

Urine Patch Area Coverage of an Intensively Stocked Dairy Pasture



Jim Moir^{A*}, Keith Cameron^A,
Hong Di^A and Ulrike Fertsak^B

^A Centre for Soil and Environmental Research,
Lincoln University, Canterbury, New Zealand.

^B Institute of Hydraulics and Rural Water
Management, University of Natural Resources and
Applied Life Sciences (BOKU), Vienna, Austria.

* Email: jim.moir@lincoln.ac.nz

Context and Rationale

- In grazed pastures systems the majority of ingested nitrogen (N) is excreted in animal urine, resulting in high N loading in the animal urine patch. This creates a 'mosaic' effect of nutrient return and plant growth in grazed pastures.
- The total area receiving urine deposits in any time period is critical to the understanding of nutrient cycling and nutrient loss in grazed pasture systems.
- Quantitative field spatial data of urine patch area coverage value is scarce.
- Consequently, variability and uncertainty still surrounds the current estimate of annual urine patch area coverage in grazed pasture systems, and how area coverage varies with different stocking rates, stock type and season.

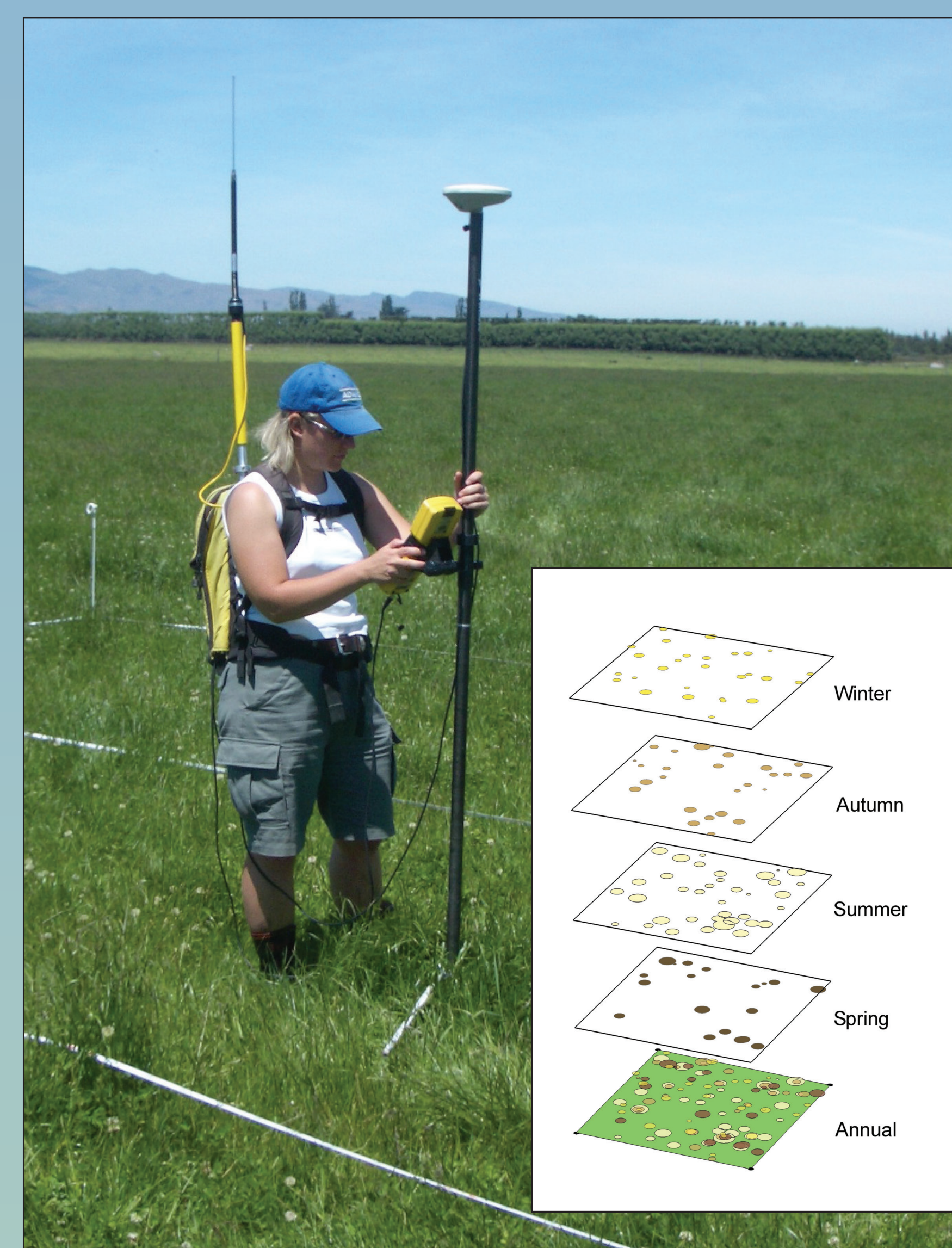
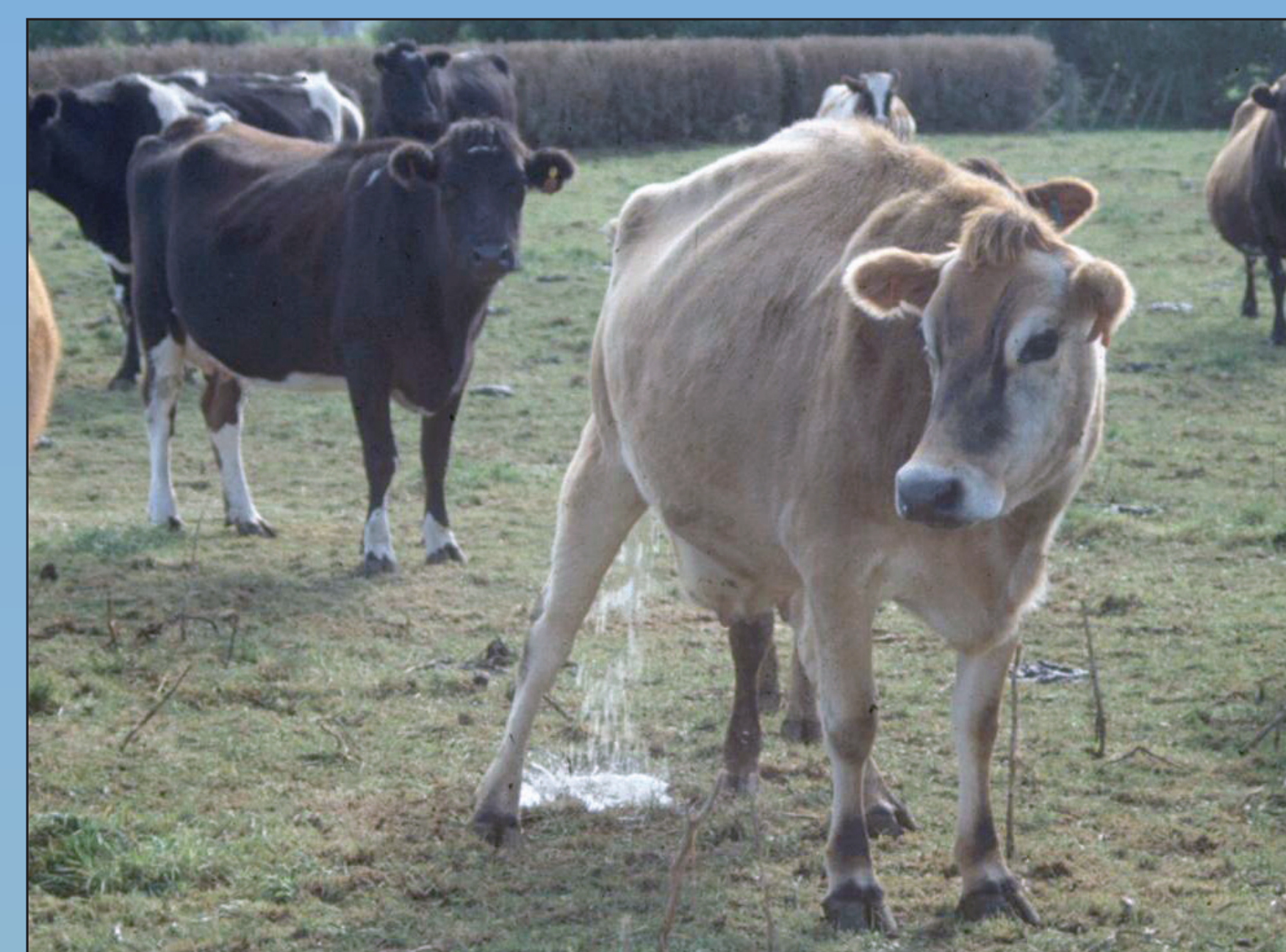


Objective

- The objective of this study was to develop a new method to quantify seasonal and annual urine patch area coverage under an intensive dairy farming system.

Methodology

- Accurate location and area measurements of urine patches were made over a 4 year period for a typical New Zealand intensively grazed dairy pasture system.
- Twelve 100 m² plots were established and monitored on typical grazing areas.
- All urine patch areas within each plot were visually identified from the enhanced pasture growth in those areas and their area and spatial location recorded with global positioning system (GPS) technology at regular time intervals through the year.
- Grazing information (grazing frequency, date, stock numbers and stock type) was recorded in order to relate area coverage data to stocking rate and grazing days.
- The GPS data was analysed using geographic information system (GIS) software to calculate seasonal and annual urine patch coverage in the paddocks on an area basis.



Results

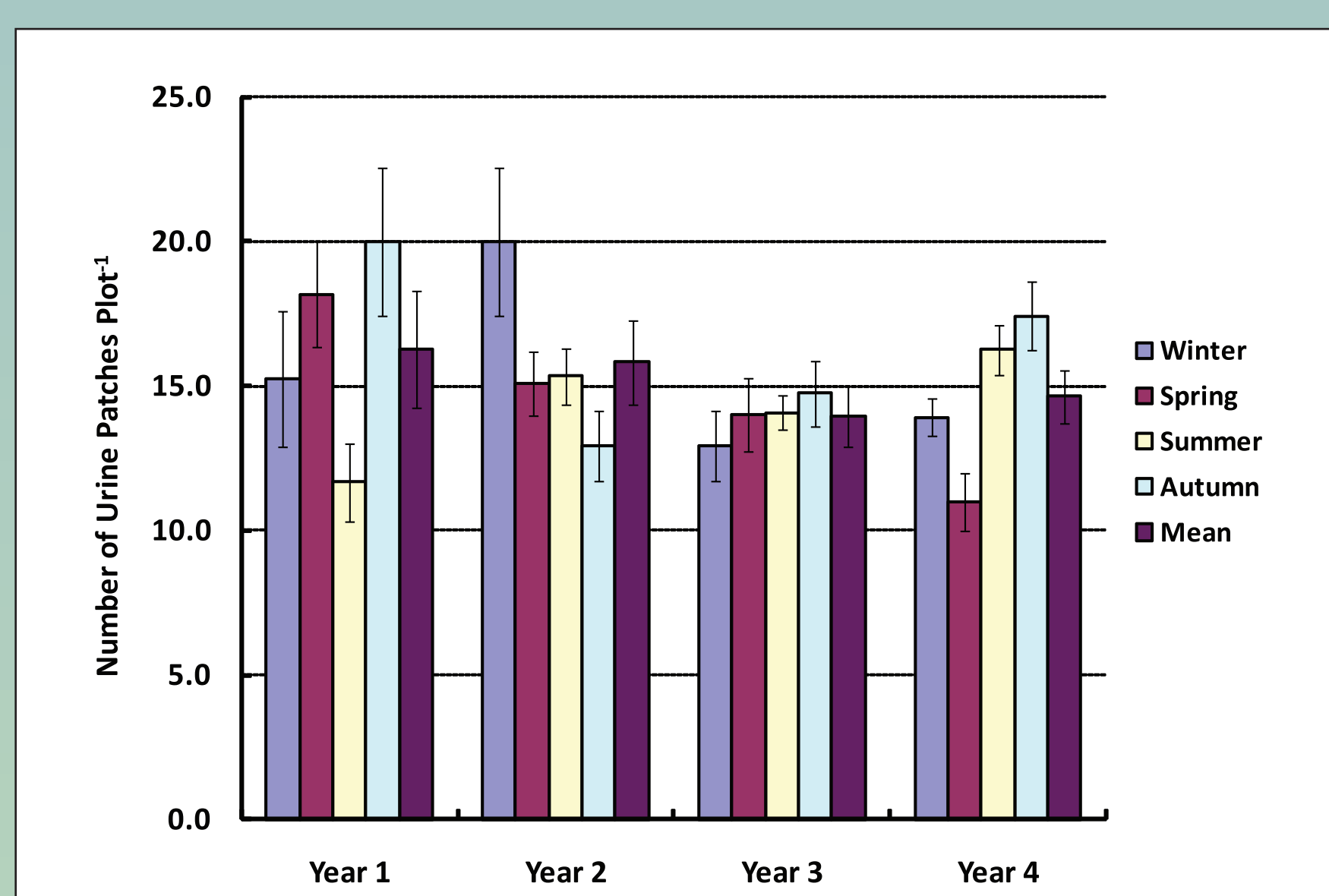


Figure 1: Mean numbers of urine patches observed per plot on a seasonal basis for all years. Error bars represent ± 1 SEM

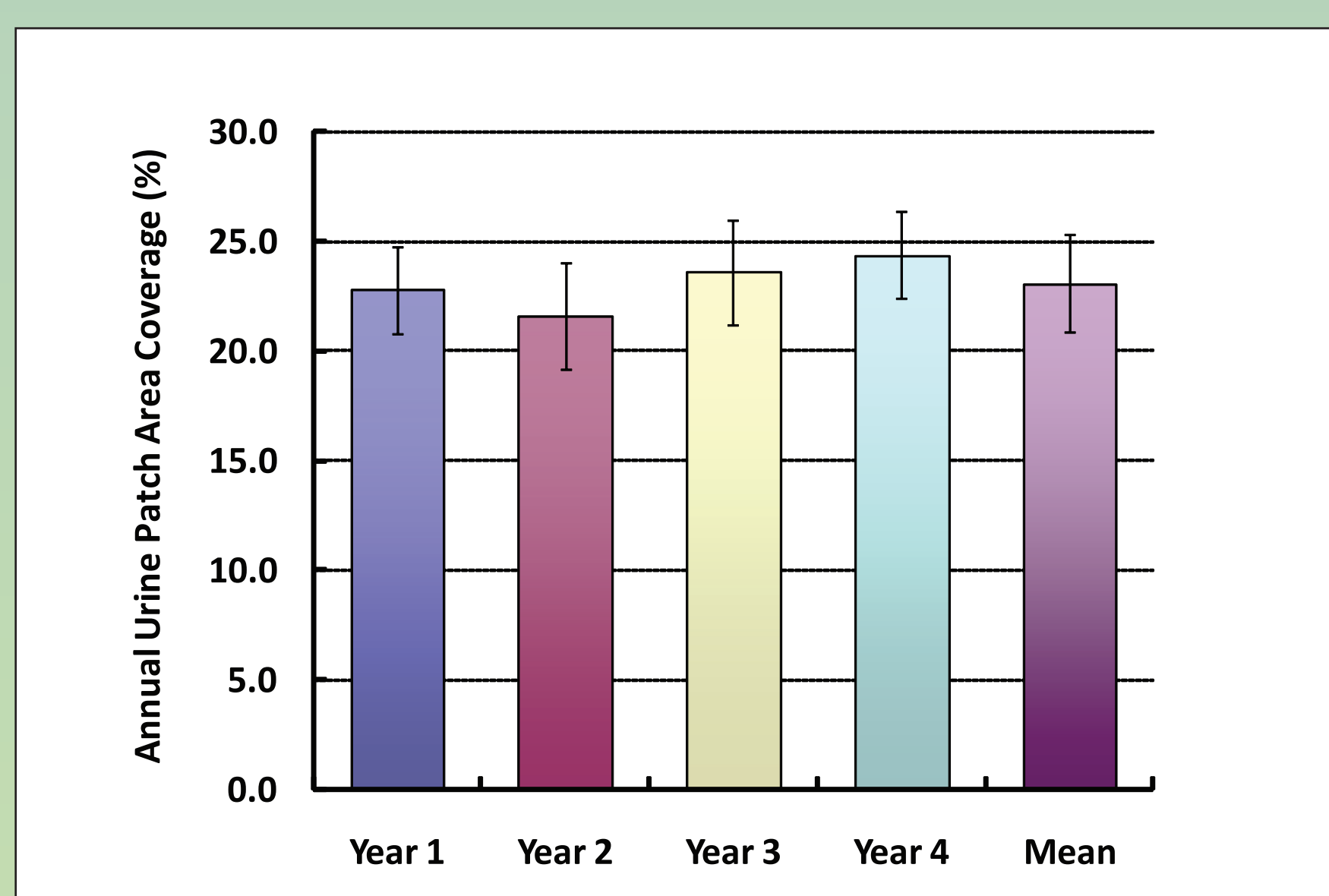
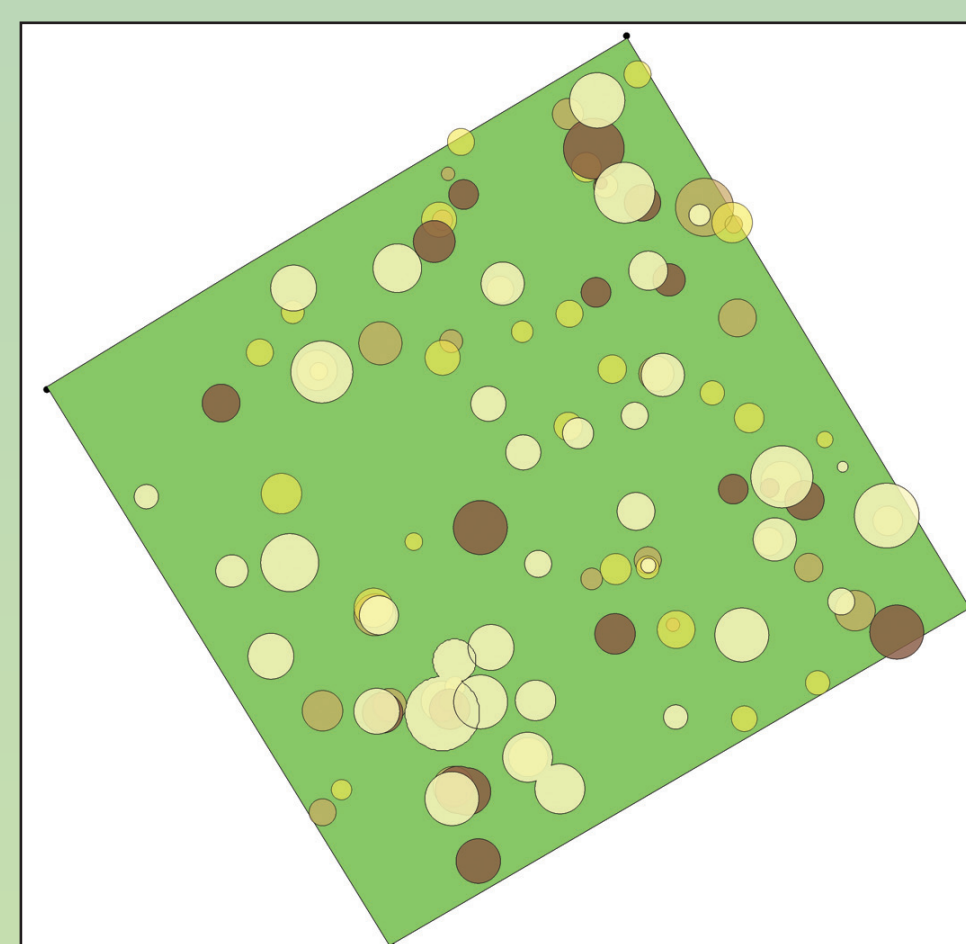


Figure 2: Mean annual area coverage of urine patches from GIS data analysis. Error bars represent ± 1 SEM.

- The mean urine patch pasture response area was 0.35 m², with a radius of 33 cm.
- On a spatial basis, urine patch area coverage varied from season to season, and between years (Figure 1). Annual area coverage by urine patches varied from 21.6 (Year 2) to 24.4 % (Year 4).
- The mean area covered by urine patches on an annual basis was 23.1 ± 2.2 % for the given stocking density and grazing management regime (Figure 2).
- It was estimated that on average 1520 urine patches ha⁻¹ were present at any time through the year.
- Urine patch coverage was shown to increase with increased stocking rate (cows ha⁻¹ or cow grazing days).
- Spatially, urine depositions were of a random nature (Figure 3).

Figure 3: A graphical example of a GIS data analysis output for cow urine depositions on one field plot for one year. These outputs were used to calculate and map the spatial area coverage of urine patches in the field on a temporal basis.



Conclusions

- This study has successfully used GPS and GIS technology to make accurate measurements of the spatial distribution and area coverage of urine depositions in intensively grazed dairy pastures in New Zealand.
- On the dairy farm, at an effective stocking rate of 4.3 cows ha⁻¹ the mean area covered by urine patches on an annual basis was 23.1 ± 2.2 % for the given stocking density and grazing management regime.
- Future research should include long-term measurements at 'medium' and 'low' stocking rates in order to investigate the relationships between stocking rate and area covered by urine depositions.

Acknowledgements

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