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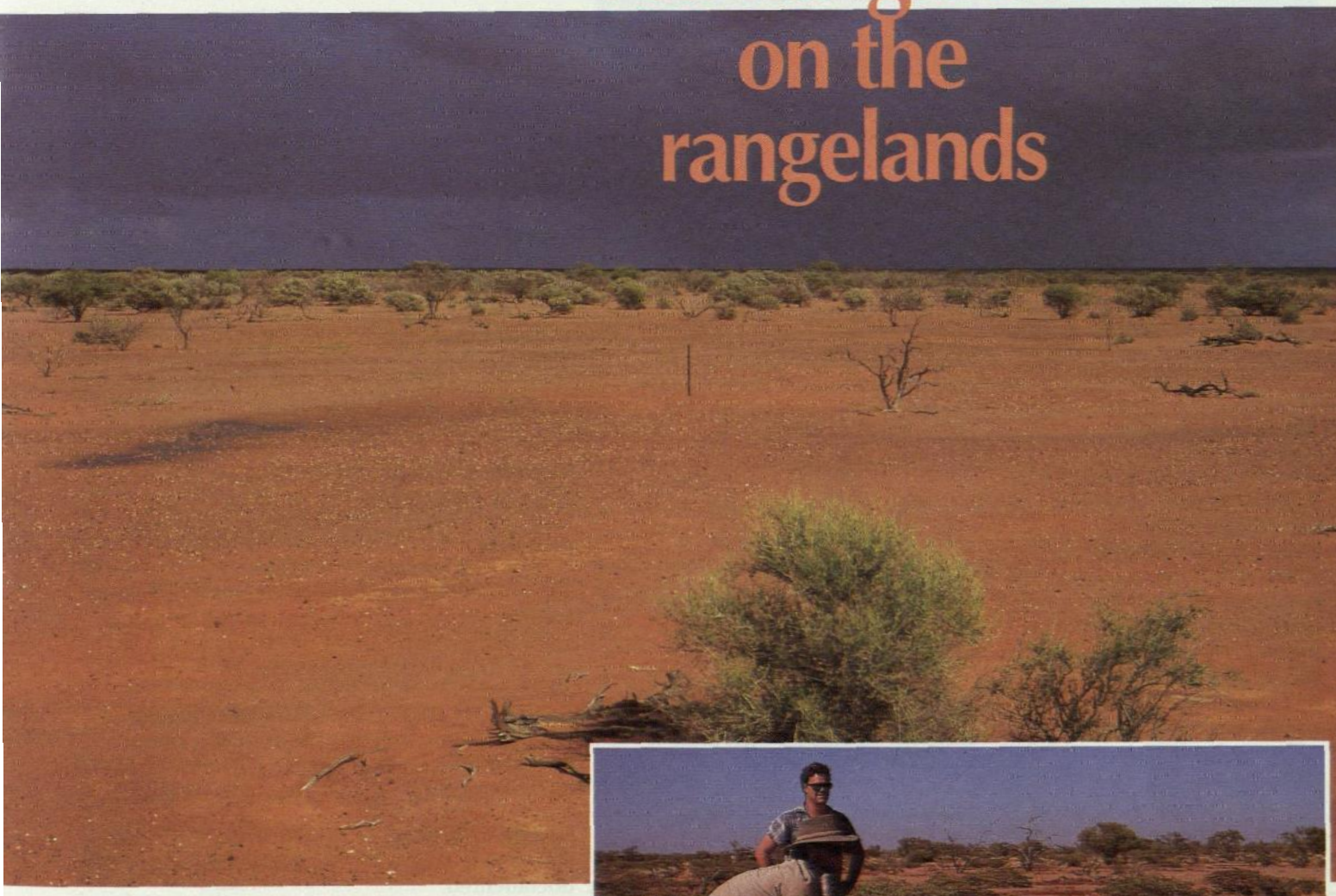

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Kangaroos and other native animals should be maintained across their natural range, including areas set aside for pastoral use.

But the added grazing pressure on native vegetation from sheep, cattle and feral animals, together with unnaturally high numbers of kangaroos, has seriously degraded much of our rangelands.

Cattle and sheep numbers are relatively easy to control. The same cannot be said for kangaroos.

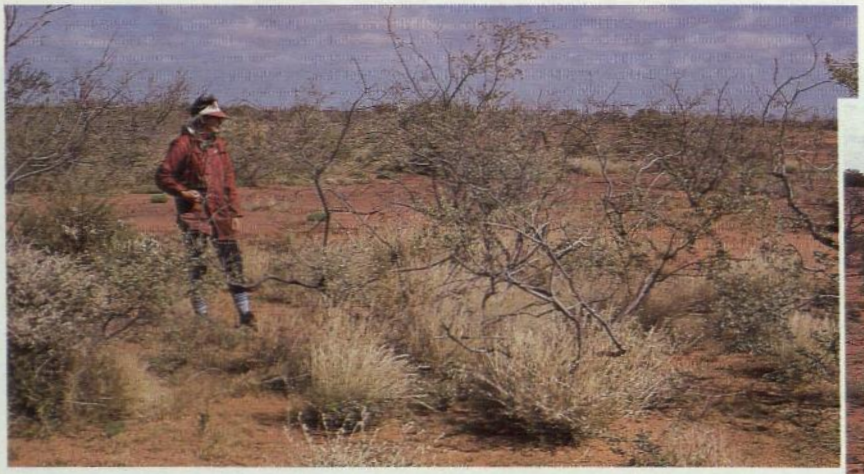
Access to widespread man-made watering points has allowed kangaroos to continue breeding when normally a shortage of water would suppress reproduction.

Pastoralists complain that commercial kangaroo shooting is not always effective in preventing damage caused by kangaroos. More effective control might be achieved by restricting their access to artificial watering points.

The following article shows why and how this can be done.

TOP: An example of a degraded rangeland. Note the lack of ground cover and the predominance of unpalatable shrubs.

ABOVE: Having caught this large male kangaroo after adding sedative to his drinking water, Grant Norbury (holding kangaroo) and Chris Nichols attached a radio collar and are ready to release him.



ABOVE: Dale Norbury standing amongst an abundance of drought-resistant perennial grasses in an area where no livestock or kangaroos graze.

In the other photo (far right), there is a lack of grasses in an area where only kangaroos graze.

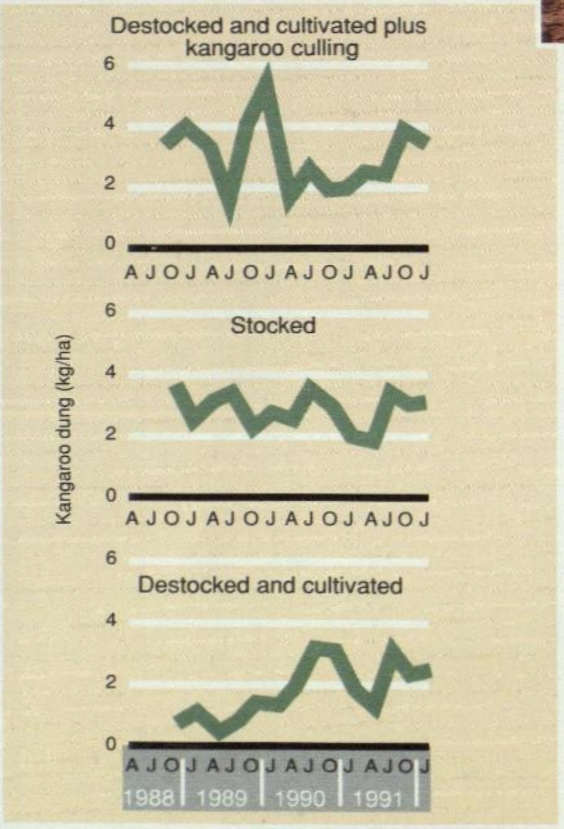


Figure 1. The amount of kangaroo dung in each paddock. Paddocks were destocked in April 1989.

Background

Much of Australia's arid rangelands are in varying states of degradation. For example, nearly one-quarter of the 74,500 sq. km Carnarvon Basin is reported to be in poor range condition (Payne *et al.* 1987).

In an attempt to overcome this problem, local land conservation districts are embarking on range regeneration programs that involve removal of stock and, in many cases, ploughing and seeding of shrubs and grasses.

Cultivation is seen as the only hope of restoring severely eroded land to a productive state. It is, however, a costly, time consuming and risky operation.

The success of regeneration depends on many factors, not the least of which includes rainfall, something which cannot be guaranteed in Western Australia's arid rangelands.

Adding to their worries, pastoralists believe that removal of stock signals the start of a kangaroo invasion, with kangaroos taking over from where the sheep left off.

Exactly what impact kangaroos are having on attempts to regenerate degraded land is not well documented.

Gascoyne study

Our project on Middalya and Wandagee stations, 150 km north-east of Carnarvon, examines three questions:

- Do kangaroos prefer to graze regenerating areas, and if so, from how far will they travel?
- What impact do kangaroos have on regenerating shrubs and pasture?
- Does commercial kangaroo shooting reduce the impact of kangaroos?

Three paddocks of similar size (7500 ha) and land type were studied. One paddock remained stocked with sheep; one was destocked and some of the denuded areas cultivated and re-seeded with native shrubs; and the other paddock was destocked and re-seeded, and a commercial kangaroo shooter operated within it. All paddocks received similar rainfall that was typical of the long-term annual average (237 mm).

Kangaroo invasion

Kangaroo dung was collected every three months from 60 permanent transects located in the three paddocks to examine the distribution of kangaroo grazing.

There was a six-fold increase in kangaroo dung in one of the destocked paddocks over an 18-month period since stock were removed in April 1989 (see Figure 1). Kangaroo dung levels in the stocked paddock were relatively stable over the same period.

Large swings in the amount of kangaroo dung in the other destocked paddock occurred simultaneously with the licenced shooting of about 2050 kangaroos during the study period. This high level of culling may only have been achieved by a continual influx of kangaroos into this paddock. Had there been no shooting, the influx of kangaroos may have been similar to that in the other destocked paddock.

In addition to destocked paddocks, some areas subject to cultivation and re-seeding showed increased amounts of kangaroo dung, indicating relatively intense kangaroo grazing.

Kangaroo movements

Forty-six kangaroos were fitted with collar-mounted radio transmitters that emitted a unique frequency, and their movements tracked by using a light aircraft every two months over three years.

Although a few kangaroos covered distances of up to 130 km, our results showed that, on average, red kangaroos live over an area of about 30 sq. km, less than half the size of a typical paddock in Western Australia's arid pastoral lands. This limited movement implies that kangaroos invading regenerating areas are local animals from nearby.

Local invasion is contrary to the beliefs of most pastoralists, who consider that kangaroos migrate from distant locations. The thought of mobs of migrating kangaroos converging onto hard-earned attempts at regeneration suppresses pastoralists' enthusiasm for kangaroo control.

Given an effective control method (see later), local invasion should provide an incentive for kangaroo control programs on sensitive areas of rangeland because control is more likely to be effective if incursions are predominantly from local populations.

Impact of kangaroos

We also studied the impact of kangaroo grazing on shrubs and pasture in the absence of stock. We compared plant regrowth inside five kangaroo-proof exclosures (each 300 m x 150 m) where there were no herbivores, with plant regrowth in similar areas outside, where only kangaroos grazed. We measured the biomass (total plant growth), natural replacement and deaths of individual shrubs and recorded pasture biomass.

Of the six most common shrub species, kangaroo grazing significantly reduced the recruitment and survival of the palatable shrub, silver saltbush (*Atriplex bunburyana*). Its loss was noticeable as seasonal conditions became drier. There was also an obvious impact on grasses. At last count, there was 40 times more grass inside the exclosures compared with outside (see Figure 2).

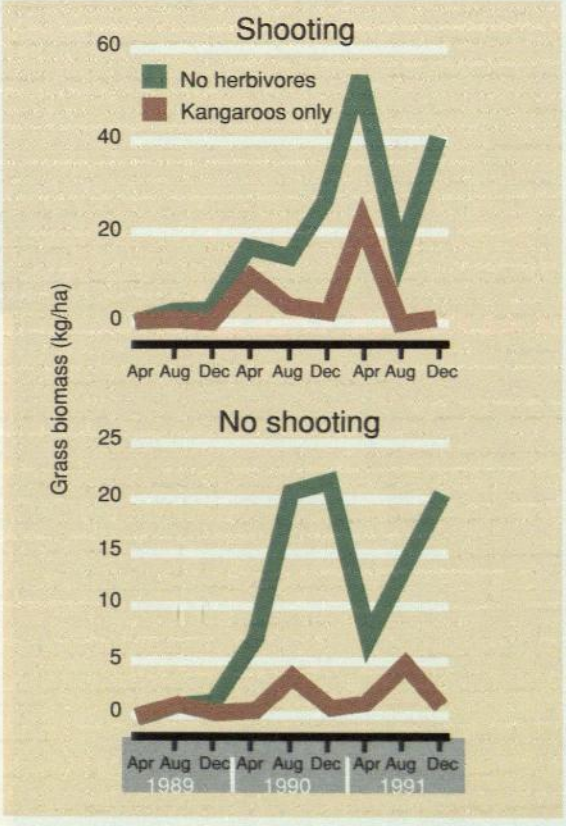
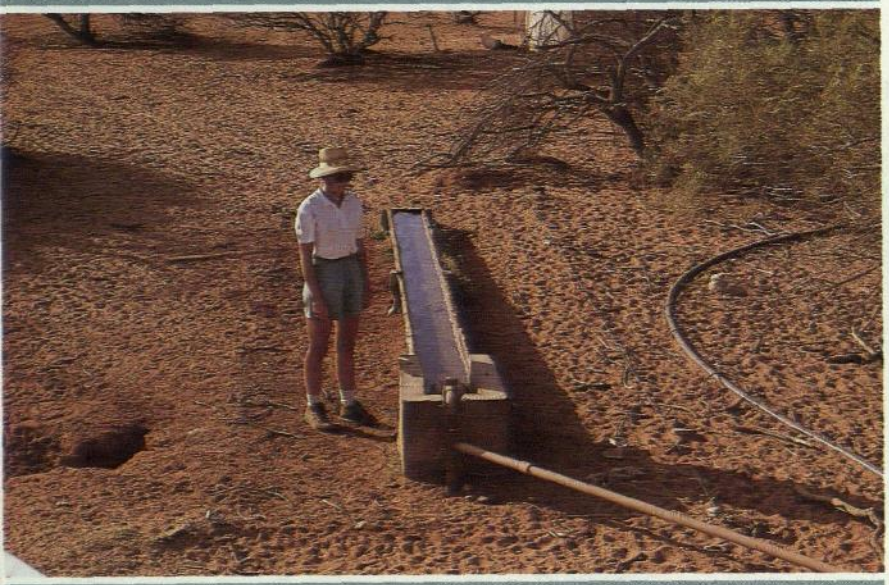


Figure 2. Changes in total grass in areas where no herbivores grazed (inside exclosures) compared with areas grazed by kangaroos only (outside exclosures).

Kangaroo shooting made little difference to the impact of kangaroos on the regrowth of grasses.

The most common grasses included the drought-resistant perennials *Eragrostis setifolia*, *E. xerophila* and *Cenchrus ciliaris*, and the annuals, *E. dielsii* and *Enneapogon caerulescens*. The regrowth of perennial species, in particular, is integral to the regeneration of arid rangelands. A perennial root system helps to restore soil stability and



A Finlayson trough consists of an electrified wire 1.1 m from the trough edge and about 4 cm above the ground.

The Finlayson watering trough

The provision of artificial watering points has allowed populations of large kangaroos to increase in the arid and semi-arid rangelands.

We briefly examined the effectiveness of a selective watering device, known as a Finlayson trough, that is designed to exclude kangaroos but allow stock to drink.

The device is a low-lying electrified wire that surrounds a trough. Stock can step over this wire, but a kangaroo's feet or tail touch it (see Figure 3).

Of the 292 times we saw red kangaroos attempt to drink from the trough, 99 per cent were unsuccessful. Most kangaroos received shocks through the feet before they could reach the earthed water. Sheep made 309 attempts to drink. In 17 per cent of these attempts, they received minor shocks to the legs. Their drinking was disrupted only for a short time.

Initially there was a build up in kangaroo numbers around the troughs, followed by a rapid decline 10 days later. Presumably, kangaroos had dispersed to non-electrified waters 4 km away.

Finlayson troughs could be used humanely to concentrate kangaroos around watering points, thereby making commercial kangaroo harvesting more effective. They could also be used to keep kangaroos out of small regenerating areas; or, by gradually installing Finlayson troughs, would allow kangaroos to adjust to fewer artificial watering points.

improve water penetration, thus improving moisture supply to plants. Perennials also return valuable organic matter to the soil and provide protected niches in which other seed can germinate.

Commercial kangaroo shooting

One of the aims of commercial kangaroo shooting is to reduce kangaroo numbers to a level that minimises agricultural damage. This was not the case in our study, where we tried to establish perennial species in the absence of stock. The impact of kangaroo grazing on grasses, for example, was just as evident in the paddock where the commercial shooter operated (see Figure 2).

These results emphasise the need for integrating more effective methods of kangaroo control with stock reductions, if attempts to regenerate degraded rangelands are to succeed.

Options for control

Pastoralists often complain that commercial kangaroo shooting is not always effective in reducing kangaroo damage. Our brief examination of shooting supports this observation.

This is not surprising for a number of reasons. The commercial value of kangaroos to a shooter is such that more intense shooting efforts are not always cost effective; shooting intensity can vary with the market value of kangaroo products; shooters can only travel over a small area of the vast rangelands and so do not encounter a large portion of the kangaroo population; and selective shooting of large males is an inefficient means of restricting population growth.

This study provides scientific rationale for implementing more effective forms of kangaroo control. For example, if the value of kangaroo products was to increase, a more intensive shooting effort may result. This is one reason why kangaroo meat should be sold for human consumption throughout Australia.

Fertility control is another option, but the technology is not yet fully developed and there are significant problems with administering sterilants to wild kangaroos.

Properly maintained electric fencing can effectively control the grazing distribution of stock, feral animals and even kangaroos. It should be adopted more widely.

One of the major causes of high densities of kangaroos in pastoral areas is the provision of artificial watering points for stock. Significant control of kangaroo populations may therefore

In an attempt to get to water, kangaroos dug this deep hole just outside the electrified wire surrounding a Finlayson trough. In the end, they sought water elsewhere.

be achieved by the humane use of a selective watering device that allows stock to drink but excludes kangaroos (see 'The Finlayson watering trough' on page 60).

Kangaroos are magnificent animals and conserving them across their range is imperative. However, their impact on regenerating rangelands should not be overlooked. Given a properly monitored and humanely conducted kangaroo control program, the restoration of our degraded rangelands should be enhanced.

Acknowledgments

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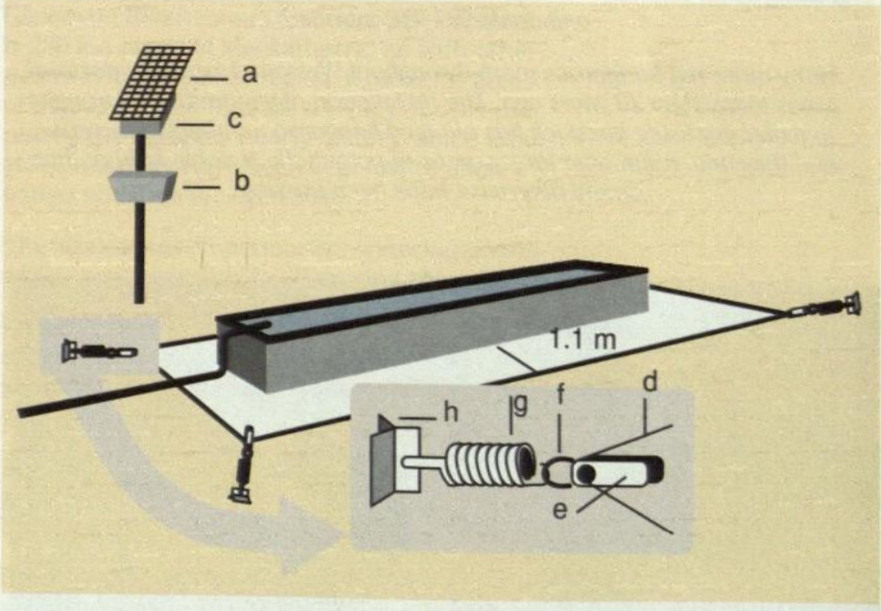

Figure 3. Drawing of a Finlayson trough. a. solar panel, b. 12 V battery, c. energiser, d. 2.8 mm electrified wire 1.1 m from the water's edge and about 4 cm above the ground, e. ceramic insulator, f. 2 mm tie-wire tied four times g. spring, h. picket.