An unirrigated, unfertilized remnant paddock adjacent to irrigated paddocks

Pasture improvement and mob grazing enhance net ecosystem carbon uptake

Grazers in queue

Landcare Research
Manaaki Whenua

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BACKGROUND

- Pasture improvement supports more frequent grazing and higher animal production.
- Improved paddocks receive regular irrigation, fertilisation and are mob-grazed several times a year.
- Unimproved paddocks are not irrigated or fertilised, and are grazed only once per year.
- How does pasture improvement alter the net ecosystem carbon balance under mob-grazing?

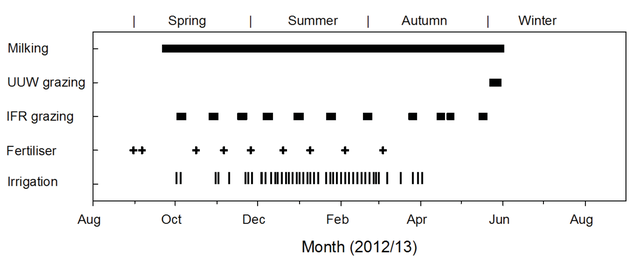
OBJECTIVES

- Compare net ecosystem carbon balance for improved (intensively managed) and unimproved (extensively managed) paddocks at a commercial dairy farm (265 ha) on stony soils in Canterbury, New Zealand.

METHODS

- Pasture improvement began in 2011, which included regular pivot irrigation and fertilization (urea).
- Eddy covariance and supporting instruments were deployed in August 2013.
- Irrigation provided 460 mm per year, or 50% more precipitation than rainfall.
- Fertilizer N was applied periodically, for a total of 180 kg N ha^{-1} yr^{-1}.
- $C_{paddock} = C_{NEP} + C_{excreta} + C_{urea} - (C_{grazed} + C_{leached})$

  C_{NEP} - Net ecosystem exchange (-NEE)
  $C_{excreta}$ - Proportion of cattle intake
  C_{urea} - Urea application
  C_{grazed} - Biomass removed
  $C_{leached}$ - Estimated using water balance and DOC.
- Data were filtered and periods of instationary flow and very low turbulence were eliminated using the standard deviation of vertical wind speed (Acevedo et al. 2009).
- Data gaps (36%) were filled according to Barr et al. 2004.

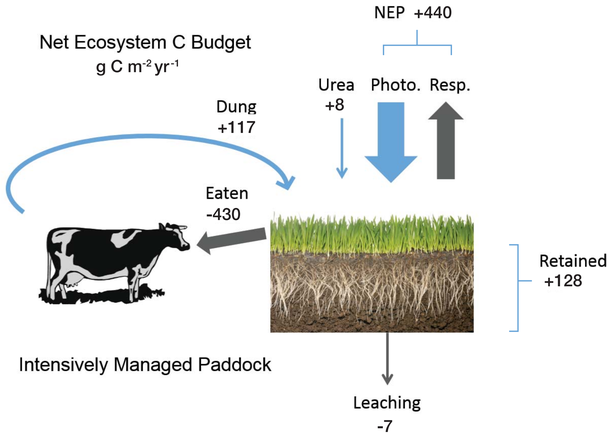


Dairy farm management overview

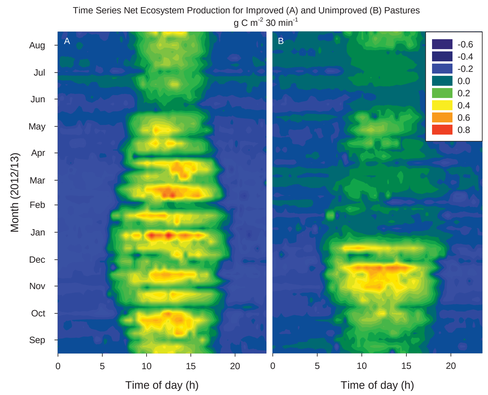
The day after grazing

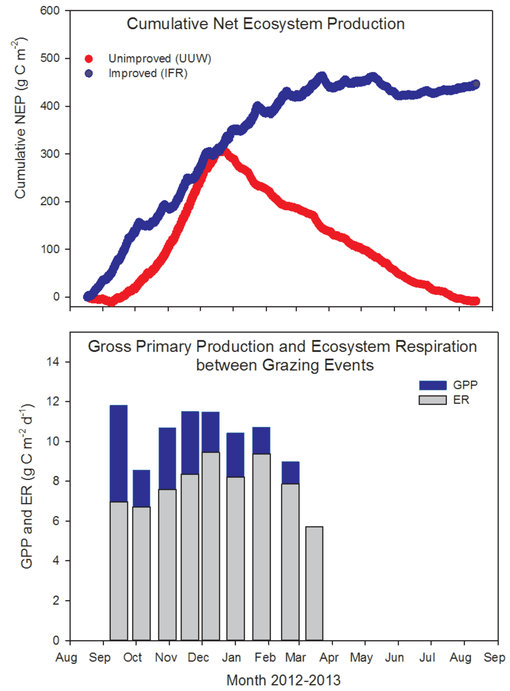
RESULTS

The first year of data indicate:
The improved paddock was a net C sink, gaining 128 g C $m^{-2}yr^{-1}$
The unimproved paddock was a net C source, losing 13 g C $m^{-2}yr^{-1}$



Net ecosystem C budget for the irrigated, intensively managed dairy paddock





Cumulative net ecosystem production (NEP) during the first year (Aug 2012-Aug 2013), where NEP= -NEE (top panel). Average daily gross primary production (GPP) and ecosystem respiration (ER) between grazing events (bottom panel).

CONCLUSIONS

- Results represent one year and suggest greater net ecosystem C uptake for improved pasture (irrigated, fertilised and mob-grazed), as compared to unimproved pasture, for this physiographic region.

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