



Foto: Iain James Gordon

Capítulo 6

Na condição de humilde pecador converso
Vou semeando letra e grãos ao som do vento
Talvez a letra se converta em rima ou verso
Quem sabe os grãos possam gerar o meu sustento.

Serei capaz de me livrar da fúria insana
Ou aprender as muitas leis do universo
Farei nevar em toda tropical savana
Ou emergir um continente submerso.

Geovane Alves de Andrade



Agricultural Activities, Management and Conservation of The Natural Resources of Australian Tropical Savannas

Iain James Gordon

Abstract

Savannas cover over 25 % of Australia; most of them in the tropics and subtropics in the north of the continent. Following the arrival of European settlers these grasslands have been used primarily for livestock production, mainly sheep and cattle, with little importance given to native wildlife or biodiversity. Over this time there has been substantial transformation of the savannas with the addition of infrastructure such as fencing and water-points, and inputs such as the sowing of exotic pasture species. This sort of investment by livestock enterprises has led to severe loss in the system's natural capital due to erosion of soils, habitat destruction and extinction of biodiversity. With oscillations in global markets, climate change and prolonged droughts there is now growing pressure on farmers in Australian savannas to provide commodities that are more diversified than livestock alone. These products may have commercial value, such as alternative wildlife products or carbon credits. However, they may have no direct economic value, such as native species protection or landscape aesthetics. Diversifying land management enterprises for a broader range of products is likely to enhance their resilience and livelihoods. But for non-market natural capital a compact will be required whereby the society pays for the stewardship to meet societal needs. It is also likely that enterprises will not see each other as independent or even in competition, but they will see the opportunity as cooperating in order to manage the system. Such a system has a larger scale than in the past, and there are more stakeholders involved in management planning than has been the case thus far. There is therefore, a need to develop integrated cooperative management planning tools to meet future demands of planners at local, regional and national scales. This will require changes in attitude by both the farmers and the society in Australia.



Introduction

The tropical savannas of Australia cover around 1.9 million km² (or 25 % of the country's total area) across the top of the continent stretching from Broome in the Northwest to below Mackay on the Eastern seaboard (Fig. 1). They are featured by an overstorey of trees and an understorey of herbaceous plants, typically C4 grasses. Eucalyptus species dominate the canopy in areas with more than 600 mm annual rainfall, with *Acacia* or *Casuarina* species inhabiting the drier, and often less fertile areas (WALKER; GILLISON, 1982; TOTHILL; MOTT, 1985). Bushfires have a major influence in shaping the vegetation in the region with frequent dry season fires, that limit tree recruitment, keeping the canopy open (DYER et al., 2001). This region of Australia supports an abundance of both plants and animals, many of which are endemic and adapted to harsh climatic conditions (WOINARSKI et al., 2007).

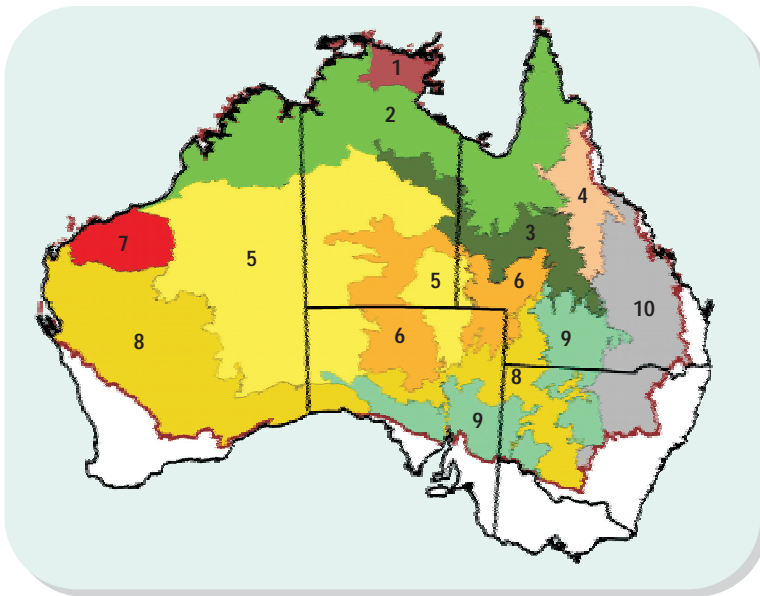


Fig. 1. Map of Australia's savannas and rangelands. 1. Arnhemland and Tiwi Islands: Eucalyptus savannas; 2. Tropical Eucalyptus savannas; 3. Mitchell grass (*Astrelba* spp.) downs; 4. Einsleigh and Desert Uplands Eucalyptus savannas; 5. Arid deserts dominated by Spinifex (*Triodia* spp.) hummock grasslands; 6. Chenopod and hummock grasslands; 7. Pilbara hummock grasslands; 8 & 9. Acacia and Eucalyptus woodlands and shrublands; 10. Highly modified rangelands dominated by exotic grasses.

Source: Fisher et al. (2004).



Because of their tropical position, Australian savannas have highly seasonal rainfall (400 mm – 1200 mm per year) falling in a distinct wet and dry season (monsoonal system); with the wet season occurring mainly in December through March and the dry season lasting for up to 9 months. There is no such thing as average rainfall in the tropics, seasons vary in length and the quantity of rainfall can vary substantially between years. Daytime temperatures are high, especially in the wet season, typically around the mid 30's°C, falling to mid 20's°C in the dry season. Evapo-transpiration is high throughout the year and cyclones are also frequent.

The soils of the region are generally very old, well weathered and featured by infertility which means that the region generally has low potential productivity even where rainfall is high. Historically, human population was relative sparse subsisting through a hunter-gatherer lifestyle moving across the landscape and settling for short periods around waterpoints or water courses (BERNDT; BERNDT, 1981). Following European settlement, the primary land use in Australian tropical savannas has been extensive livestock breeding for beef and to a lesser extent sheep production (TOTHILL; GILLIES, 1992) with other forms of natural resources. Land use has been limited by climate and soils (e.g. forestry), remoteness and distance to markets (e.g. tourism, horticulture) or lack of markets (e.g. wildlife utilisation). The extensive livestock industry is generally based upon private enterprises comprising pastoral stations which range in size from about a few hundred hectares to near 1M hectares and carry up to 65,000 head of cattle (BORTOLUSSI et al., 2005), predominantly the Brahman (*Bos indicus*) breed. Since the 1990s there has been a rapid increase in the live beef export trade from Northern Australia to markets in South East Asia and the Middle East (SCHICK, 1997).

Australia is one of the most urbanised countries in the world with over 95 % of the population living around the coast. Agricultural production accounts for just over 2.5 % of the GDP, down from over 10 % in the 1970s. Currently, the population density in the savannas of Northern Australia is very low, with less than 300,000 living in the region and few towns reach over 10,000 people (WOINARSKI et al., 2007). The majority of people in the rural sector work in extensive beef enterprises or in industries associated with those.

Pressures to Australian Tropical Savannas

There are a number of pressures to Australian savannas, some of which are a result from their geographic location (e.g. droughts, cyclones etc) and others are because of human exploitation of natural resources. An example of the latter is that the



development of infrastructure, such as fencing and waterpoints and the use of supplementary feed on grazing properties have increased the stocking rate of livestock savannas resulting in heavy utilisation of the vegetation resource, particularly during droughts (GORDON; NELSON, 2007). Heavy grazing by livestock in savannas can reduce the vegetation cover and change the vegetation composition towards perennial species, leading to increased soil erosion during the wet season. In the past there also were incentives for removal of trees to increase understorey vegetation production, but again this can lead to increased vulnerability of the land to erosion and reduce the carbon storage capacity of savanna systems. The increased bare ground under heavy grazing pressure in itself can lead to increased opportunities for weed invasion, reducing the carrying capacity of the land. Also, the sowing of exotic species (e.g. buffel grass, *Cenchrus ciliaris*) to increase forage for livestock has negative impacts on biodiversity (GRICE, 2006). Once there is degradation it can take a very long time, sometimes even centuries, for the savannas to recover, leading to a reduction in the capacity of these ecosystems to support human livelihoods and biodiversity (SMYTH; JAMES, 2004; WALKER; SALT, 2006).

Over the past few decades there were also droughts in the southern part of Australia (1982 – 1984; 1994 – 1995 and since 2002) that have cost Australians over A\$ 3.5 billion in drought relief measures to farmers. It is now well recognised by scientists and politicians alike that with increases in global atmospheric CO₂ there will be changes in the global climate. Despite general increases foreseen in global temperatures and rainfall these will be felt locally in different ways. The expectation for the savannas in Northern Australia is that they will become wetter and slightly warmer and that there will be an increase in the intensity of rainfall and droughts (CSIRO, 2008).

A New Approach

As discussed above, for over two centuries, the savannas of Northern Australia have been dominated by livestock production, which, on the one hand, has led to a substantial economic boom in the region but on the other has led to degradation of ecosystems' natural capital and resulted in limitations to other opportunities of economic development (WOINARSKI et al., 2007). With changes in climate, markets and public perception there is increasing pressure being brought to bear on the livestock enterprises in Northern Australia to look to new livelihood opportunities from the savannas (see HOLMES, 2002). Many new products are likely to be based upon the provision of services from savanna ecosystems.



Ecosystem services are a set of ecological functions that are useful to humans by sustaining life or livelihoods (Fig. 2). These are anthropocentric services but do not necessarily need to be economic in nature – they can be provisioning (e.g. food and timber), regulating (e.g. flood and climate control), supporting (e.g. soil formation) or cultural (e.g. recreation and aesthetic values) (Millennium Ecosystem Assessment 2005). Savanna landscapes in Northern Australia provide a range of these services for Australian society including carbon sequestration, biosafety and recreation, and the management of savannas to provide services could provide substantial economic return. For example, fire management could increase annual carbon storage in the savanna vegetation and soils by 0.25 t C ha^{-1} - 0.75 t C ha^{-1} , if this could be applied to 20 % of the 35 million hectares of Australian savannas burnt annually, then this would give a potential increase in annual C storage of 6-19 Mt $\text{CO}_2\text{-e}$, or 1.2 % - 3.7 % of Australia's total 2005 greenhouse gas emissions (PURDON, 2007).

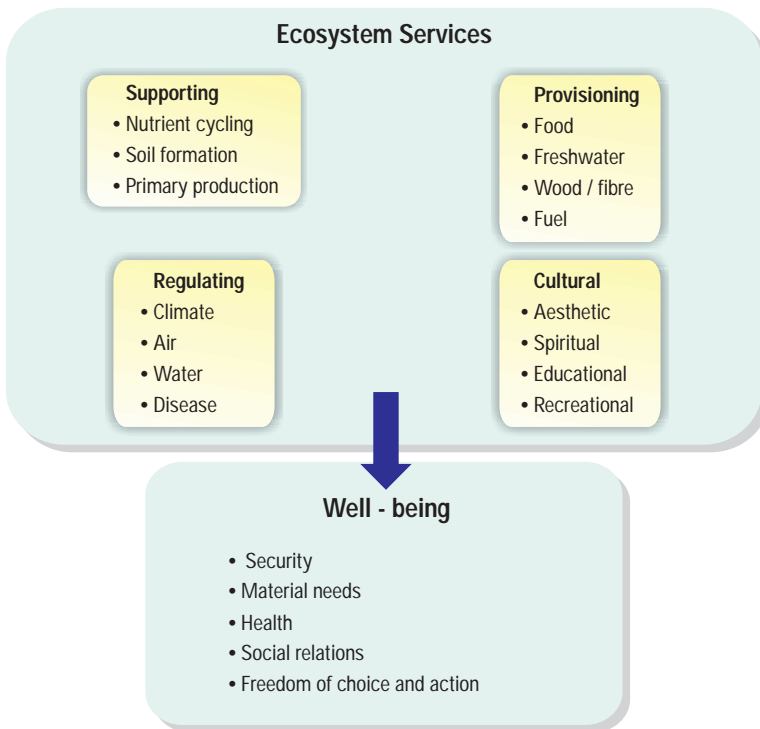


Fig. 2. Ecosystem services and their impact on human well-being.
Source: Adapted from Millennium Ecosystem Assessment (2005).



These new opportunities may have commercial value, such as alternative wildlife products (e.g. kangaroo, SALES; DINGLE, 1998) or carbon credits (ROBERTSON, 2003). They may, however, have no direct economic value, such as native species protection or landscape aesthetics. For the latter services, society may pay for land management to achieve societal benefits (GUTMAN, 2007). If society is to engage in the payment for the provision of ecosystem services then there will have to be a contract entered into for the achievement of the outcome or the management inputs required. This will however, require a change in attitude by a majority of farmers since, currently, many hold the view that stewardship would remove their autonomy and independence. The means by which engagement in stewardship is achieved will have to take attitude into account with landowners preferring voluntary agreements over market-based instruments or statutory regulation (e.g. COCKLIN et al., 2007). A change in behaviour may be more easily achieved on land held under leasehold than in freehold; over 50 % of Australia's savanna land is held under farming leasehold agreement that were originally established to support livestock production (WOINARSKI et al., 2007). New leasehold agreements offer the opportunity to include stewardship of natural resources (including biodiversity) as part of the leasehold agreement.

With over 20 % of the land area in tropical savannas under aboriginal ownership in the Northern Territory and Western Australia (WOINARSKI et al., 2007) fire management on aboriginal lands could be one area that would quickly provide economic return under stewardship schemes. As described above, Savanna fires release significant amounts of carbon into the atmosphere; by reintroducing indigenous practices of early season prescribed burning to limit the extent and spread of late season wildfires that lead to high emission rates of greenhouse gases along with a carbon trading or offset scheme economic returns could flow into aboriginal communities.

The opportunity for diversification of savanna based enterprises into the provision of ecosystem services will fundamentally rely upon the natural capital available in the system. Any degradation in natural capital will reduce the ability of the land to provide these services. Historically, the domination of land use in Australian savannas by livestock production has been at the expense of other ecosystem services. This degradation of vegetation composition, structure and cover can have major impacts on the ability of savanna systems to sustain not only livestock production but biodiversity, store carbon and reduce erosion risk. This can lead to a reduction in the economic viability



of pastoral enterprises and limit the opportunity to derive income from alternative sources. Restoring the natural capital is the key to providing sustainable livelihoods through the provision of ecosystem services from the savannas. Much technical information is now available on how to manage grazing to restore the functions of degraded savanna systems. For example, reduction in grazing pressure through the removal of stock and resting pastures during the wet season has been shown to improve pasture condition, increase water storage and increase carbon retention in the soil whilst potentially having positive impacts on the economic output of the enterprise (GORDON; NELSON, 2007). This means that graziers can achieve “win-win” outcomes that benefit ecosystem services through increased vegetation cover and the productive capacity of the land. An innovative approach to linking ecosystem restoration with markets may be to achieve restoration of degraded landscapes in the savannas through payments for the provision of services; for example, reforestation of savannas cleared for agricultural production through a carbon trading scheme could be used to provide a carbon sink for governments to fulfil their Kyoto commitments (HARPER et al., 2007) and benefit biodiversity (WOINARSKI et al., 2007).

In the long run the capacity of the Northern Australian savanna systems to provide livelihoods for people will depend upon the resilience of ecosystems and human enterprises and communities. Resilience refers to a system’s capacity to adapt to change while essentially remaining in the same state and retaining the same functions (WALKER; SALT, 2006). The development of resilient enterprises in the Australian savannas will have to be based around a number of different products in order to spread the risk from market, climatic and as yet undefined shocks. Given the scale that these shocks are likely to take and the scale of the heterogeneity of resources in the Northern Australian landscape it is unlikely that individual enterprises can incorporate the diverse portfolio necessary to optimise resilience. Therefore, despite the size of the enterprises, there is a need for systems to be established that facilitate cooperation; this can either be through the mechanisms put in place for payments for management or through overarching management institutions that are responsible for the disbursement of public funds to priority actions in order to maintain or enhance ecosystem services. Institutional arrangements need to be put in place to support such cooperation range from infrastructure to legislative frameworks and integrated planning tools developed to support decision making at a range of scales.



Conclusions

This is a time of change for Australian tropical savannas. The livestock industry is no longer seen to have the primary right to operate in the region; pressure is growing to reduce the impacts of farming enterprises on biodiversity and other ecosystem services provided by the savannas. This offers an opportunity for diversification of economic income streams for those enterprises based around new markets and payments for management of ecosystem services. This will involve the development of means by which new markets can be developed and contracts between society and farmers in order to meet public good outcomes of savanna management. However, with the growth of the economies in India and China and the associated increases in individual wealth and spending power there could be increases in the demand for livestock products, which would change the economic drivers for Australian tropical savannas and would need strong government involvement to ensure that land management mistakes of the past were not continued into the future.

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