

Comparison of rotational grazing and continuous grazing on native pasture: preliminary results from Old Man Plains.

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This report presents background, methodology and recommendations for the grazing trial conducted at Old Man Plains Research Station as part of the Desert Knowledge CRC project “Rangelands grazing management strategies for improved economics and resource stability” funded by the National Landcare Program. The project was completed by a partnership including DPIFM, CLMA, DKCRC and CSIRO.

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Abstract

There has been widespread interest by the industry in spelling practices, which hold out the potential for increased production without damage to natural resources, and may lead to sustained production with recovery of the natural resources. The benefits of rotational grazing in the semi arid rangelands have been little documented and it is therefore difficult for managers to commit to these new grazing strategies. The trial at Old Man Plains Research Station, 50km south west of Alice Springs, compares a four paddock rotation with a continuously grazed paddock, both used by breeder herds. Both the treatment and control paddocks are dominated by native pastures of mulga (*Acacia aneura*) over woollybutt (*Eragrostis eriopoda*) and kerosene grass (*Aristida holathera*) and oatgrass (*Enneapogon avenaceus*) pastures. The four paddock rotation was designed to allow herd management activities to be incorporated into paddock moves and was based on the Resource Consulting Services design.

The study aimed to test the hypotheses that rotational grazing will improve the quality and quantity of pasture available, improve land condition and therefore animal productivity and reduce risks associated with a variable climate. This report presents the methodology and data collected to date. Pasture data consists only of pre trial data. A summary of plant species diversity and rank abundance is provided. Cattle in the rotation performed slightly better than the control with regard to average cow weight and branding percent. Pregnancy status and branding percent were similar for both treatments. At the time of reporting, the trial had not been running for very long (approximately 16 months), so it was not possible to draw any recommendations on the grazing strategy itself.

This trial was run in conjunction with studies on Idracowra and Mt Riddock stations.

1. Background

There is a growing awareness amongst pastoral land managers of the need to manage their natural resources to ensure a strong, environmentally sound industry that will be sustainable into the future. Through land management extension activities, pastoralists are gaining a good understanding of how natural ecosystems function in relation to the grazing enterprise.

In the arid rangelands, the cost of intensive infrastructure and increased management input is often prohibitively expensive when considering alternative grazing strategies. Breeding enterprises are also concerned with grazing strategies that require regular herd movements at the risk of separating cows and calves. The grazing strategy trialled at Old Man Plains Research Station was designed to minimise cost and ongoing management commitments using a Droughtmaster breeder herd. It is based on a four paddock rotation that is discussed as part of the Resource Consulting Services Grazing for Profit workshop.

This report presents the methodology and data collected to date. As the trial had not been running for very long it was not possible to draw any recommendations on the grazing strategy itself.

Study Site

Old Man Plains Research Station lies approximately 50km south west of Alice Springs. Average temperatures for the region range from a low of 21.4°C to a high of 36.3°C in January and a low of 4.0°C to a high of 19.7°C in July. The median October to September rainfall at the homestead is 238mm and the median summer rainfall is 173mm.

The area of land under rotation is in the central part of Old Man Plains Research Station. The two northern paddocks (No. 1 and Crows Nest) are predominantly calcareous shrubby grasslands that support palatable, annual pastures of oatgrass (*Enneapogon avenaceus*) (Figure 1 & Table 1). The two southern paddocks (East and West Whitepoint) are mostly sand plains with mulga (*Acacia aneura*) over perennial grasses such as woollybutt (*Eragrostis eriopoda*) and kerosene grass (*Aristida holathera*). These areas are much less palatable and nutritious than the northern paddocks. The control paddock (Waterhouse) is a mixture of both land types. Throughout all paddocks, scattered small drainage floors supporting mulga and ironwood (*Acacia estrophiolata*) over a mixed grassland are a focus for grazing. These broad land types are described using the land resource mapping of Lennartz and Whitehouse (2002).

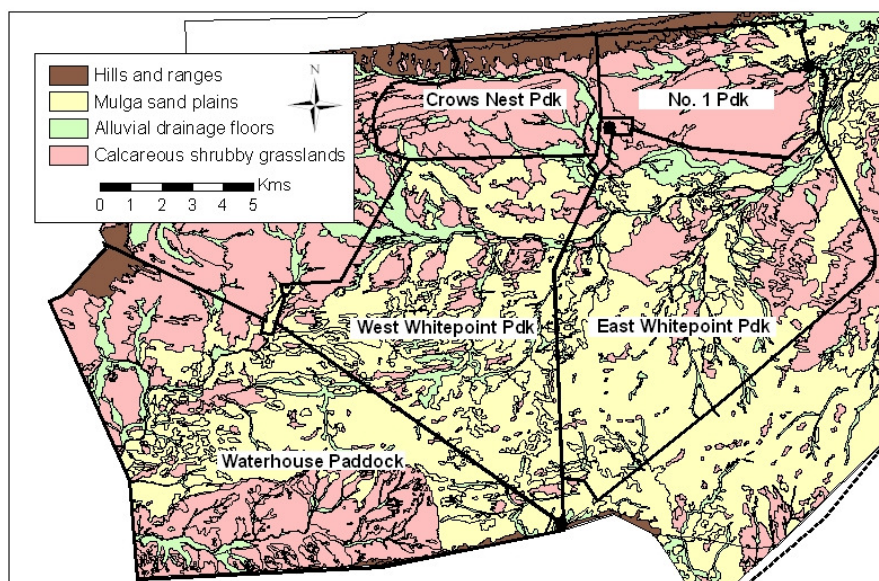


Figure 1: Land types of the trial area, Old Man Plains Research Station, from Lennartz & Whitehouse (2002).

Table 1: Land types occurring within the trial area, Old Man Plains Research Station.

	Calcareous Shrubby Grasslands Pebbly, calcrete plains and rises. Sparse witchetty bush and mulga shrubland over oatgrass.
	Mulga Sand Plains Broad sandy plains. Mulga woodland over erect kerosene grass & woollybutt grass.
	Alluvial Drainage Floors Shallow drainage floors, some incised channels. Mulga and/or ironwood woodland over a mixed grassland of oatgrass, erect kerosene grass and buffel grass.

Hypotheses

1. Summer spelling will improve the quality and quantity of pasture available.
2. Improved land condition will increase animal productivity.
3. Spelling and rotational grazing will reduce risks associated with a variable climate.

Objectives

- Decrease overheads through intensification ie. using one paddock at a time not all paddocks continuously.
- Increase gross margin, as the timing of moving stock through the paddocks allows for controlled mating.
- Cows have a better chance of being in good condition as they are always going onto fresh feed.
- Pastures are rested during the growing season and land condition will be maintained.

2. Methodology

A continuously grazed control paddock was compared with a four paddock rotation (Figure 2).

Grazing Strategies

The rotationally grazed treatment consisted of four paddocks that are considerably smaller than the district average of 335km² (Leigo, 2006). The two northern paddocks have an average size of 25km². The southern paddocks, West Whitepoint and East Whitepoint Paddocks, are 68km² and 79km² respectively. The northern paddocks are dominated by oatgrass, an annual pasture species that is capable of producing abundant, nutritious fodder, even when it has hayed off (Allan & Wilson 2006). Being an annual species it must set seed so that it can regenerate during subsequent summer growing seasons. Spelling these paddocks every summer allows the plants to achieve seed maturity and produce maximum growth thus maximising the opportunities for maintaining pasture condition and optimising pasture availability.

The southern paddocks are dominated by less palatable, perennial grasses such as woollybutt and erect kerosene grass. This pasture type has low palatability and nutrition and low carrying capacity. The grazing strategy allows these paddocks to be spelled every second summer. The northern rotational paddocks were watered from No. 1 trough and the southern paddocks were watered from both No.1 trough and Whitepoint bore.

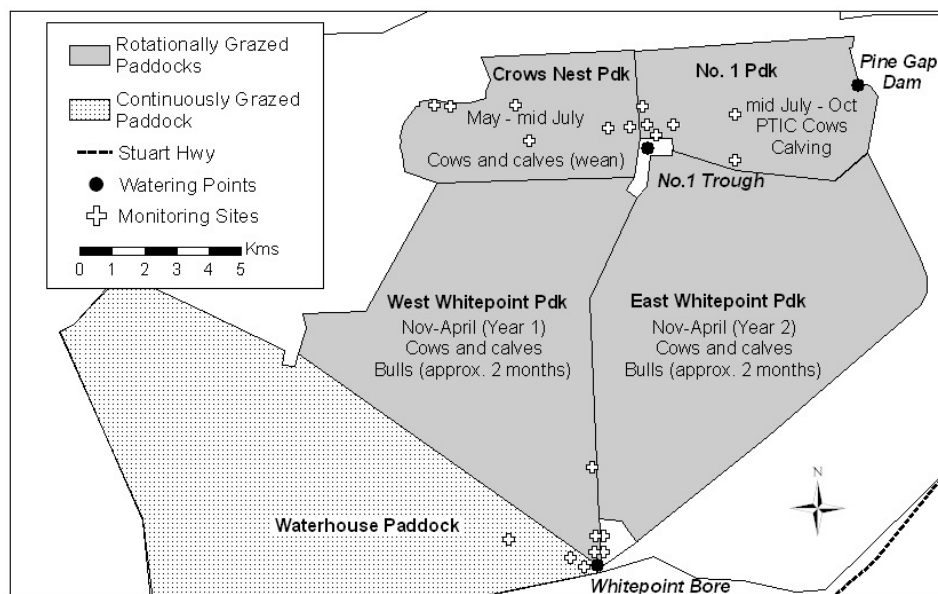


Figure 2: Layout of rotationally grazed paddocks and adjacent continuously grazed control paddock, Old Man Plains Research Station.

When cattle are moved from one paddock to another within the rotation they are simply trapped through the yard at the central watering point (No. 1 trough). Trap gates are set by one person on a routine bore run. If desired, herd management activities such as branding and pregnancy testing can be incorporated into the moves.

The control consisted of one continuously grazed paddock (Waterhouse paddock) of 93km². Bulls are included in the herd for the same two month period as in the rotationally grazed paddocks. The paddock is watered by Whitepoint bore.

Stocking rate

Whilst cattle can travel large distances from water, it has been found that grazing intensity declines with distance from water (Fisher 2001). To simplify our calculations, we assumed that most grazing occurs within 5km of water and that grazing is even within this area. 151km² (77%) of the rotationally grazed paddocks and 49km² (53%) of the continuously grazed paddocks was within 5km of water.

Stocking rates were calculated annually using forage budgets at the end of the summer growing season in April. Available forage was calculated using the formula; Yield x Palatability Index x Utilisation. The palatability index and utilisation rates are specific to individual land types and land condition classes and have been described using methodology from the Grazing Land Management workshop for central Australia (Chilcott *et al.* 2005). Utilisation rates may appear to be high given the land condition status however the available pasture is reduced using the palatability index.

Stock numbers for the rotation were set so as to ensure that the paddock with the lowest carrying capacity was not overgrazed. Stock numbers for the rotation and the control were set to achieve desired utilisation levels as per the guidelines in the central Australian Grazing Land Management Workshop (Chilcott *et al.* 2005).

Table 2: Palatability index and utilisation rates used for forage budgets.

Land Type	Land Condition Class	Palatability Index	Utilisation (%)
Calcareous Shrubby Grassland	C	0.65	25
Mulga Sand Plain	A	0.2	15
Alluvial Drainage Floors	B	0.7	20

Seasonal Conditions

Rainfall records were collected via an accumulating rain gauge located at Whitepoint bore and No.1 Dam. An automatic gauge was also located at No.1 Dam as of January 2007.

Pasture Assessment

Stratified site sampling was used to gauge pasture composition, quantity and cattle grazing distribution. All of the pastures were assessed in April 2007 (Table 3 - 4) and are due to be reassessed in April 2008.

Table 3: Assessment record for rotationally grazed paddocks.

ROTATIONALLY GRAZED PADDOCKS			
Paddock	Date In – Date Out	Days	Pasture Assessment Date
West Whitepoint	1/11/06 – 30/4/07	181	Apr 2007
No.1	1/5/07 – 4/9/07	127	Apr 2007
Crows Nest	5/9/07 – 29/10/07	55	Apr 2007
East Whitepoint	30/10/07 – 30/3/08*		Apr 2007

* Proposed date for reassessing cattle numbers based on forage budget.

Table 4: Assessment record for continuously grazed paddocks.

CONTINUOUSLY GRAZED PADDOCKS		
Paddock	Date In – Date Out	Pasture Assessment Date
Waterhouse	1/11/06 – 30/3/08*	Apr 2007

* Proposed date for reassessing cattle numbers based on forage budget.

Two sites at 500m, 1km and 3km from water were located within each of the rotationally grazed paddocks and the control paddock. Sites were selected to ensure that the vegetation was representative of the dominant vegetation communities within the trial. At each site, 50 x 1m² quadrats were laid out in a one hectare grid.

Each quadrat was assessed for cover, total yield, top three species by percentage yield, species diversity, cattle activity and defoliation.

Cover was described as a percentage of soil surface covered with vegetative matter, living or dead. The assessment of cover was a visual estimation.

Yield assessments were also visually estimated with observers calibrating their estimates at the end of every day with ten dry weight samples. Yield was described as the amount of standing pasture.

The *three species ranked highest by percentage yield* were identified along with their percentage of yield. The total does not equal 100% where there are other species present eg. Species 1 = *Enneapogon avenaceus* 60%, Species 2 = *Tribulus terrestris* 25%, Species 3 = *Sida fibulifera* 10%

All plants occurring within a quadrat were identified to at least genus and then species where possible. This provided an assessment of plant *species diversity*.

Cattle activity was described using a qualitative index based on the relative abundance of dung and/or hoofprints (Table 5).

Table 5: Cattle activity index.

Score	Description
0	No sign of cattle activity
1	Light activity
2	Moderate activity
3	Heavy activity

Heavy activity was described as either a well used stock pad or where nearly all of the non-vegetated part of the quadrat was covered with either manure or hoofprints. Whilst it did not refer to actual grazing it provided an insight into how cattle moved around a paddock.

Defoliation was described using an index based on estimated percentage of yield that had been removed (Table 6).

Table 6: Defoliation index.

Score	% Defoliation	Description
0	No defoliation	No grazing
1	>0 and ≤5%	Slight grazing
2	>5% and ≤25%	Moderate grazing
3	>25% and ≤50%	Heavy grazing
4	>50% and ≤75%	Very heavy grazing
5	>75% and ≤100%	Severe grazing

Stock Performance

The initial induction of cows and calves into the trial (November 2006) included both the treatment and control animals. The rotation herd was Droughtmaster whilst the control herd was dominated by Tuli crosses.

Pregnancy status, calving percentages, branding percentages and animal weights were collected throughout the year. Bulls were placed with the herds for two months at a rate of approximately 4%.

Supplementation was continuously provided in the form of Uramol blocks in both the trial and the control.

3. Results

Seasonal Conditions

Seasonal conditions for the duration of the trial to date are described in Figure 3. The monthly totals suggest that above median rain fell in most months throughout both summers. This is likely to have allowed pasture to become robust and more resilient to grazing.

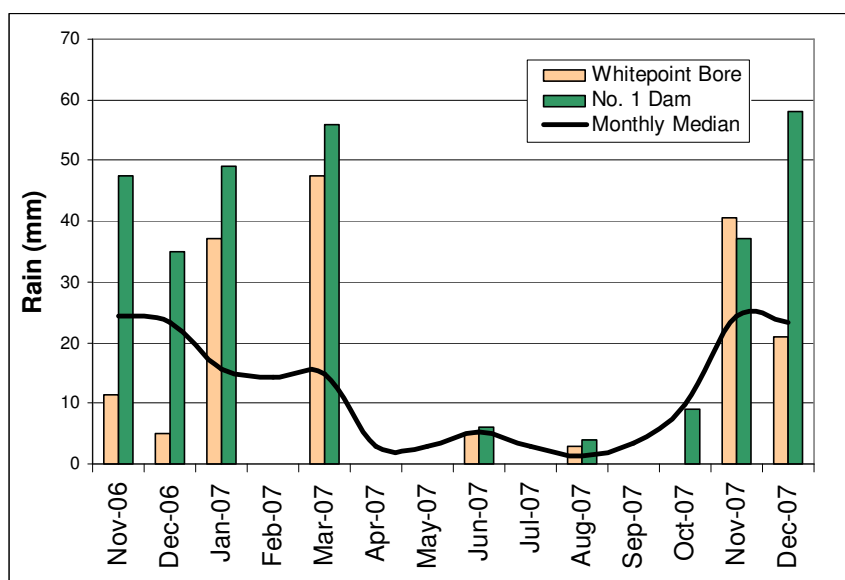


Figure 3: Old Man Plains monthly rainfall from November 2006 to December 2007.

Stocking Rates

When calculating stocking rates, the area described is only that within 5km of water as it is unrealistic to expect that all parts of a paddock are utilised evenly (Norton 2003, Quirk & McIvor 2006, Low 1972, Fisher 2001, Hunt *et al.* 2007).

Rotationally grazed treatment

Because paddock size, forage available and grazing time varied within the rotationally grazed treatments, a range of stocking rates were used (Table 7). Crows Nest and No. 1 Paddocks are similar in size and land type however their carrying capacity differed as Crows Nest had not recovered well from fire in 2002. The first grazing period was only part of a rotation. The first full rotation began on the 1st May 2007. The average stocking rate for 2007/08 was 1.1 AE/km². Average stocking rates were based on the area within 5km of water in all four of the paddocks

assigned to rotational grazing. Even though one of the paddocks was not used in a given rotation it cannot be used for any other herd and therefore it should be part of the calculation.

Table 7: Stocking rate per rotationally grazed paddock

Year	Rotation	Paddock	Area (km ²) within 5km of water	Days	AE/km ² /year
2006-2007	Part only	West Whitepoint	59.3	181	0.85
2007-2008	One	No. 1	20.1	127	1.72
2007-2008	One	Crows Nest	24.2	55	0.63
2007-2008	One	East Whitepoint	52.0	Est.181	0.96

Continuously grazed control

The stocking rate for the continuously grazed paddock in 2006/07 was 0.76 AE/km².

Pasture Assessment

Pretrial assessment of yield and cover was undertaken in April 2007 (Table 3).

Table 8: Pretrial yield and cover assessment, April 2007.

	Continuous Grazing	Rotational Grazing
Yield (Kg/Ha)	288	369
Cover (%)	19	14

Species Diversity

Species composition is expected to be different between the two areas as the dominant vegetation communities vary and this is shown in Table 9 and Figures 4 - 5. The rotational grazing paddocks have considerably higher number of species than the continuously grazed paddock.

Table 9 : Total number of species recorded.

Time of Assessment	Rotational Grazing	Continuous Grazing
Pretrial 2007	76	40

In the following species abundance graphs (Figures 4 – 5), species are only included when frequency is >1%.

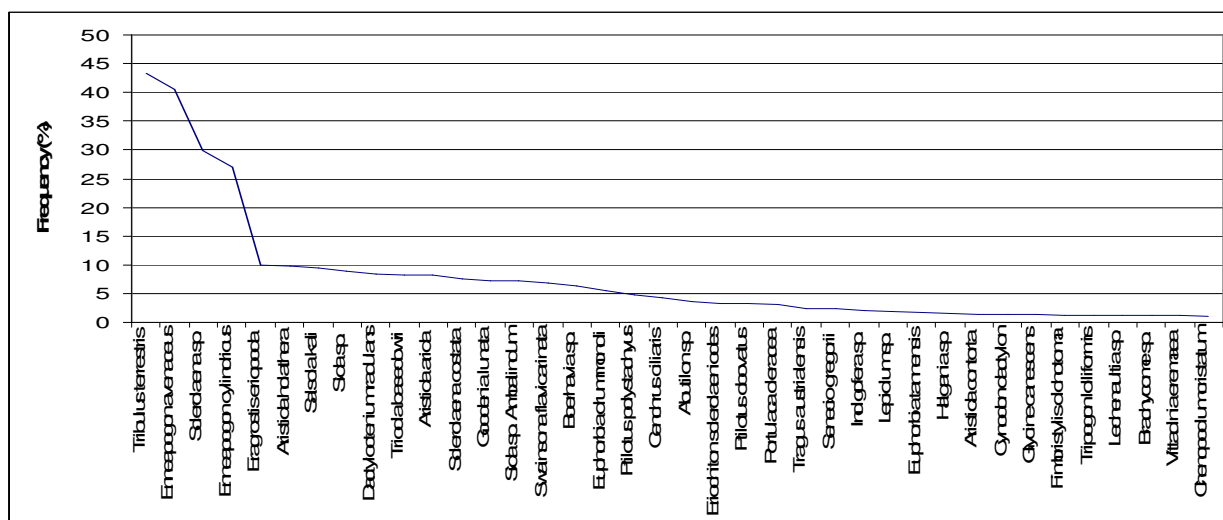


Figure 4: Rank abundance of species in rotationally grazed paddocks, pre grazing 2007.

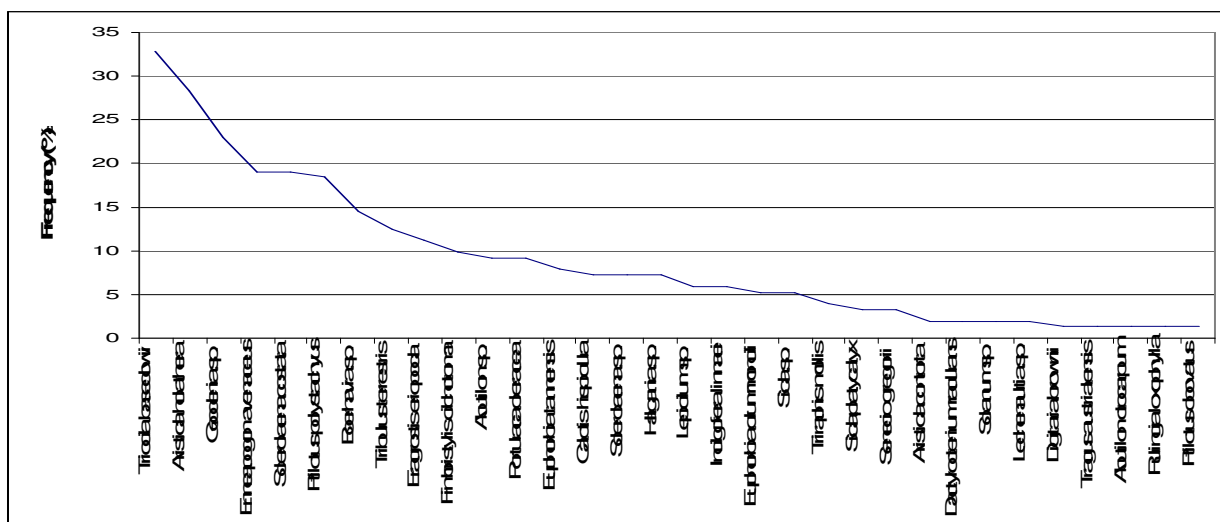


Figure 5: Rank abundance of species in continuously grazed paddock, pre grazing 2007.

Stock Performance

Regular stock management activities undertaken to date have been recorded in the Table 10. Stock in the rotation performed slightly better than the control with regard to average cow weight and branding percent. Although the control cows were almost 30kg lighter than the treatment cows, the differences were not quite significant (T-test, $t(53)=2.00$, $P=0.051$). The calf weights were not significantly different (T-test $t(24)=2.06$, $P=0.337$). Pregnancy status and branding percent were similar for both treatments.

Table 10: Animal performance data from September 2007 to March 2008.

Treatment	Date	No. cows	No. Pregnant	Preg %	Avg cow wght (kg)	No. calves branded	Branding %	Avg calf wght (kg)
Control	20/9/07	30	20	67%				
	6/3/08	30			514	17	57%	144
Treatment	11/9/07	81	56	69%				
	5/3/08	80			553	50	63%	144

4. Future Work & Recommendations

This project will continue with funding received from NHT through the Northern Territory Natural Resource Management Board. It is not possible to make any recommendations regarding the grazing strategy at this stage. The recommendations in this section refer to future research within the trial

It is recommended that pasture sampling (cover, yield, yield composition, species diversity) be undertaken at the end of the summer growing period; approximately April or May. Cattle activity and defoliation could be done immediately after or mid-way through a graze period to capture 'normal' patterns of use. Use may vary depending on seasonal conditions or the time cattle have spent in the paddocks eg. cattle will use surface waters after rain and therefore activity in the monitoring sites will not truly reflect distance from water.

Additional waters need to be located in the southern rotational paddocks (West and East Whitepoint) and the control paddock (Waterhouse). This will increase the available forage. Current location of watering points forces cattle to use very narrow strips of country when accessing water and this is likely to be causing undue pressure on the land resources in these areas.

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