0.18	219	216	80	70
Depreciation	27,947	7.3%	0.34	0.29	363	347	133	113
Total Overheads	63,403	16.5%	0.77	0.68	823	808	302	263
TOTAL DAIRY OPERATING EXPENSES	321,050	83.3%	3.90	4.03	4,169	4,784	1,529	1,560
Non-Dairy Operating Expenses	0	0.0%	0		0		0	
Total Operating Expenses	321,050	83.3%	3.90		4,169		1,529	
OPERATING PROFIT								
DAIRY OPERATING PROFIT	64,272	16.7%	0.78	0.48	835	575	306	188
Non-Dairy Operating Profit	0	0.0%	0.00		0		0	
Total Operating Profit	64,272	16.7%	0.78		835		306	

DairyBase

Physical Detail A

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
Benchmark Group Ranked by: Farm business type : 1- Owner operator

		2015-16		2014-15	2013-14
Physical Description	**Units**	**Farm**	**Benchmark**	**Farm**	**Farm**
Milking area	ha	77.0	138.6	77.0	77.0
Support block effective area	ha	32.0	38.2	32.0	32.0
Percent of farm at different height to dairy		0%	10%	0%	0%
Peak cows milked		210	425	229	233
Stocking rate	cows/ha	2.7	3.1	3.0	3.0
Cow breed		Friesian	Friesian	Friesian	Friesian
Cow liveweight	kg	480	474	480	480
Liveweight/ha	kg/ha	1,309	1,452	1,428	1,452
BW reliability		123 / 55 LIC		125 / 50 LIC	131 / 55 L
PW reliability		139 / 75 LIC		143 / 49 LIC	155 / 69 L
Season's rainfall	mm	1329 NIWA	1100	1250	1250
					1,710
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					pring or
Milksolids (MS) Production to factory - (Seasonal year)					
Milksolids/ha	kg/ha	1,069	1,189	1,146	1,240
Milksolids/cow	kg/cow	392	388	385	410
					85%
					1.83
					3.8%
Days in Milk per cow		275	261	256	275
Feed Eaten					
Pasture & Crop eaten	MJME/ha	151,603	151,395	128,580	138,868
Pasture & Crop eaten	t DM/ha	13.8	13.8	11.7	12.6
Imported supplements eaten	t DM/ha	0.9	2.0	2.9	2.8
				15.0	15.9
				0.1	0.0
				972	927
Imported supplements & grazing eaten	kg DM/cow	534	782	1137	1099
Average utilisation imported supplement		85%	82%	87%	81%
Average ME imported supplements	MJ/kgDM	10.8	10.7	10.9	10.8
Crops Grazed & Harvested					
Farm area in grazed winter crop	ha	4.0	0.2	0.0	4.0
Farm area in grazed summer crop	ha	5.0	1.5	4.5	4.7
Farm area in harvest crop	ha	0.0	2.1	1.8	0.0
Percent of farm harvested for hay & silage		7%	15%	11%	15%
People					
Cows/Labour unit	cows/FTE	100	147	109	101
Milksolids/Labour unit	kg/FTE	39,200	56,822	42,029	41,530

How much milk was produced

How long the cows were milked for

How much food they ate

DairyBase

Financial Detail

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
Benchmark Group Ranked by:
Farm business type : 1- Owner operator

	Total $		$ Per kg MS		$ Per Ha		$ Per Cow	
GROSS FARM REVENUE (GFR)	**Farm**	**% of GFR**	**Farm**	**Benchmark**	**Farm**	**Benchmark**	**Farm**	**Benchmark**
Net Milk Sales	312,402	81.1%	3.79	3.87	4,057	4,592	1,488	1,498
Net Dairy Livestock Sales	69,303	18.0%	0.84	0.69	900	814	330	265
Value of Change in Dairy Livestock	-358	-0.1%	-0.00	-0.08	-5	-91	-2	-30
Other Dairy Revenue	3,975	1.0%	0.05	0.04	52	44	19	14
DAIRY GROSS FARM REVENUE	385,322	100.0%	4.68	4.51	5,004	5,359	1,835	1,748
Non-Dairy Cash Income	0	0.0%	0.00		0		0	
Value of Change in Non-dairy livestock	0	0.0%	0.00		0		0	
Total Gross Farm Revenue	385,322	100.0%	4.68		5,004		1,835	
OPERATING EXPENSES								
Labour Expenses								
Wages	45,824	11.9%	0.56	0.59	595	697	218	227
Labour Adjustment - Unpaid	3,750	1.0%	0.05	0.09	49	104	18	34
Labour Adjustment - Management	49,650	12.9%	0.60	0.28	645	330	236	108
Total Labour Expenses	99,224	25.8%	1.21	0.96	1,289	1,131	472	369
						242	77	79
						139	32	45
						53	20	17
Total Stock Expenses	36,754	9.5%	0.45	0.48	477	566	175	185
Feed Expenses								
Supplement Expenses								
Net Made,Purchased,Cropped	37,541	9.7%	0.46	0.61	488	720	179	235
Less Feed Inventory Adjustment	18,239	4.8%	0.22	0.04	238	46	87	16
Cash Feed	5,155	1.3%	0.06	0.05	67	34	25	11
Total Supplement Expenses	24,366	6.3%	0.30	0.60	316	709	116	231
Grazing & Run Off Expenses								
Young & Dry Stock Grazing	0	0.0%	0.00	0.23	0	276	0	90
Winter Cow Grazing	0	0.0%	0.00	0.03	0	32	0	10
Support block Lease	16,429	4.3%	0.20	0.08	213	92	78	30
Owned Support block Adjustment	11,250	2.9%	0.14	0.06	146	73	54	24
Total Grazing & Support block expenses	27,679	7.2%	0.34	0.40	359	473	132	154
Total Feed Expenses	52,045	13.5%	0.63	0.99	676	1,182	248	385
Other Working Expenses								
Fertiliser	15,903	4.1%	0.19	0.36	207	423	76	138
Nitrogen	0	0.0%	0.00	0.03	0	40	0	13
Irrigation	0	0.0%	0.00	0.02	0	20	0	6
Regrassing	6,919	1.8%	0.08	0.04	90	47	33	15
Weed & Pest	624	0.2%	0.01	0.02	8	21	3	7
Vehicles	13,306	3.5%	0.16	0.10	173	124	63	40
Fuel	0	0.0%	0.00	0.04	0	51	0	17
R & M - land & buildings	12,526	3.3%	0.15	0.18	163	211	60	69
R & M - plant and equipment	11,964	3.1%	0.15	0.08	155	97	57	31
Freight and General	8,382	2.2%	0.10	0.05	109	64	40	21
Total Other Working Expenses	69,624	18.1%	0.85	0.92	904	1,098	332	358
Overheads								
Administration	9,140	2.4%	0.11	0.11	119	128	44	42
Insurance	7,512	1.9%	0.09	0.07	98	79	36	26
ACC	1,946	0.5%	0.02	0.03	25	38	9	12
Rates	16,858	4.4%	0.20	0.18	219	216	80	70
Depreciation	27,947	7.3%	0.34	0.29	363	347	133	113
Total Overheads	63,403	16.5%	0.77	0.68	823	808	302	263
TOTAL DAIRY OPERATING EXPENSES	321,050	83.3%	3.90	4.03	4,169	4,784	1,529	1,560
Non-Dairy Operating Expenses	0	0.0%	0		0		0	
Total Operating Expenses	321,050	83.3%	3.90		4,169		1,529	
OPERATING PROFIT								
DAIRY OPERATING PROFIT	64,272	16.7%	0.78	0.48	835	575	306	188
Non-Dairy Operating Profit	0	0.0%	0.00		0		0	
Total Operating Profit	64,272	16.7%	0.78		835		306	

How much palm kernel cost

DairyBase

Physical Detail A

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
Benchmark Group Ranked by:
Farm business type : 1- Owner operator

		2015-16		2014-15	2013-14
Physical Description	**Units**	**Farm**	**Benchmark**	**Farm**	**Farm**
Milking area	ha	77.0	138.6	77.0	77.0
Support block effective area	ha	32.0	38.2	32.0	32.0
Percent of farm at different height to dairy		0%	10%	0%	0%
Peak cows milked		210	425	229	233
Stocking rate	cows/ha	2.7	3.1	3.0	3.0
Cow breed		Friesian	Friesian	Friesian	Friesian
Cow liveweight	kg	480	474	480	480
Liveweight/ha	kg/ha	1,309	1,452	1,428	1,452
BW reliability		123 / 55 LIC		125 / 50 LIC	131 / 55 L
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Pasture & Crop eaten	t DM/ha	13.8	13.8	11.7	12.6
Imported supplements eaten	t DM/ha	0.9	2.0	2.9	2.8
				0.3	0.3
				15.0	15.9
				0.1	0.0
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Imported supplements & grazing eaten	kg DM/cow	534	782	1137	1099
Average utilisation imported supplement		85%	82%	87%	81%
Average ME imported supplements	MJ/kgDM	10.8	10.7	10.9	10.8
Crops Grazed & Harvested					
Farm area in grazed winter crop	ha	4.0	0.2	0.0	4.0
Farm area in grazed summer crop	ha	5.0	1.5	4.5	4.7
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Percent of farm harvested for hay & silage		7%	15%	11%	15%
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Cows/Labour unit	cows/FTE	100	147	109	101
Milksolids/Labour unit	kg/FTE	39,200	56,822	42,029	41,530

How much milk was produced

How long the cows were milked for

How much food they ate

DairyBase

Financial Detail

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
Benchmark Group Ranked by: Farm business type : 1- Owner operator

	Total $		$ Per kg MS		$ Per Ha		$ Per Cow	
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Value of Change in Non-dairy livestock	0	0.0%	0.00		0		0	
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Other Working Expenses								
Fertiliser	15,903	4.1%	0.19	0.36	207	423	76	138
Nitrogen	0	0.0%	0.00	0.03	0	40	0	13
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Regrassing	6,919	1.8%	0.08	0.04	90	47	33	15
Weed & Pest	624	0.2%	0.01	0.02	8	21	3	7
Vehicles	13,306	3.5%	0.16	0.10	173	124	63	40
Fuel	0	0.0%	0.00	0.04	0	51	0	17
R & M - land & buildings	12,526	3.3%	0.15	0.18	163	211	60	69
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Rates	16,858	4.4%	0.20	0.18	219	216	80	70
		3%	0.34	0.29	363	347	133	113
		5%	0.77	0.68	823	808	302	263
		3%	3.90	4.03	4,169	4,784	1,529	1,560
		0%	0		0		0	
		3%	3.90		4,169		1,529	
OPERATING PROFIT								
DAIRY OPERATING PROFIT	64,272	16.7%	0.78	0.48	835	575	306	188
Non-Dairy Operating Profit	0	0.0%	0.00		0		0	
Total Operating Profit	64,272	16.7%	0.78		835		306	

How much palm kernel cost

Operating profit

DairyBase

Physical Detail A

Dowson Family Trust Partnership (Farm ID: 623485)
Dairy Season ended: 2016 Printed: 3 April 2017

Number in Benchmark Group: 48
Benchmark Group Selected by: Profitability and Physical analysis
Benchmark Group Ranked by: Farm business type : 1- Owner operator

		2015-16		2014-15	2013-14
Physical Description	**Units**	**Farm**	**Benchmark**	**Farm**	**Farm**
Milking area	ha	77.0	138.6	77.0	77.0
Support block effective area	ha	32.0	38.2	32.0	32.0
Percent of farm at different height to dairy		0%	10%	0%	0%
Peak cows milked		210	425	229	233
Stocking rate	cows/ha	2.7	3.1	3.0	3.0
Cow breed		Friesian	Friesian	Friesian	Friesian
Cow liveweight	kg	480	474	480	480
Liveweight/ha	kg/ha	1,309	1,452	1,428	1,452
BW reliability		123 / 55 LIC		125 / 50 LIC	131 / 55 L
PW reliability		139 / 75 LIC		143 / 49 LIC	155 / 69 L
Season's rainfall	mm	1329 NIWA	1100	1250	1250
					1,710
					4
					spring on
Milksolids (MS) Production to factory - (Seasonal year)					
Milksolids/ha	kg/ha	1,069	1,189	1,146	1,240
Milksolids/cow	kg/cow	392	388	385	410
					85%
					1.83
					3.8%
Days in Milk per cow		275	261	256	275
Feed Eaten					
Pasture & Crop eaten	MJME/ha	151,603	151,395	128,580	138,868
Pasture & Crop eaten	t DM/ha	13.8	13.8	11.7	12.6
Imported supplements eaten	t DM/ha	0.9	2.0	2.9	2.8
				15.0	15.9
				0.1	0.0
				972	927
Imported supplements & grazing eaten	kg DM/cow	534	782	1137	1099
Average utilisation imported supplement		85%	82%	87%	81%
Average ME imported supplements	MJ/kgDM	10.8	10.7	10.9	10.8
Crops Grazed & Harvested					
Farm area in grazed winter crop	ha	4.0	0.2	0.0	4.0
Farm area in grazed summer crop	ha	5.0	1.5	4.5	4.7
Farm area in harvest crop	ha	0.0	2.1	1.8	0.0
Percent of farm harvested for hay & silage		7%	15%	11%	15%
People					
Cows/Labour unit	cows/FTE	100	147	109	101
Milksolids/Labour unit	kg/FTE	39,200	56,822	42,029	41,530

How much milk was produced

How long the cows were milked for

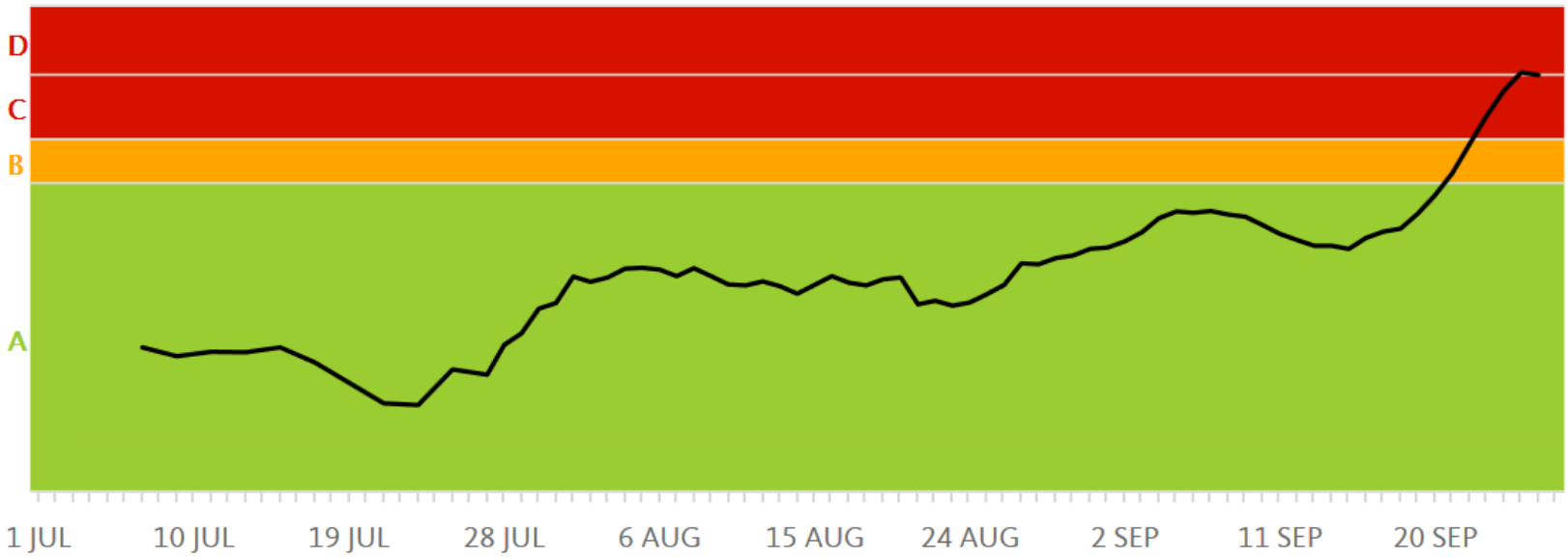
How much food they ate

Orang-utan: “person of the forest”

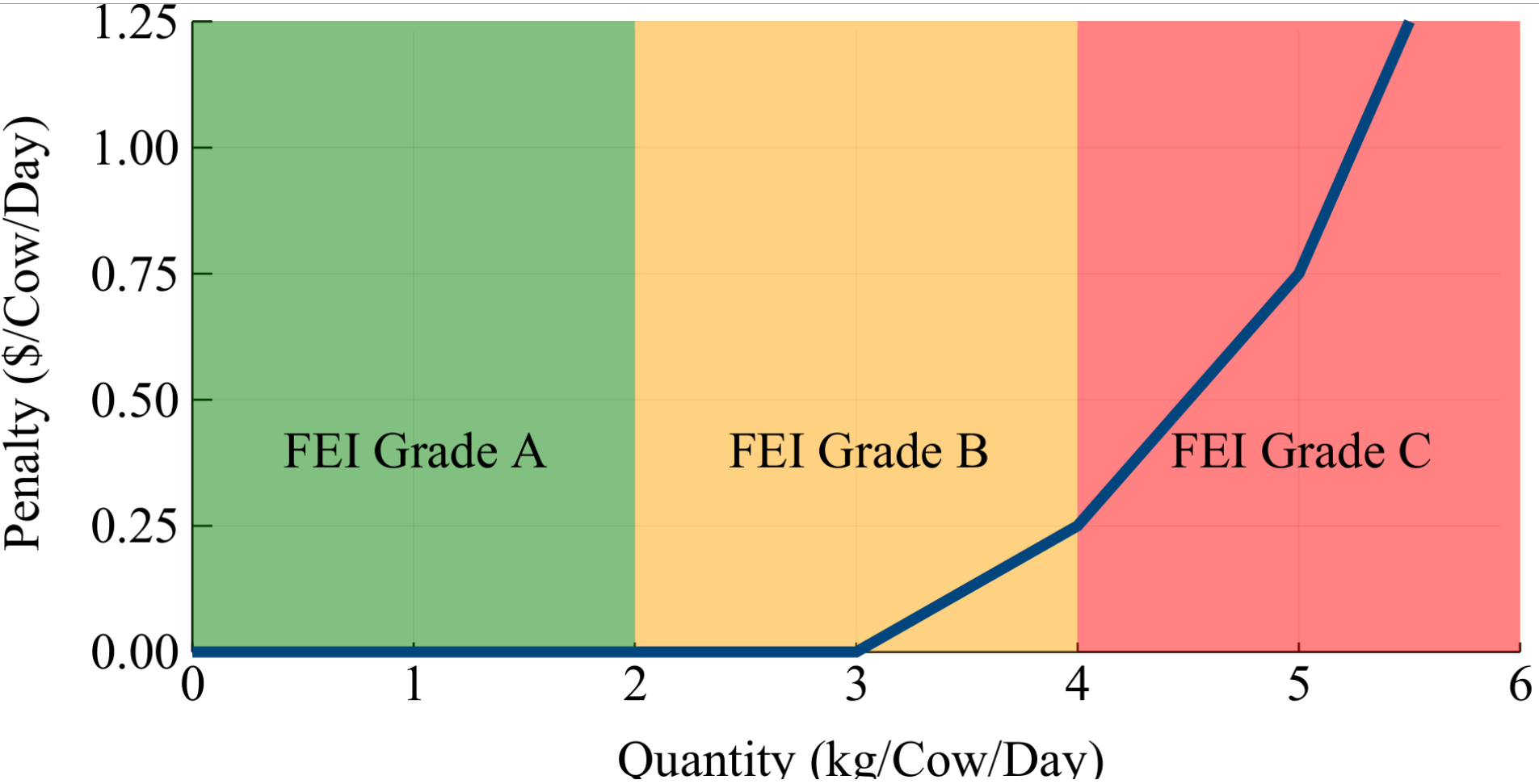
SAVING THE ORANGUTANS

01/07/17 - 27/09/17 | 2017/18 | Last 10 Days

FEI : **This Season**



Kg/
Litr
SC
Kg/
Fat
Mil
Pro
FEI


1.25
1.00
0.75
0.50
0.25
0.00
Penalty ($/Cow/Day)
FEI Grade A
FEI Grade B
FEI Grade C
0
1
2
3
4
5
6
Quantity (kg/Cow/Day)

FORECASTING THE MILK PRICE

← 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.

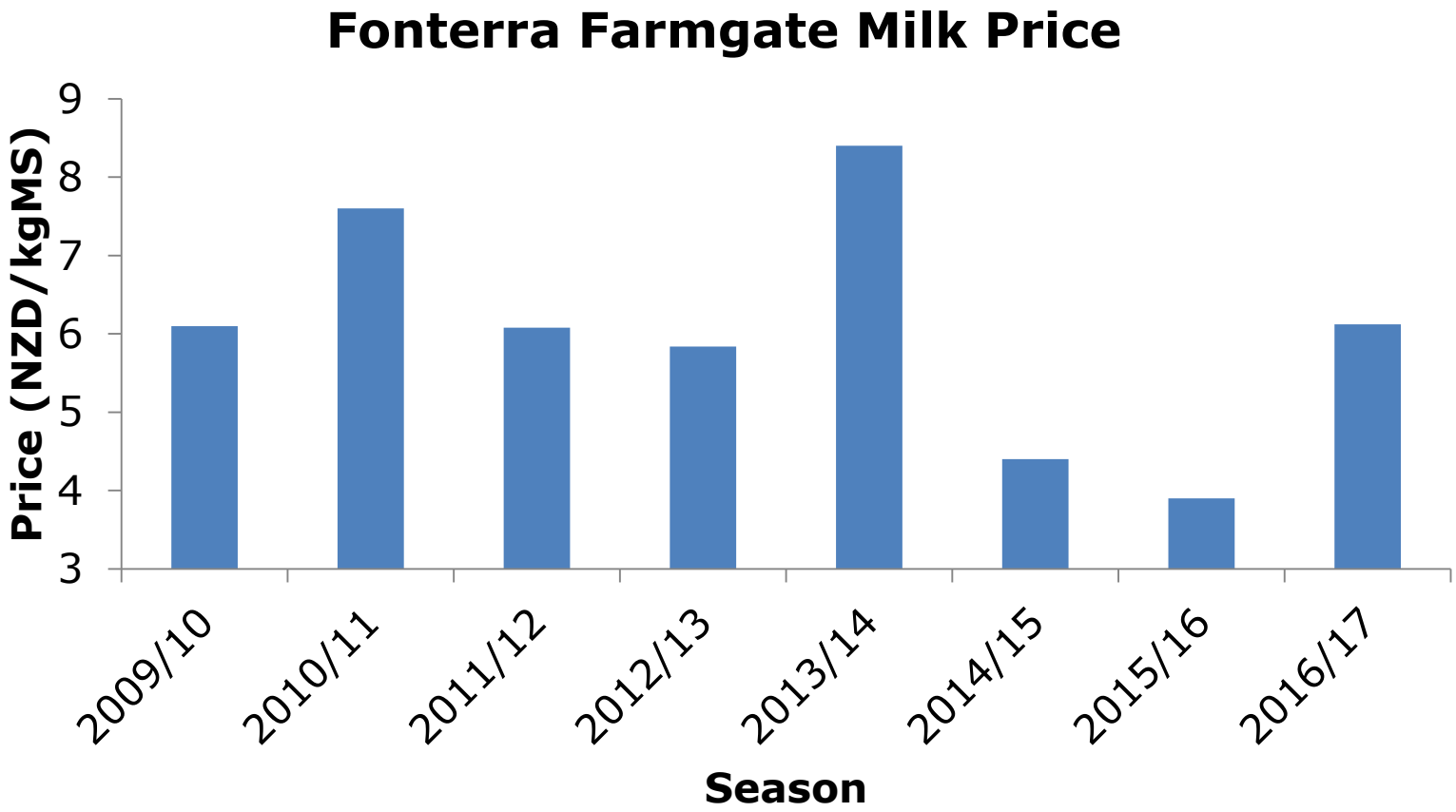
ASB's Nathan Penny has been predicting a 2016/17 payment that will start with a '6'. In contrast, W
ongoing gl
Fonterra's
that predic

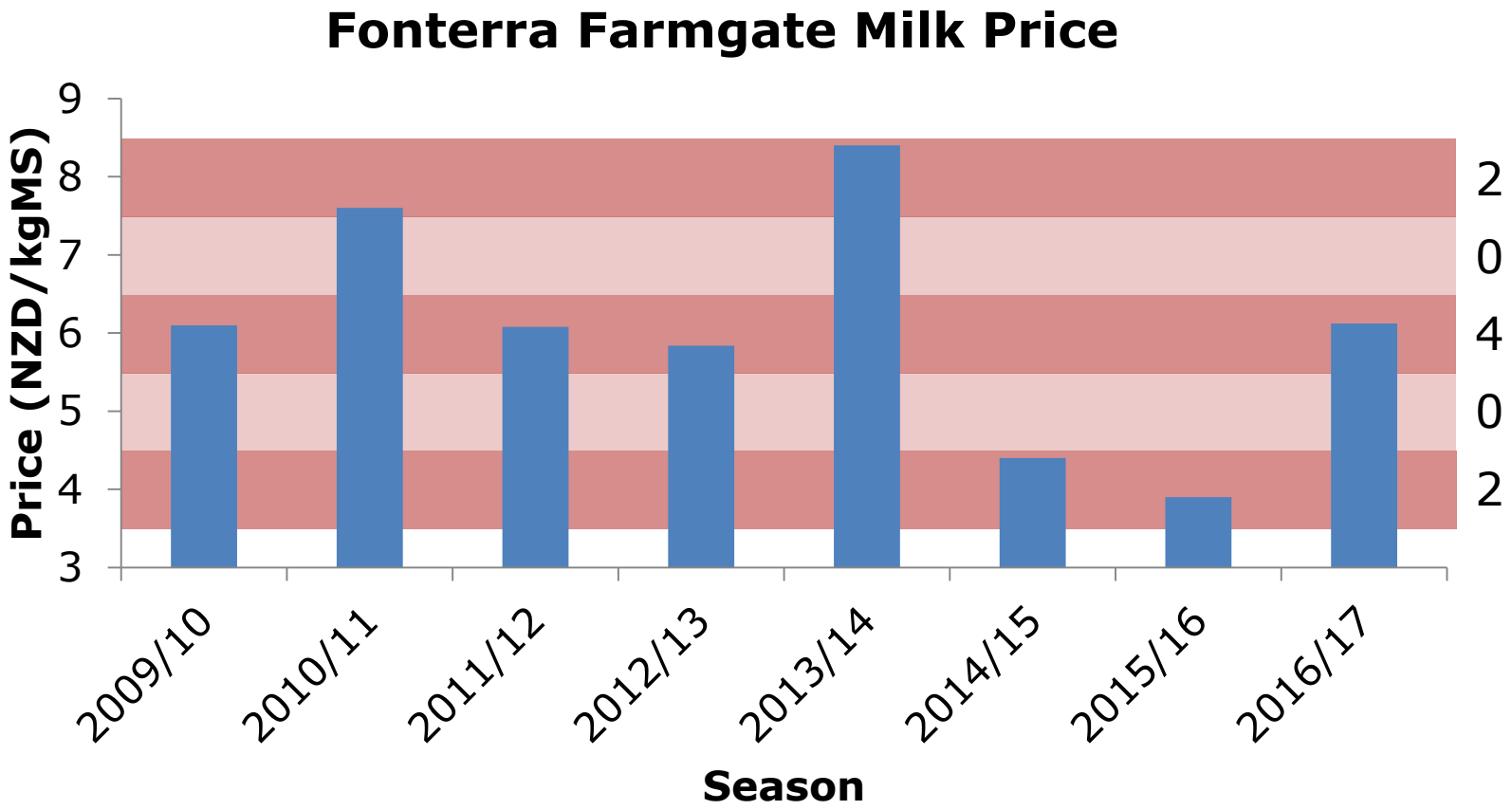
Dairy price estimates are consistently wrong

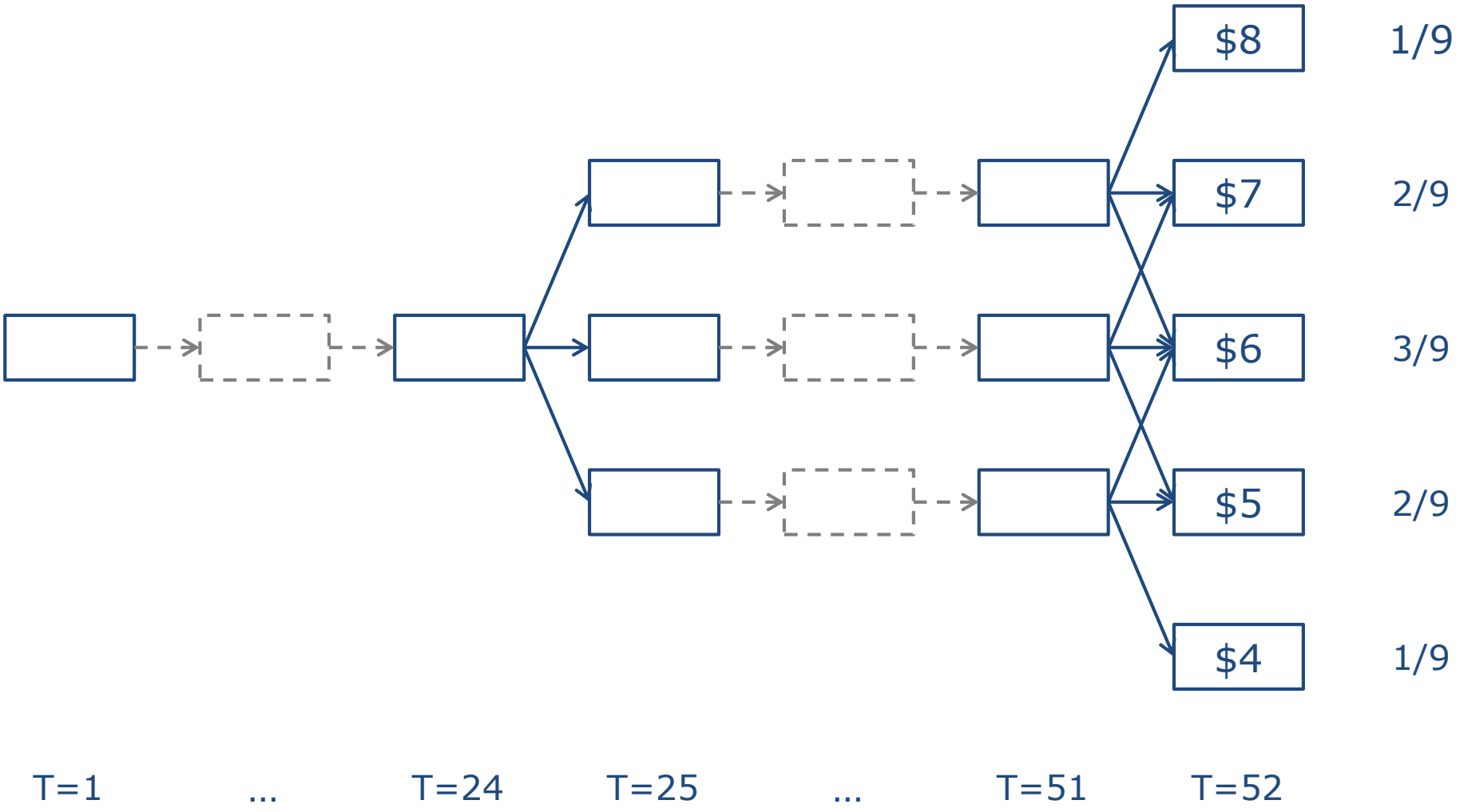
Posted on May 31, 2016

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.

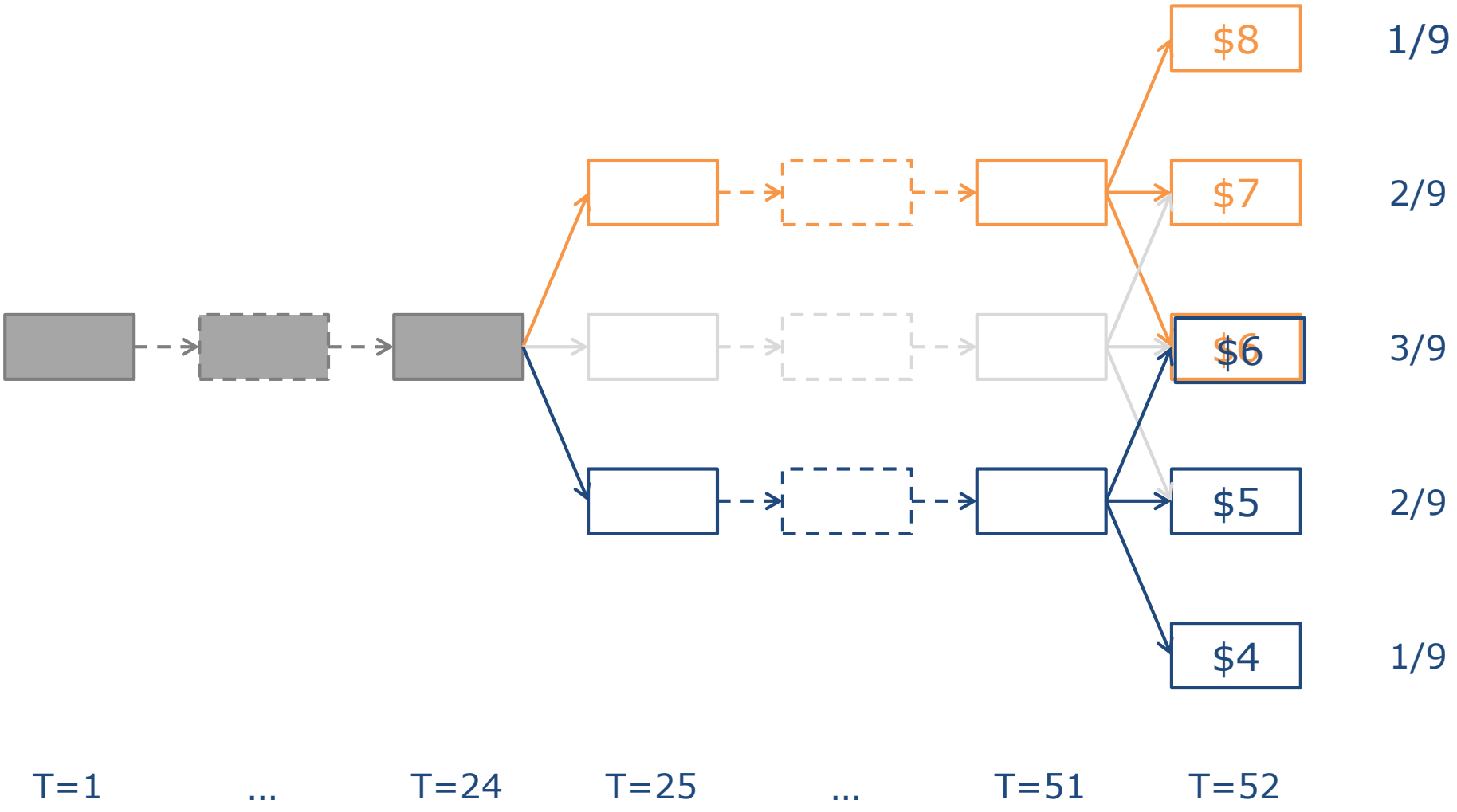
Year	Opening Forecast ($)	Actual Payment ($)	Variation $)
2011/12	6.75	6.08	- 0.67
2012/13	5.50	5.84	+ 0.34
2013/14	7.00	8.40	+ 1.40
2014/15	7.00	4.40	- 2.60
2015/16	5.25	3.90 (not yet final)	- 1.35


Fonterra Farmgate Milk Price
Price (NZD/kgMS)
9
8
7
6
5
4
3
2009/10
2010/11
2011/12
2012/13
2013/14
2014/15
2015/16
2016/17
Season


Fonterra Farmgate Milk Price
Price (NZD/kgMS)
9
8
7
6
5
4
3
2
0
4
0
2
2009/10
2010/11
2011/12
2012/13
2013/14
2014/15
2015/16
2016/17
Season


$8
$7
$6
$5
$4
1/9
2/9
3/9
2/9
1/9
T=1
...
T=24
T=25
...
T=51
T=52

RESULTS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2/9
$6
3/9
$5
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$4
1/9
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...
T=24
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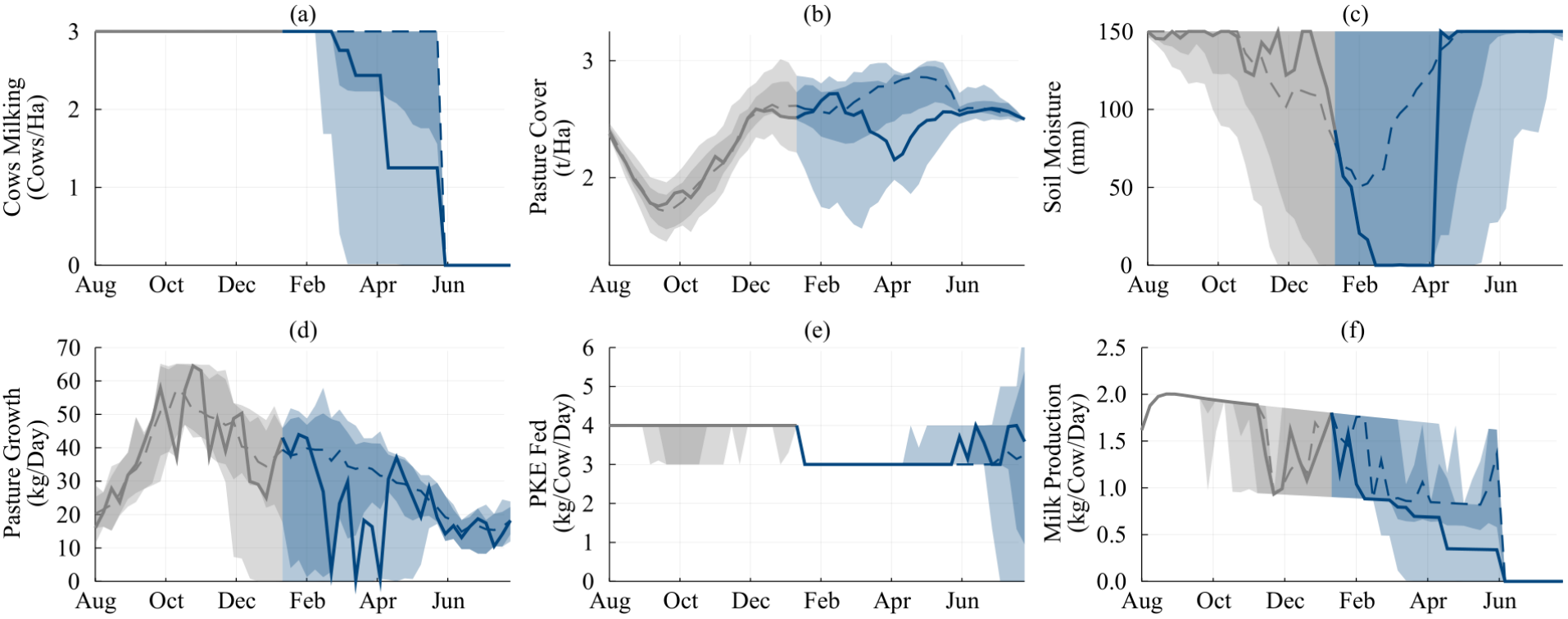
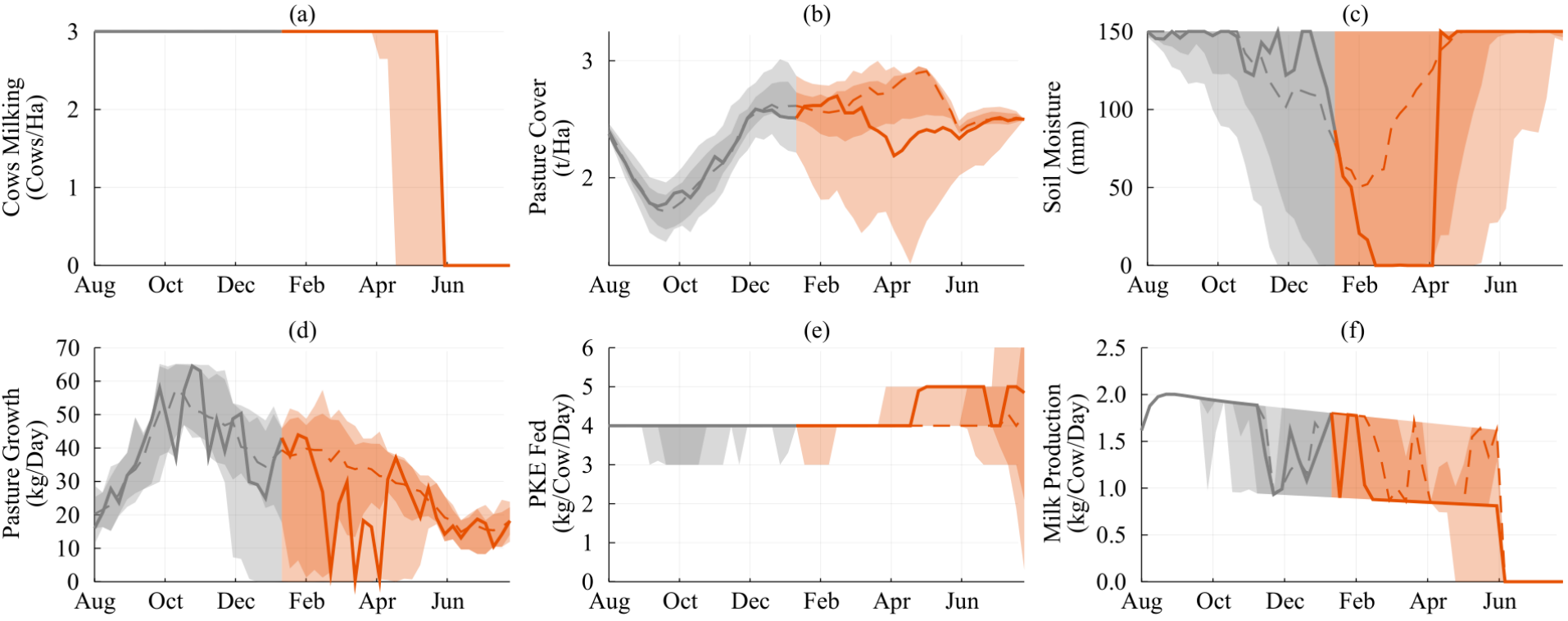
Low Price Scenarios

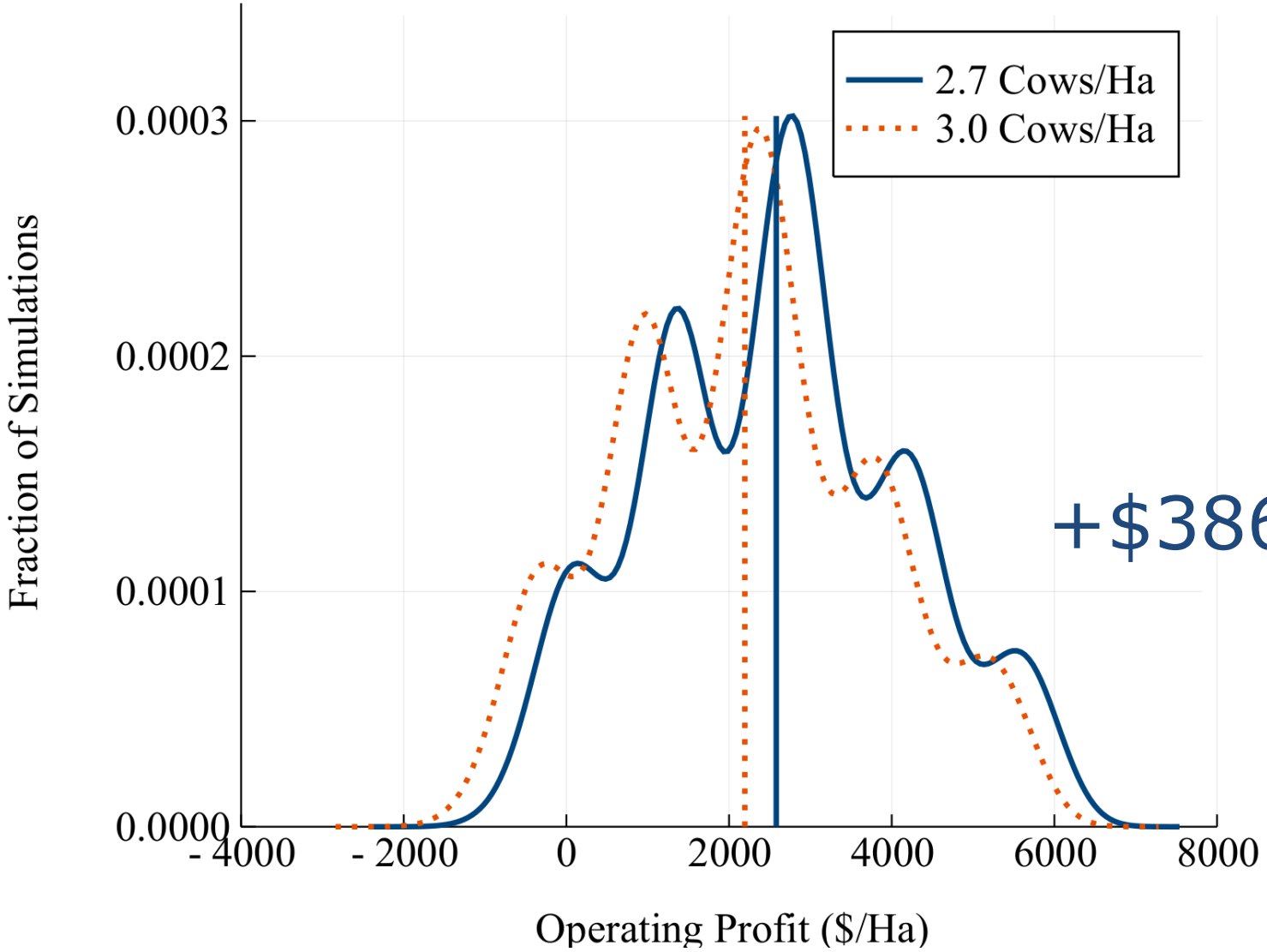


High Price Scenarios



CAN WE DO BETTER?

Lowering the Stocking Rate



+$386/Ha

What next?

- A better price model
- A better weather model
- A better animal model
- Milk Price Futures
- Nitrogen
- Ability to sell/buy stock
- Sheep and Beef?
- Cropping?

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

SDDP.jl

A Julia library for Stochastic Dual Dynamic Programming

Oscar Dowson

odow003@aucklanduni.ac.nz

THE AIR-CONDITIONING EXAMPLE

The air-conditioning problem

- Consider the problem of producing air-conditioners over a period of three months.
- During standard working hours, the factory can produce 200 units per month at a cost of $100/unit.
- Unlimited overtime can be scheduled, however it costs $300 to produce a unit.
- In the first month, there is a known demand of 100 units.
- In months two and three, there is an equally likely demand of 100 or 300 units.
- Air-conditioners can be stored between months at a cost of $50/unit
- All demand must be met.

The air-conditioning problem

State

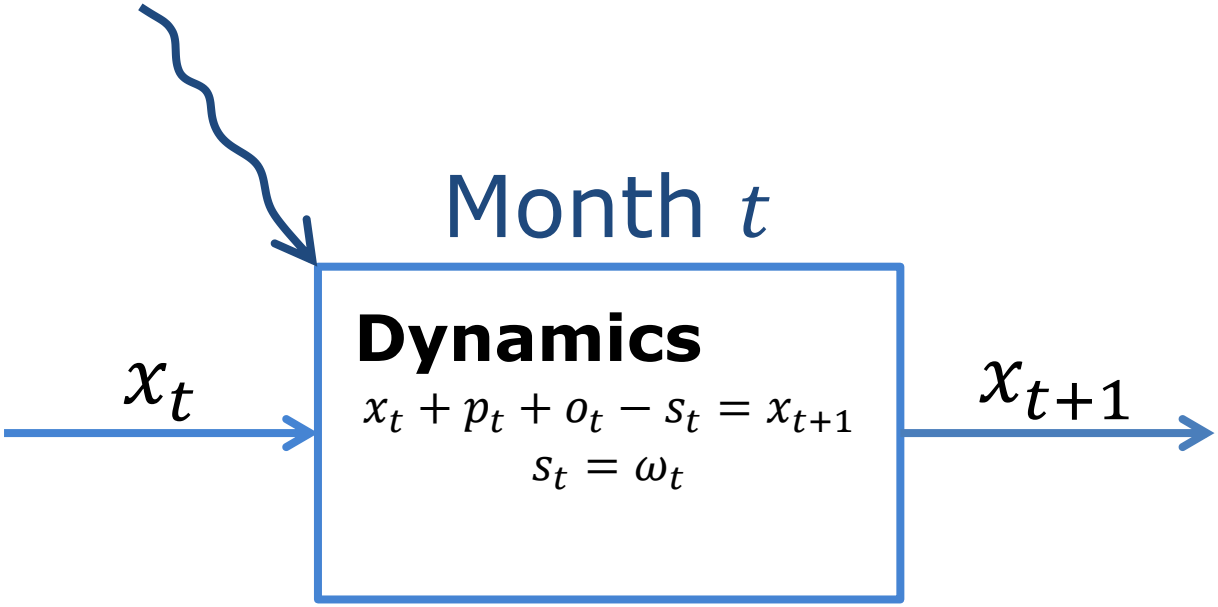
- Number of units in storage: $x_t \geq 0$

Controls

- Normal production: $0 \leq p_t \leq 200$
- Overtime production: $o_t \geq 0$
- Sales: $s_t \geq 0$

The air-conditioning problem

Noise: units demanded ω_t

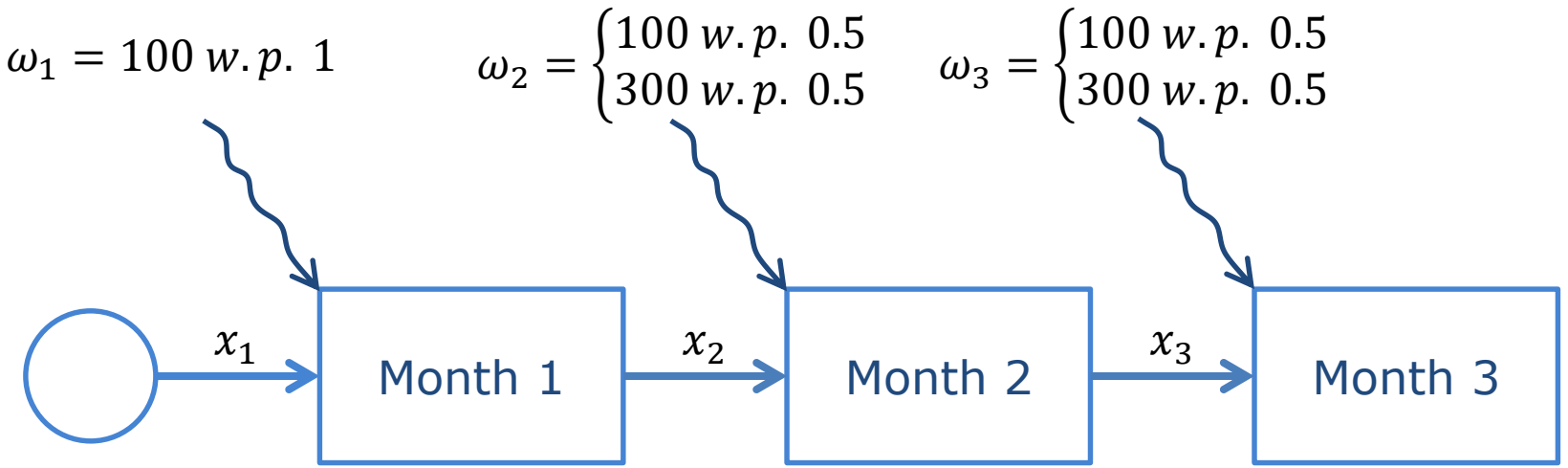


Immediate Cost $100p_t + 300o_t + 50x_{t+1}$

The air-conditioning problem

$$\begin{aligned} \min \quad & 100p_t + 300\, o_t + 50\, x_{t+1} \\ \text{s.t.} \quad & x_t + p_t + o_t - s_t = x_{t+1} \\ & s_t = \omega_t \\ & 0 \le p_t \le 200 \\ & o_t, s_t, x_t \ge 0 \end{aligned}$$

The air-conditioning problem



The air-conditioning problem

```
using JuMP, SDDP, Clp

m = SDDPModel(
         stages = 3,
objective_bound = 0.0,
          sense = :Min,
         solver = ClpSolver()
                                ) do sp, t
    @state(sp, xt_1 >= 0, xt == 0)
    @variables(sp, begin
        0 <= pt <= 200
             ot >= 0
             st >= 0
    end)
    @constraint(sp, xt + pt + ot - st == xt_1)
    D = [ [100], [100, 300], [100, 300] ]
    @rhsnoise(sp, wt=D[t], st == wt)
    P = [ [1.0], [0.5, 0.5], [0.5, 0.5] ]
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```

$$\min \quad 100p_t + 300\,o_t + 50\,x_{t+1}$$

$$\text{s.t.} \quad x_t + p_t + o_t - s_t = x_{t+1}$$

$$s_t = \omega_t$$

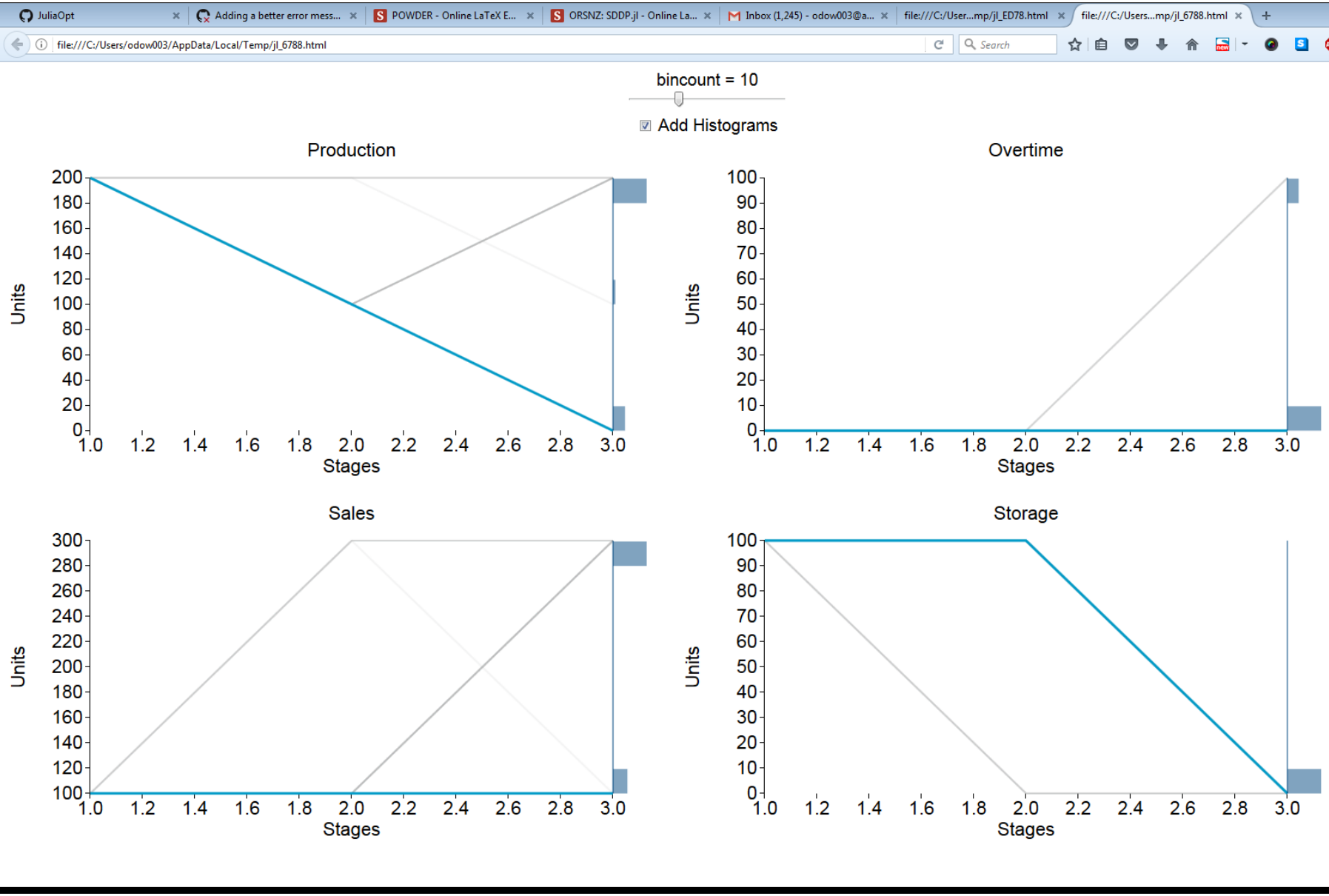
$$0 \le p_t \le 200$$

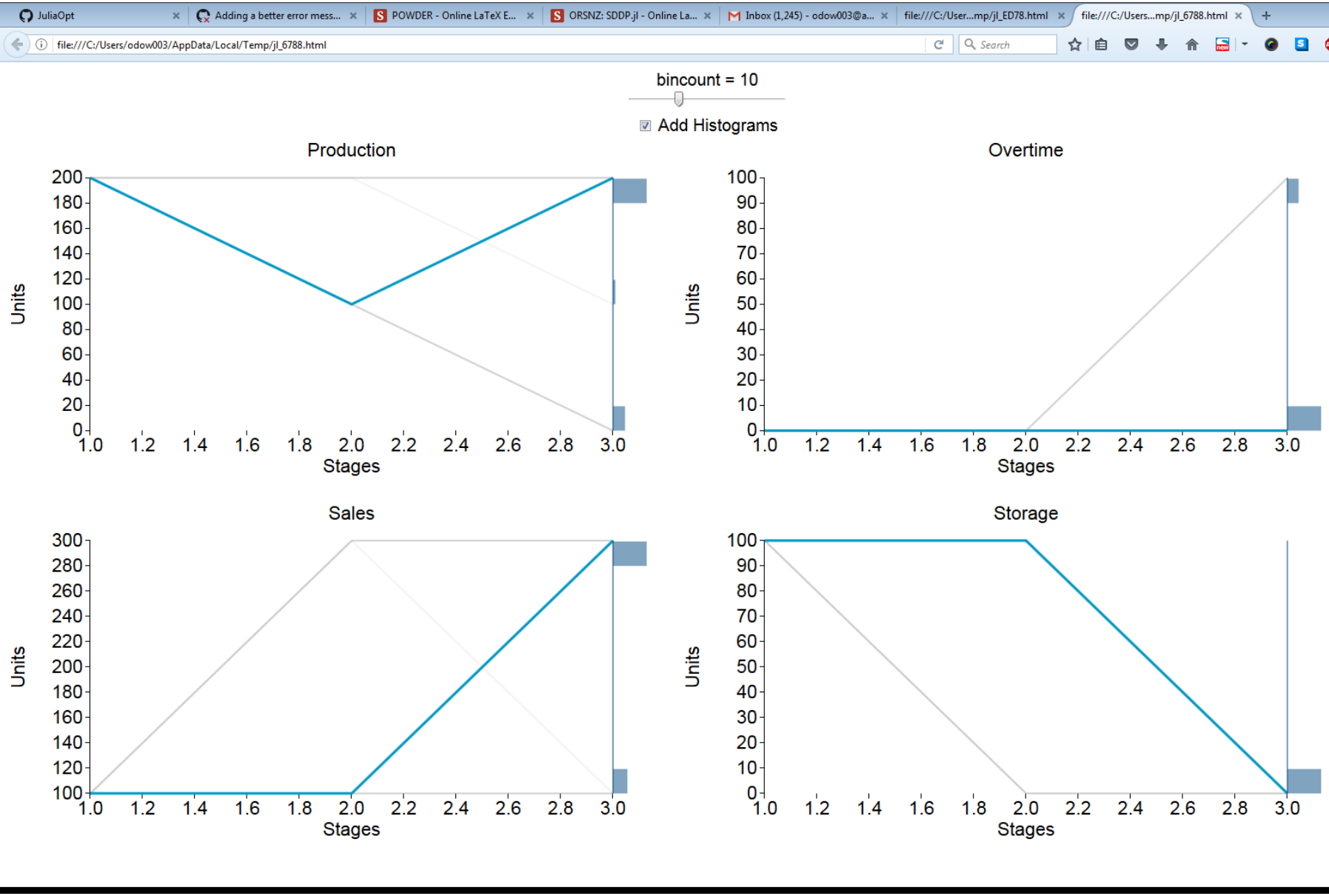
$$o_t, s_t, x_t \ge 0$$

The air-conditioning problem

```
julia> solve(m, max_iterations=10)

--------------------------------------------------------------------------------
                     SDDP Solver. © Oscar Dowson, 2017.
--------------------------------------------------------------------------------
    Solver:
        Serial solver
    Model:
        Stages:         3
        States:         1
        Subproblems:    3
        Value Function: Default
--------------------------------------------------------------------------------
             Objective                |  Cut  Passes    Simulations   Total
     Simulation       Bound   % Gap   |   #     Time     #    Time    Time
--------------------------------------------------------------------------------
       70.000K        60.000K         |     1    1.0      0    0.0    1.0
       62.500K        62.500K         |     2    1.0      0    0.0    1.1
       55.000K        62.500K         |     3    1.0      0    0.0    1.1
       55.000K        62.500K         |     4    1.0      0    0.0    1.1
       60.000K        62.500K         |     5    1.0      0    0.0    1.1
       95.000K        62.500K         |     6    1.0      0    0.0    1.1
       40.000K        62.500K         |     7    1.0      0    0.0    1.1
       60.000K        62.500K         |     8    1.0      0    0.0    1.1
       40.000K        62.500K         |     9    1.0      0    0.0    1.1
       95.000K        62.500K         |    10    1.0      0    0.0    1.1
--------------------------------------------------------------------------------
    Other Statistics:
        Iterations:         10
        Termination Status: max_iterations
================================================================================
```


JuliaOpt
Adding a better error mess...
POWDER - Online LaTeX E...
ORSNZ: SDDP.jl - Online La...
Inbox (1,245) - odow003@a...
file:///C:/User...mp/jl_ED78.html
file:///C:/Users...mp/jl_6788.html
file:///C:/Users/odow003/AppData/Local/Temp/jl_6788.html
Search
bincount = 10
Add Histograms
Production
Overtime
Sales
Storage
Units
Stages
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0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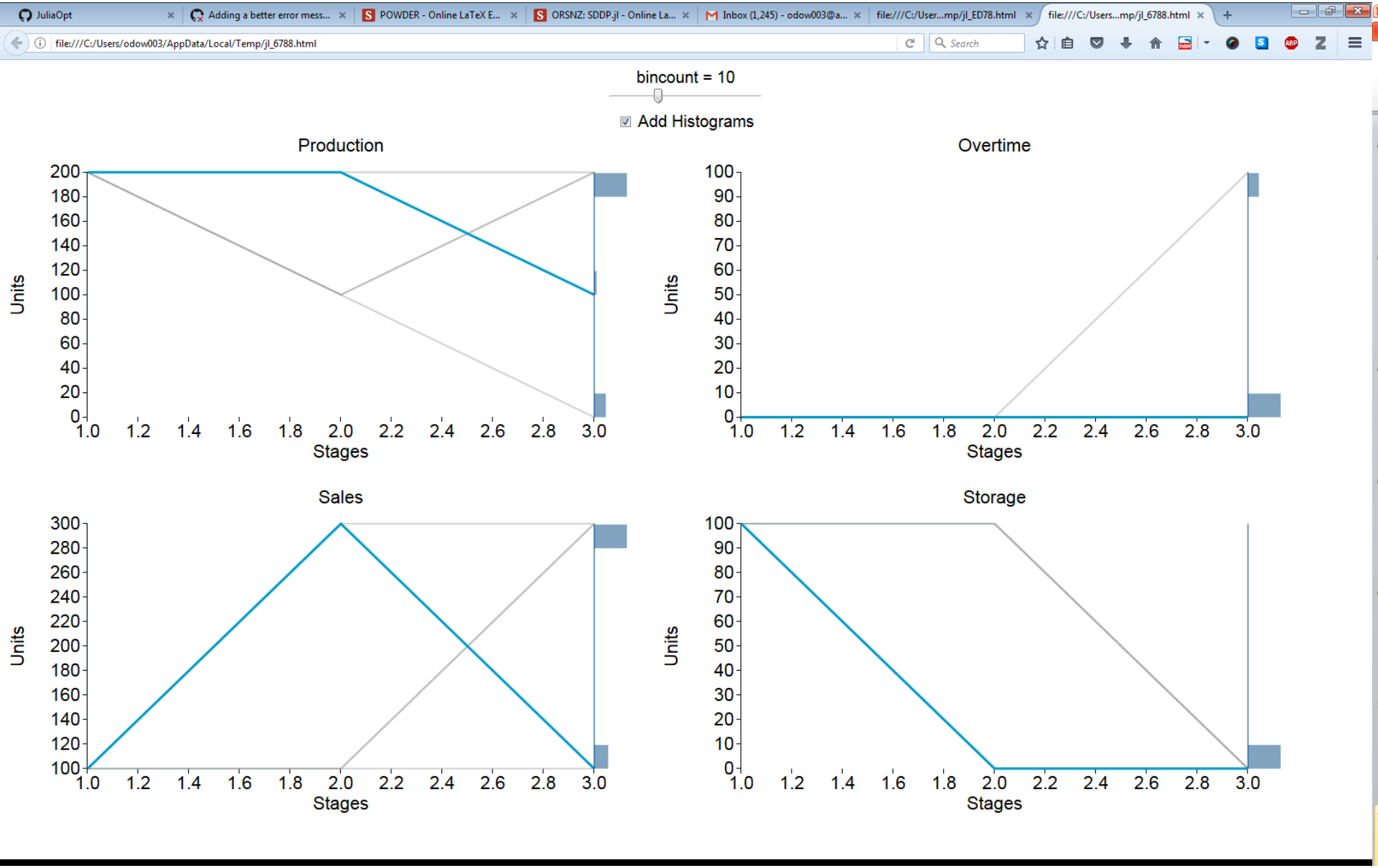
1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0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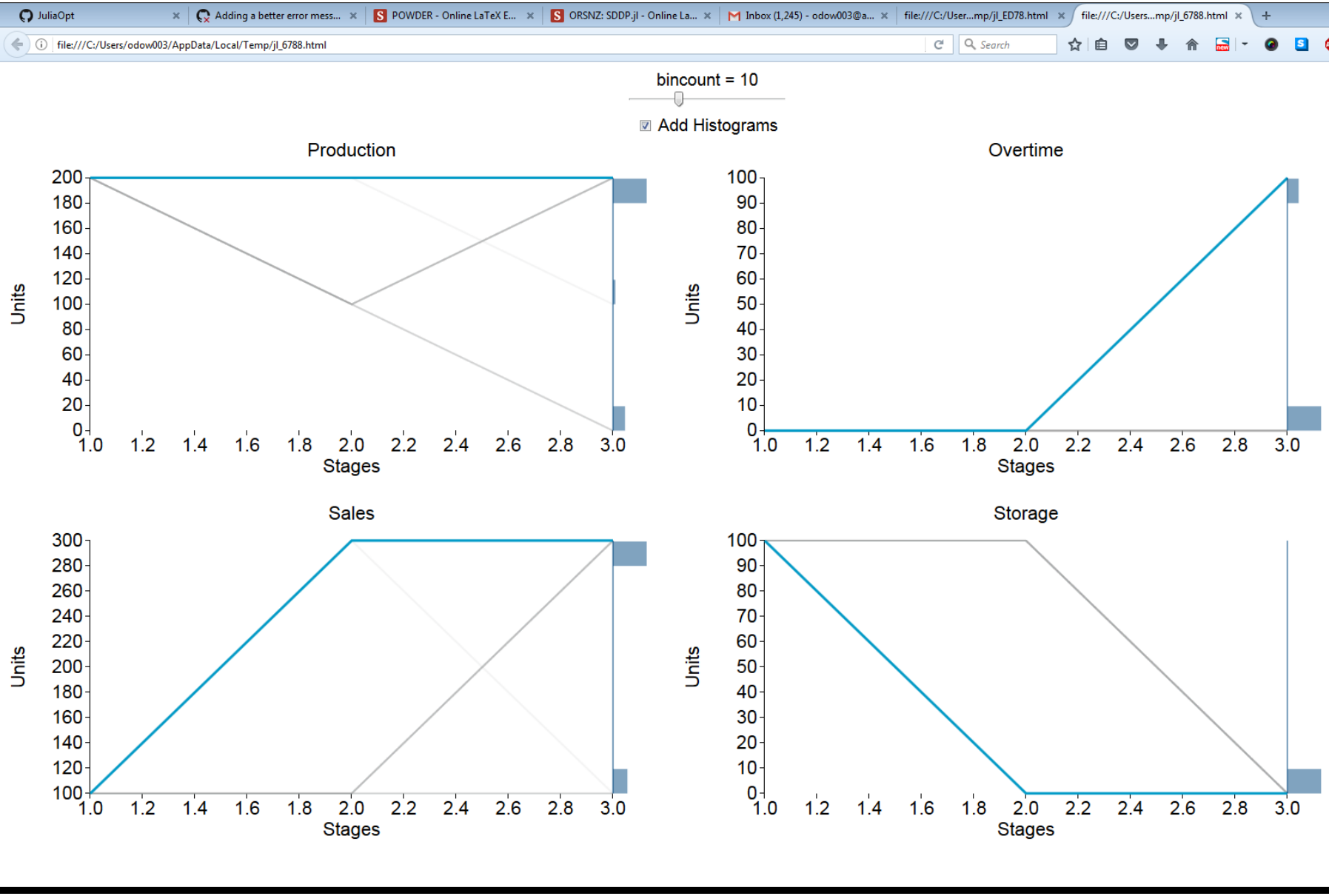
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Adding a better error mess...
POWDER - Online LaTeX E...
ORSNZ: SDDP.jl - Online La...
Inbox (1,245) - odow003@a...
file:///C:/User...mp/jl_ED78.html
file:///C:/Users...mp/jl_6788.html
file:///C:/Users/odow003/AppData/Local/Temp/jl_6788.html
Search
bincount = 10
Add Histograms
Production
Overtime
Sales
Storage
Units
Stages
1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0
0 20 40 60 80 100 120 140 160 180 200
0 10 20 30 40 50 60 70 80 90 100
100 120 140 160 180 200 220 240 260 280 300

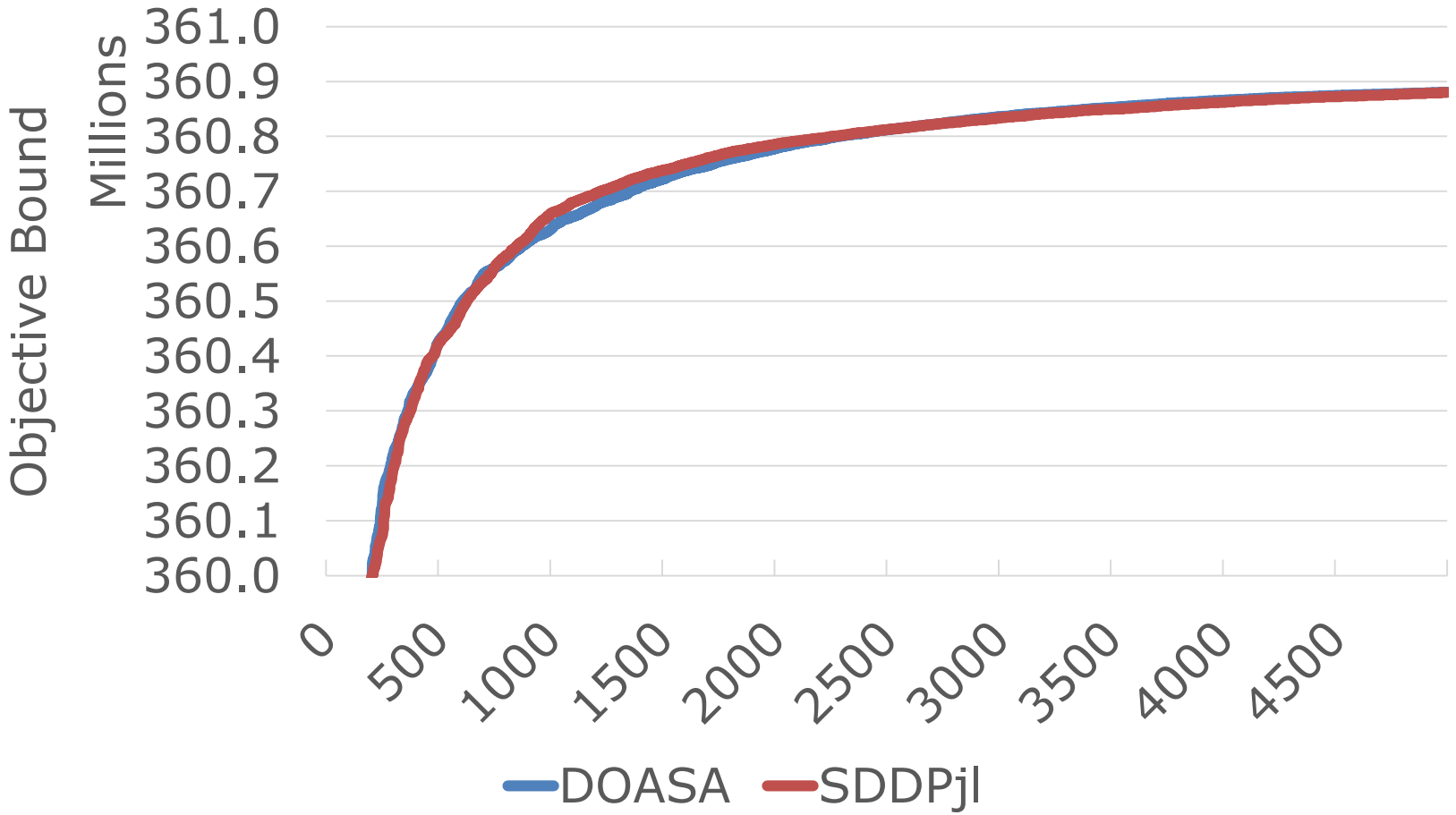
The NZ Hydro-Thermal Scheduling Problem

BENCHMARKING

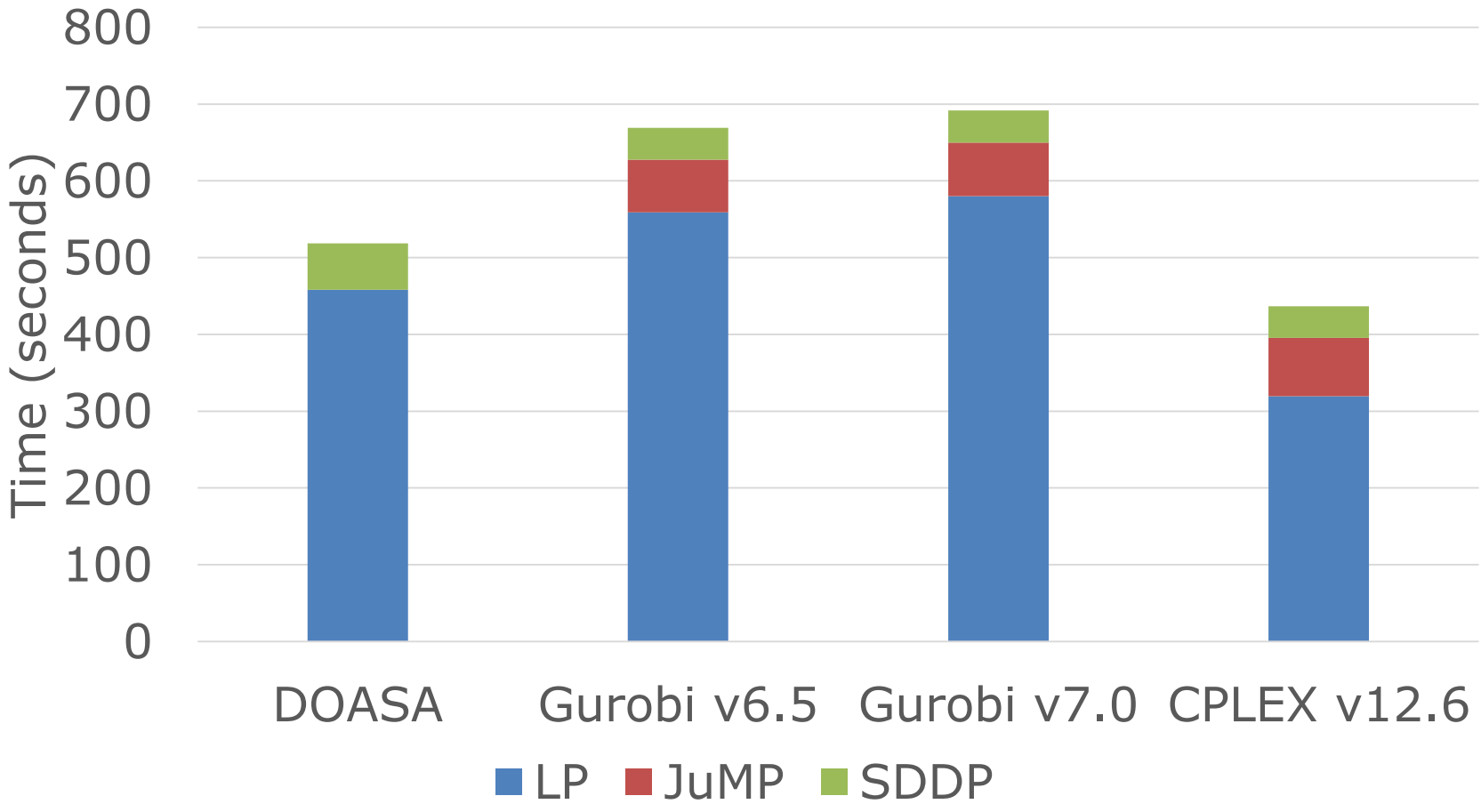
Correctness I

	DOASA	**SDDP.jl**
2005	493,125,281	493,125,281
2006	423,420,729	423,420,729
2007	575,859,349	575,859,349
2008	446,507,222	446,507,222
2009	340,096,459	340,096,459

Correctness II



Performance



Performance