Landcare Research
Manaaki Whenua

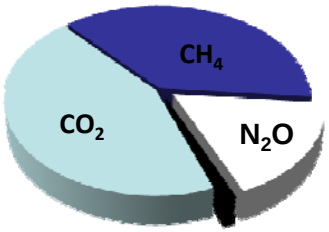
Carbon exchange in New Zealand ecosystems

John Hunt, Sam Grover, Johannes Laubach, Peter Millard, Tony McSeveny, Graeme Rogers, David Whitehead

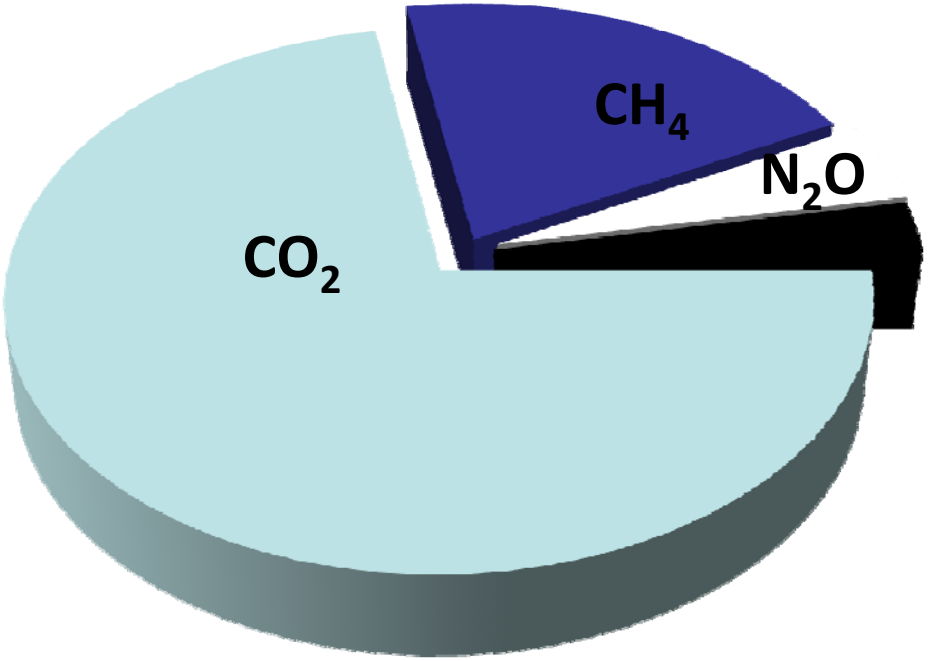
Landcare Research's carbon exchange studies

- Background
  - One of 3 groups in NZ
  - Grasslands, mature forest, young shrubland
  - All sites had a specific question to answer
- Current research
  - Regenerating shrubland
- Future research
  - Managed grasslands: irrigated dairy

New Zealand

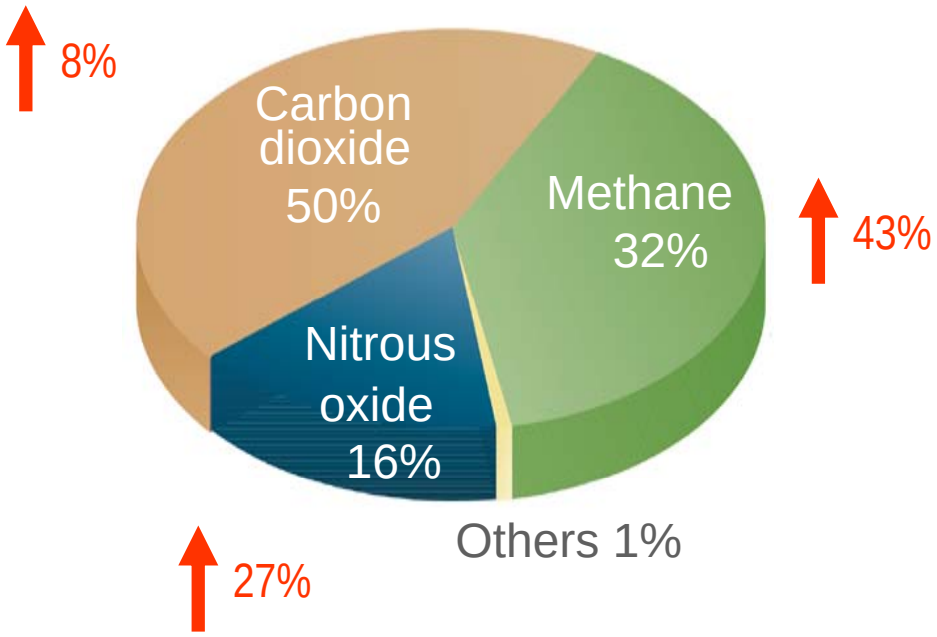


Australia



	GHG prod (Mt CO_{2eq})	% agriculture	% global GHG
New Zealand	71	47	0.2
Australia	545	15	1.4

Why do we bother?



1. Commitment to Kyoto agreement
2. We cheat using offsets
3. Different GHG profile
4. Multiple advantages – water/energy/production
5. Trade implications
   - Clean green
   - Carbon miles

Abandoned field - Oxford

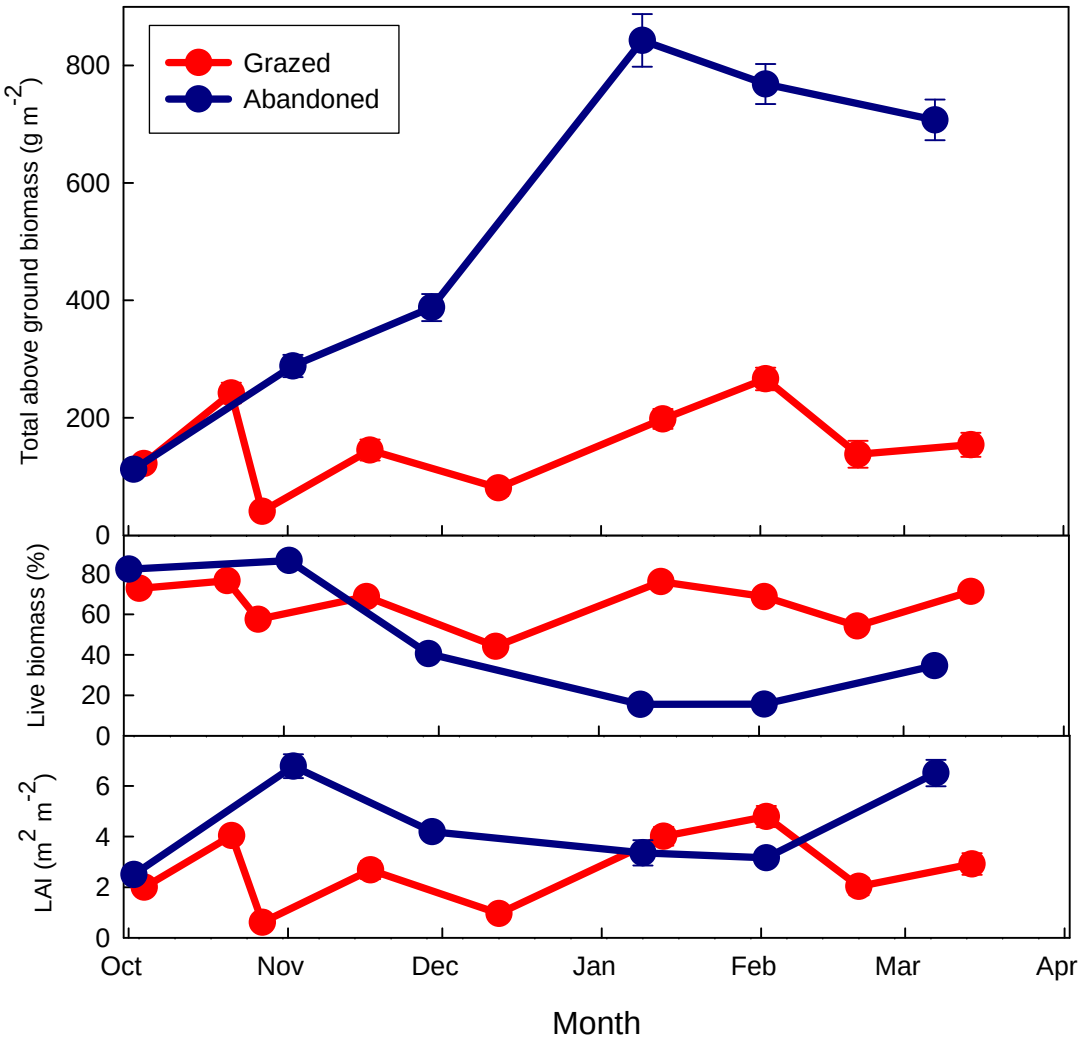
2005
Cattle grazed

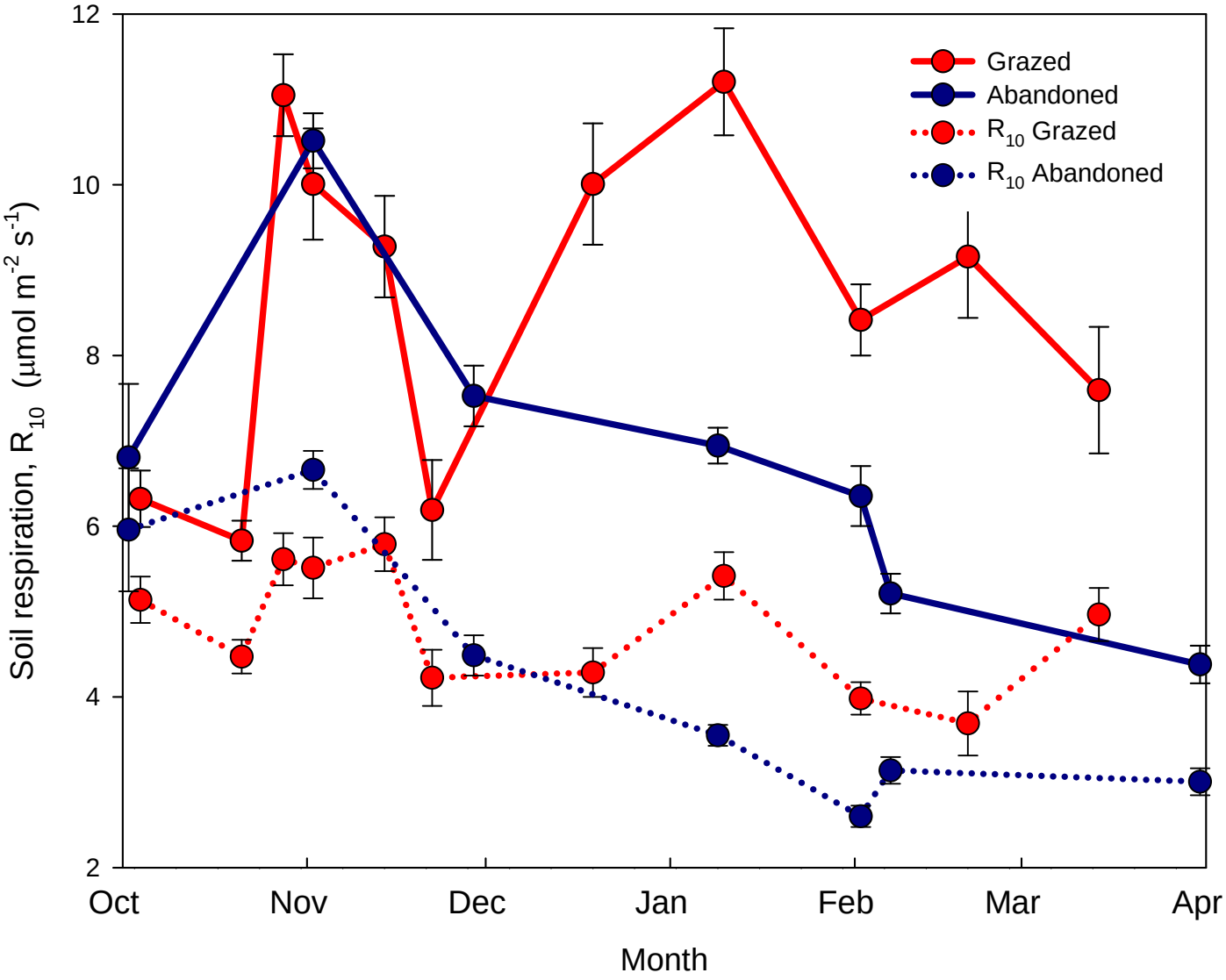
Abandoned pasture reverting to forest:
- Economic
- Erosion
- Biodiversity
- Carbon accumulation – Kyoto

2006
Abandoned
and planted

2007
First seeding

2010
Trees > 2m


Grazed
Abandoned
Total above ground biomass (g m-2)
800
600
400
200
0
Live biomass (%)
80
60
40
20
0
LAI (m2 m-2)
6
4
2
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month


Soil respiration, R_{10} (µmol m^{-2} s^{-1})
12
10
8
6
4
2
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month
Grazed
Abandoned
R_{10} Grazed
R_{10} Abandoned

Oxford NEE


Culmulative flux (gC/m2)
500
400
300
200
100
0
-100
-200
Oct 05
Jan 06
Jun 06
Oct 06
Feb 07
Jun 07
Oct 07
Feb 08
Jun 08
Oct 08
Feb 09
Jun 09
Oct 09
Feb 10
Date

Oxford

- Site preparation and planting caused a major loss of carbon
- Carbon loss was quickly offset by above ground biomass
- Continued to accumulate carbon for next 4 years
- Trees are just now > 10% of biomass

Future Research Goals

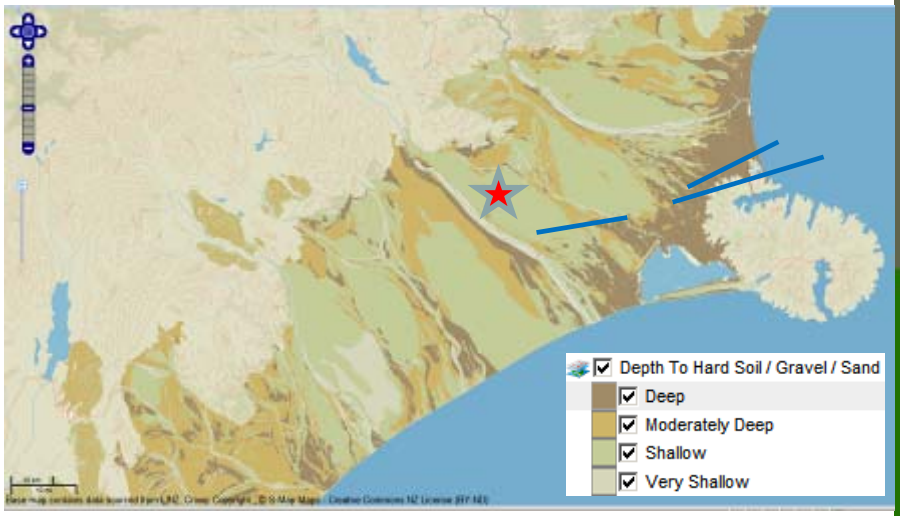
Large scale conversion of dryland to irrigated dairy (140,000 ha dairy, 73% thin soils)

How does land use change effect:

- GHG emissions, 3 gases
- Whole farm GHG budget
- Water implications, WUE
- Surface albedo
- Soil carbon storage
- Soil carbon turn over
- Nutrient flows

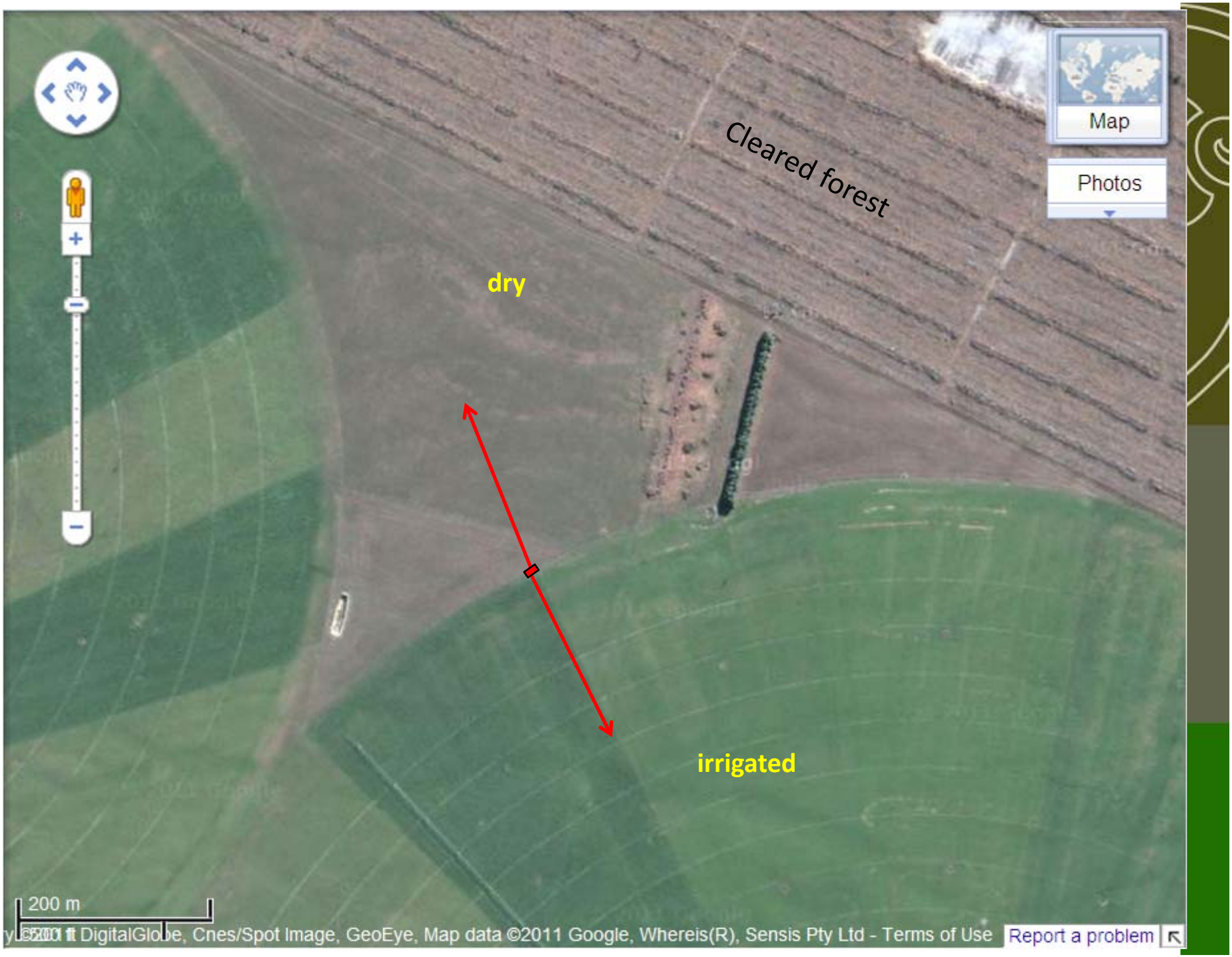
Proposed site

Active fault lines

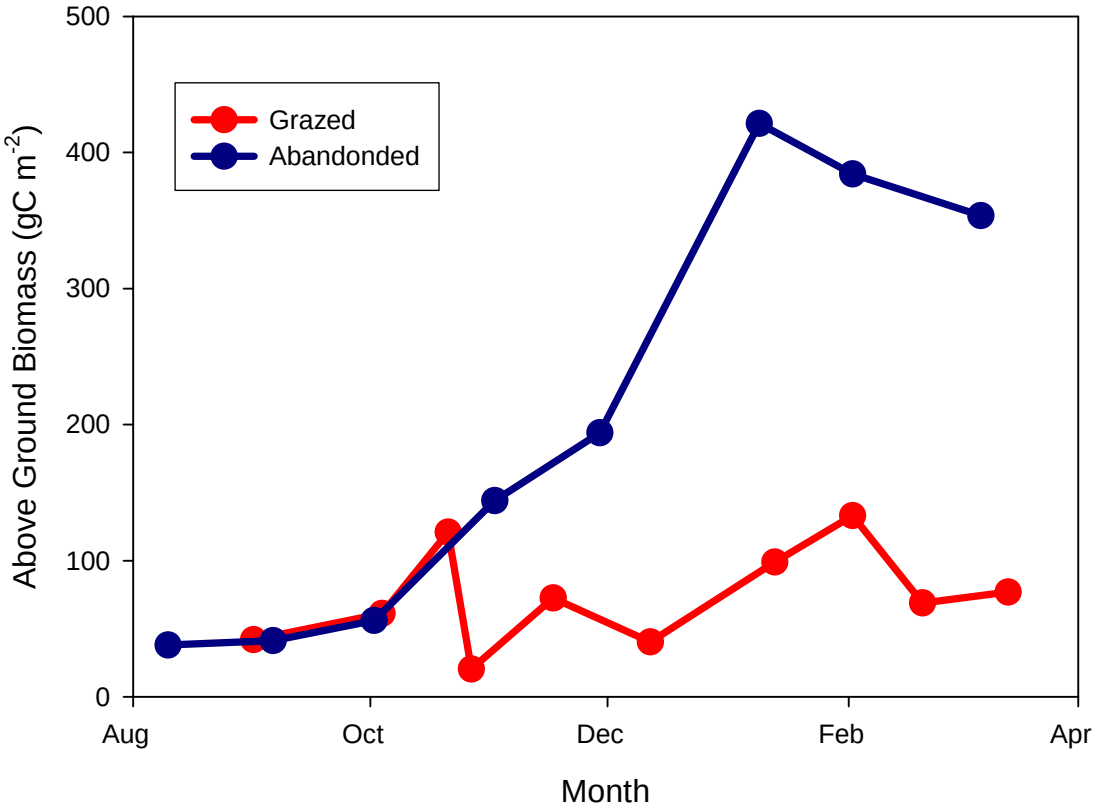


What to measure and how

- Paired site approach at a newly converted farm
- Eddy covariance CO_2, H_2O, energy
- FTIR flux gradient + chambers
  CH_4, N_2O, CO_2, $^{12}C/^{13}C$ isotopes
- Soil respiration, continuous and spatial
- Stable carbon isotopes to partition soil respiration
- Meteorological, albedo, biomass
- Grazing events, milk production, irrigation events


Cleared forest
dry
irrigated
Map
Photos
200 m
DigitalGlobe, Cnes/Spot Image, GeoEye, Map data ©2011 Google, Whereis(R), Sensis Pty Ltd - Terms of Use
Report a problem

Plan to maintain this as a medium term installation – invite collaboration to use these facilities


500
400
300
200
100
0
Above Ground Biomass (gC m-2)
Grazed
Abandonded
Aug
Oct
Dec
Feb
Apr
Month