Evaluating The Effects Of Grazing Management

Logbook

- 25.2.16
  - brainstorm with parents
  - decided to pursue a research project studying the benefits of cell grazing

- 27.2.16
  - excessive background research
  - found multiple valuable references in school library and online

- 2.3.16
  - continue brainstorm
  - formulate preliminary hypothesis, aim, and abstract
  - continue background research

- 6.3.16
  - discussed sampling techniques
  - soil moisture, soil carbon level, brix, species, penetration (hardness of soil), pasture production
  - nominated pasture production, soil moisture content, plant biodiversity, and species frequency as viable to measure, and significant in results

- 7.3.16
  - talked over selection of sites
  - needed paddocks close to each other, but one managed conventionally, and the other "cell grazed"
  - picked 8 paddocks for comparison (4 cell grazed and 4 conventionally grazed)
  - grouped paddocks into 4 "sites"
- decided to name all cell grazed paddocks "a" in their site, and all conventionally grazed paddocks "b" for ease of reference.
  * site 1 a = paddock 5
  1 b = sunset
  * site 2 a = paddock 18
  2 b = middle west
  * site 3 a = highway 3
  3 b = west plateau
  * site 4 a = paddock 8
  4 b = camel
- all also assessed risks related to project identified and listed significant findings

11.3.16
- began formal collecting of samples
- went to all sites and took 15 representative 10 cm core samples
- this was 1 week after an approx.
- 30 mm rainfall event

Results - week 1

<table>
<thead>
<tr>
<th>Site</th>
<th>A</th>
<th>B</th>
<th>Site</th>
<th>A</th>
<th>B</th>
<th>Site</th>
<th>A</th>
<th>B</th>
<th>Site</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>23.14%</td>
<td>333,158 L/ha</td>
<td>B</td>
<td>23.82%</td>
<td>343,065 L/ha</td>
<td>Site 2</td>
<td>24.59%</td>
<td>354,096 L/ha</td>
<td>B</td>
<td>20.11%</td>
<td>289,584 L/ha</td>
</tr>
<tr>
<td>Site 3</td>
<td>22.93%</td>
<td>330,134 L/ha</td>
<td>B</td>
<td>17.07%</td>
<td>295,779 L/ha</td>
<td>Site 4A</td>
<td>24.06%</td>
<td>346,785 L/ha</td>
<td>B</td>
<td>24.17%</td>
<td>346,464 L/ha</td>
</tr>
</tbody>
</table>
16.3.16

- In order to find 4/ha reading a 500x500x100 mm representative soil section and weighed it -36 kg
- This can be used to find litres of water from a percent of water
- 24.3.16
  - Comprehensive outline of project
  - Deadlines
- 31.3.16
  - Watched Allen Savory lecture
  - Collected more info.
- 2.4.16
  - Work on aim and risk assessment
  - Took the "3 week" soil samples

Results - week 3

Site 1
- A = 18.55% = 261,120 l/ha
- B = 17.83% = 256,752 l

Site 2
- A = 18.52% = 266,588 l
- B = 14.19% = 204,336 l

Site 3
- A = 18.18% = 261,792 l
- B = 14.72% = 211,968 l

Site 4
- A = 16.72% = 232,128 l
- B = 14.94% = 215,136 l

- Procedure for calculating soil moisture content
  1) Weigh samples collected
  2) Place in oven and dry
  3) Re-weigh samples
  4) The difference is the moisture content
  5) Convert to percent
  6) Optional, convert to litres/ha

Evaluating the Effects of Grazing Management
6.4.16
- draft introduction + abstract
10.4.16
- photographed all sites
  - ground cover (close ups) + landscape shots
11.4.16
- extensively worked on introduction.
13.4.16
- work on abstract
  - thought about presentation
22.4.16
- wrote 4th draft of introduction
  - looked over scoring rubric and
  - how to adhere to it.
- collected reams of data from farm manager
  on previous pasture production + paddock
  history, for all 4 sites
24.4.16
- began work on graphs for production
29.4.16
- full day
- got visit from Judy Earl
  - took her to all 4 sites
  - she helped in identifying multiple plant
    species
  - estimated ground cover (%)
  - graded paddock quality (-10)
  - recomp recommended a % Frequency
    test for plant species
  - provided us with a lot of information
    i.e., papers + surveys
  - identified species in all sites with her.
  - Evaluating The Effects of Grazing Management
Site 1a
- Danthonia - paspallum
- Kangaroo - red grass
- Parramatta - wire grass
- Native sorghum - Queensland blue
- Chilim Needle Grass - wild carrot
- Backwire grass - wild oat grass
- Epilobium - lucern
- Poa tussock - wild rice
- Groundcover = 98% - Paddock rating = 7.6

Site 1b
- Species:
  - Red grass
  - Danthonia
  - Wire grass
  - Lucern
  - Clover
- Groundcover = 95% - Paddock rating = 4

Site 2a
- Species:
  - Chilim Needle Grass
  - Wire grass
  - Stiper
  - Plains grass
  - Austroshpa rudis
  - Danthonia
  - Paspallum
  - Barbed wire
- Groundcover = 100% - Paddock rating = 4.5

Site 2b
- Species:
  - Slender bamboo - Red grass

Evaluating The Effects of Grazing Management
- corkskrew stipa
- barbwire
- panicum
- Danthonia
- Chilian needle grass (CN6)
- Stipa
  - 95% ground cover, paddock rating = 2.5

* Site 3a

species:
- red grass
- woody ped vetch
- wallaby
- CN6
- spring grass
- paspallum
- chicory
- lucerne
- ritidus sperma
- wire grass
- 75% ground cover, paddock rating = 4

* Site 3b

species:
- paspallum
- ritidus sperma
- styper
- lepidium
- Danthonia
- wire grass
- red grass
- lucerne
- plains grass
- chicken
- plantain

- ground cover = 30% - paddock rating = 2

* Site 4a

species:
- wire grass ( Aristida ramosa ) - dominant
- pea tussock
- barbed wire
- Danthonia
- spear grass
- wild sorghum ( native )
- paramatta
- lempandra
- red grass
- kangaroo
- native panic

- 98% ground cover, paddock rating = 3

Evaluating the Effects of Grazing Management
later in the day
* Site 46
  species:
  - pea tussock
  - Dactylis glomerata
  - Stipa
  - Kangaroo
  - Wire grass
  - Ovata
  - Red grass
  - Paspalum
  - ground cover = 98% - paddock resting = 3
  - later in the day, took the 7 week soil moisture samples from all 8 sites.
  - Results - week 7
  Site 1 A = 14.36% = 206,755 L/ha
  B = 13.57% = 195,422
  Site 2 A = 14.86% = 213,998
  B = 10.93% = 157,493
  Site 3 A = 8.73% = 125,741
  B = 8.36% = 120,326
  Site 4 A = 12.58% = 181,209
  B = 12.4% = 178,545
  6/5/16
  - heard lecture on grazing ecology from Glenn Morris PhD
  - who represents local farmers at government level
  - showed interest in my project and gave me some advice and encouragement
  - explained how to present data on species & soil moisture
  - asked to use the data we collected for a lecture to government officials on climate change.
  8/5/16
  - talked to Farm manager about paddock production records and their reliability. He assued
Evaluating the Effects of Grazing Management

Afternoon: Collected "Frequency of species" data in all for sites. Use advice from Judy Earl as well as gross field guide (see table)

*9.5.16
- Learned how to use Excel program for making tables and graphs
- Started to rough out production graphs

*13.5.16
- Began writing "Data Collecting Techniques" outline for soil moisture, beneficial plant species, plant biodiversity and production
- Worked on graphs on computer

*14.5.16
- Began "Data Collecting Techniques" section with soil moisture section

*17.5.16
- Worked on production graphs
- Began soil moisture graphs

*20.5.16
- Decided to add a "paddock description table" to the results section
- Collected data for that
- Drafted species frequency table on paper

*21.5.16
- Worked with farm manager to convert production DSE's to DCH/100mm + $ value

*25.5.16
- Started tables on biodiversity + frequency of pasture plant species

*29.5.16
- Finished frequency + biodiversity tables

Evaluating the Effects of Grazing Management
*11.6.16
- Filled in most tables and charts - edited format

*3.6.16
- Cut and pasted Excel graphs into Word
- Rough drafted captions for the graphs/tables

*6.6.16
- Typed captions for tables

*7.6.16
- Began to outline “Data Analysis and Discussion”
- Decided on which trends to identify/analyze
- Found some anomalies that needed explaining
- Brainstormed on creative ideas for further research
- Identified some experimental errors

*9.6.16
- Computed/calculated some Y values for discussion using statistical distribution analysis

*10.6.16
- Began to draft discussion

*13.6.16
- Continued draft of “Data Analysis and Discussion”

*15.6.16
- Finished draft of Discussion

*17.6.16
- Began typing up Discussion

*19.6.16
- Wrote draft of Conclusion

*30.6.16
- Finished almost all typing

*3.7.16
- Wrote list of Acknowledgements
- Typed up

Evaluating the Effect of Grazing Management
* 27.6.16
  - compiled list of references for bibliography

* 2.7.16
  - sketched Title Page design

* 5.7.16
  - made Title Page on computer
  - typed Table of Contents

* 10.7.16
  - gave log book to teacher to revise
  - started to go through entire report carefully, identifying and correcting any problems

* 16.7.16
  - continued revision
  - began organizing my photos of the entire survey

* 22.7.16
  - got report back from teacher
  - made appropriate revisions
  - finalized title page on computer

* 29.7.16
  - worked on format of report
  - margins, spacing, font etc

* 2.8.16
  - final revisions & check
  - read up on entry details, requirements
  - considered which sponsored awards were applicable

* 5.9.16
  - prepared for entry

Evaluating The Effects of Grazing Management
Soil Carbon %

Rainfall total (mm)

Soil Carbon % vs Year

2010
2011
2012
2013
2014
2015
2016

Evaluating The Effects of Grazing Management
Evaluating the Effects of Grazing Management

Production Value

Average DOH 2011 - 2016

Site 1A: 2377
1B: 1631

Site 2A: 2435
2B: 2083

Site 3A: 2451
3B: 1958

Site 4A: 2391
4B: 1855

1) Cell grazed (mean of 4 paddocks, 6yr average)
   - 2399 DOH/yr
   - 23.99 / 10 = 23.9 cowdays/ha/yr
   - 23.91 x 0.75 kg = 17.95 kg/ha
   - 17.95 kg/ha x 3.2 = $575.7/ha/yr

2) Conventionally grazed (mean of 4 paddocks, 6yr average)
   - 1748 DOH/yr
   - 1748 / 10 = 174.8 cd/ha/yr
   - 174.8 x 0.75 kg = 131.1 kg/ha
   - 131.1 x 3.2 = 419.5/ha/yr

3) Difference
   - 2399 DOH - 1748 DOH = 651 DOH
   - that's $156.2 more per hectare per year
   - assumes:
     - beef is sold at $3.20/kg live wt.
     - 10 DBE = 0.75 kg gained (3 yr, property average)

Evaluating the Effects of Grazing Management
Soil Moisture Results: 11.3.2016
*1 week after rainfall*

<table>
<thead>
<tr>
<th>Site 1A</th>
<th>Site 1B</th>
<th>Site 2A</th>
<th>Site 2B</th>
<th>Site 3A</th>
<th>Site 3B</th>
<th>Site 4A</th>
<th>Site 4B</th>
</tr>
</thead>
</table>

Initial measurement ($W_1$) - Secondary measurement ($W_2$) = $W_3$

$W_3 = \frac{X}{W_1} \times 100$

Soil Moisture Results: 2.4.2016
*3 weeks after rainfall*

<table>
<thead>
<tr>
<th>Site 1A</th>
<th>Site 1B</th>
<th>Site 2A</th>
<th>Site 2B</th>
<th>Site 3A</th>
<th>Site 3B</th>
<th>Site 4A</th>
<th>Site 4B</th>
</tr>
</thead>
</table>

Calculations: $W_3 = \frac{X}{W_1} \times 100$

Evaluating the Effects of Grazing Management
Soil Moisture Results 29.4.16
-7 weeks after rain

Initial measurements: secondary measurement
Site 1 A: 100.32 g : 85.92 g
  1 B: 100.33 g : 86.71 g
Site 2 A: 105.41 g : 89.74 g
  2 B: 100.985 g : 97.39 g
Site 3 A: 100.71 g : 91.91 g
  3 B: 100.76 g : 92.34 g
Site 4 A: 105.985 g : 92.65 g
  4 B: 107.24 g : 94.01 g

Difference between measurements
Site 1 A: 14.43 g
  1 B: 13.69 g
Site 2 A: 15.67 g
  2 B: 12.69 g
Site 3 A: 8.39 g
  3 B: 8.42 g
Site 4 A: 13.54 g
  4 B: 13.39 g

\[ \frac{W_2}{W_1} = \frac{x}{100} = \text{Soil Moisture %} \]

Evaluating the Effects of Grazing Management
<table>
<thead>
<tr>
<th>Name</th>
<th>1 week</th>
<th>3 weeks</th>
<th>7 weeks</th>
<th>H2O loss over 7 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>23.14%</td>
<td>18.55%</td>
<td>14.36%</td>
<td>(333,158 L/ha)</td>
</tr>
<tr>
<td></td>
<td>(333,158 L/ha)</td>
<td>(267,120 L/ha)</td>
<td>(206,755 L/ha)</td>
<td>126,403 L/ha</td>
</tr>
<tr>
<td>1b</td>
<td>23.82%</td>
<td>17.83%</td>
<td>13.57%</td>
<td>(343,054 L/ha)</td>
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<tr>
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<td>(343,054 L/ha)</td>
<td>(256,752 L/ha)</td>
<td>(195,422 L/ha)</td>
<td>147,643 L/ha</td>
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<tr>
<td>2a</td>
<td>24.59%</td>
<td>18.52%</td>
<td>14.86%</td>
<td>(354,094 L/ha)</td>
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<td>(354,094 L/ha)</td>
<td>(266,688 L/ha)</td>
<td>(213,998 L/ha)</td>
<td>170,098 L/ha</td>
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<tr>
<td>2b</td>
<td>20.11%</td>
<td>14.19%</td>
<td>10.93%</td>
<td>(289,584 L/ha)</td>
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<td>(204,336 L/ha)</td>
<td>(157,493 L/ha)</td>
<td>132,914 L/ha</td>
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<tr>
<td>3a</td>
<td>22.93%</td>
<td>18.18%</td>
<td>8.73%</td>
<td>(330,134 L/ha)</td>
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<td>8.36%</td>
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<td>(211,968 L/ha)</td>
<td>(120,326 L/ha)</td>
<td>125,453 L/ha</td>
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<tr>
<td>4a</td>
<td>24.06%</td>
<td>18.12%</td>
<td>12.58%</td>
<td>(346,453 L/ha)</td>
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<td>(346,453 L/ha)</td>
<td>(232,128 L/ha)</td>
<td>(181,209 L/ha)</td>
<td>165,244 L/ha</td>
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<tr>
<td>4b</td>
<td>24.17%</td>
<td>14.94%</td>
<td>12.90%</td>
<td>(346,464 L/ha)</td>
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<td>(346,464 L/ha)</td>
<td>(215,136 L/ha)</td>
<td>(178,545 L/ha)</td>
<td>167,919 L/ha</td>
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<tr>
<td>Species</td>
<td>1a</td>
<td>1b</td>
<td>2a</td>
<td>2b</td>
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<td>Red grass</td>
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<td>Wild Sorghum</td>
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<tr>
<td>Barbed wire</td>
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<td>Kangaroo</td>
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<td>Chilean Needle</td>
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<td>Danthonia</td>
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<td>Wild oats</td>
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<td>Slender bamboo</td>
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<td>Fescue</td>
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</tbody>
</table>

| Total            | 16 | 5  | 13 | 10 | 11 | 9  | 13 | 8  |

Evaluating the Effects of Grazing Management
Evaluating The Effects of Grazing Management - LOGBOOK Page 17
Site 1A

Site 1A groundcover
Site 1B

Site 1B groundcover
Site 2A

Site 2A groundcover
Site 2B

Site 2B groundcover
Site 3A

Site 3A groundcover
Site 3B

Site 3B groundcover
Site 4A

Site 4A groundcover
Collecting soil samples

One of 360 soil cores that we collected
Soil samples prior to dehydration and weighing

Calibrating the balance we used for weighing soil samples
Fan forced soil dehydrator

Excavating a 500x500x100mm area for soil moisture calculations
Posts marking transact for determining species frequency

500x500mm quadrant
Cell grazing yields a high concentration of manure and trampled organic matter
The team with agricultural scientist Judi Earl

The team in action