CSIRO and the Department of Agriculture, Fisheries and Forestry have been running a collaborative study with graziers to look at the effect of historical cattle stocking rates on ground cover, pasture productivity and erosion. Graziers participating in the study provided information on past and present management practices and land condition monitoring. We used this information to identify stocking rates and strategies that lead to higher productivity and lower erosion rates in the long term.

We used 25 years of satellite imagery processed through VegMachine™ software to select focus properties with historically high, medium and low ground cover levels. Pasture cover at all properties was high during wetter times. The effect of management practices and land condition became obvious during drought periods, when cover level declined depending on persistence of perennial grasses including 3P (perennial, productive and palatable) species (Fig. 1).

The project studied cover levels across three soil types common in the Fitzroy & Burdekin catchments:
- Red goldfields soils (Chromosols)
- Grey/yellow duplex soils (Sodosols or ‘spewy soils’)
- Dark cracking clay soils (Vertisols)

We found that lighter stocking rates generally result in higher cover levels and heavier stocking rates have lower cover levels (Figure 2). Higher cover levels also supported higher pasture growth, and these findings were consistent across soil types. Importantly, high cover levels also retained about double the amount of nitrogen available for plant growth, producing more protein for livestock consumption (Figure 3). Field surveys at representative sites on the properties showed that long-term vegetation cover was an

![Diagram](Figure 2. Lower animal equivalent stocking rate (AE), and higher pasture production, at higher cover levels, on Red goldfields soils.)

![Diagram](Figure 3. Higher whole-pasture Nitrogen and protein content at higher cover levels, from exclosures on Red goldfields soils, re-clipped at the end of the growth season in April 2012.)
indicator of land condition and the abundance of 3P grasses. The capacity of soil to absorb water was higher at high cover levels, retaining more rainfall onsite to support pasture growth (Figure 4). Small plot measurements of soil erosion were up to 70% lower at high cover levels.

Where does this lead us?
The good news is that cover, productivity and land condition can be improved. After reduced forage utilisation and wet season spelling practices commenced on Virginia Park in 2002, 3P grasses increased, and suspended sediment and nutrient losses in runoff declined (Figure 5).

While reducing herd size can have economic costs from changes in turn-off over the short term (several years), the Wambiana grazing trial and other case studies show that moderate stocking within the long-term carrying capacity every year can more than double gross margin returns in the long term (within 10 years).

These gains result from higher live-weight gain and product quality, lower operating costs, and a more stable income through drought cycles (Figure 6). Pasture spelling and forage budgeting can also improve economic returns and land condition if applied correctly. Other grazing practices which reduce soil loss include moving grazing pressure away from scalds, gullies and frontage country, and remediating those areas to assist recovery.

Resources available
Good natural resource management is an asset for your business. Your local extension officer can assist you with courses on grazing management and forage budgeting, property planning and pasture cover data. Grants may be available through your Natural Resource Management group to assist with erosion problems and necessary infrastructure.

Contact
Scott Wilkinson, CSIRO, (02) 6246 5582
Karl McKellar, DAFF Charters Towers, (07) 4761 5150

In summary, information from focus properties across a range of remote sensing cover levels has shown that management practices impact on land condition. Reducing stocking rates, particularly combined with wet season spelling, initiates a recovery cycle leading to long-term sustainability and profitability (Figure 7).