

THE POTENTIAL FOR ANIMAL PRODUCTION IN THE ARID ZONE

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Summary

The physical and economic environments for livestock industries in arid Australia are outlined. The limits to growth of arid zone animal production and some of the options for the future are considered.

Multiple-use of these arid rangelands will assume greater significance in the future with mining, recreation, tourism and aboriginal lands competing for space in the arid interior. There is no prospect for greatly increased animal production from the arid zone. Achieving landscape stability is seen as the most pressing problem.

I. INTRODUCTION

The arid and semi-arid lands, rangelands as defined by Perry (1967), have resources which present to the pastoralists a very **re-**stricted range of enterprise options. Climatic, biological, and economic factors, virtually restrict rural production to the conversion of native forages to meat or fibre from ruminant livestock,

Unreliable climatic conditions represent an overriding influence in the arid zone and have led to the development of a system of livestock grazing and marketing which is adapted to cope with erratic seasonal conditions. "Recent events though involving sudden and **un-**predictable falls in the price of wool, and more recently beef cattle, lead one to conclude that despite a long-standing, demonstrated capacity to cope with the effects of seasonal variation, pastoralists in the zone are not as well equipped to deal with the very large income fluctuations which result when prices for produce become depressed by changes in world markets" (BAE 1976a). The sudden closure of markets overseas for beef has severely restricted the cattle managers in their option of controlling herd size through management of volume of sales. With restricted (in some cases zero) sales from remote arid zone properties herd building and grazing pressure have risen to unprecedented levels (B.A.E. 1975). Increased livestock numbers will bring greater pressure onto the rangeland resource, and may involve a run-down of the resource base. Currently, extreme fluctuations in prices received and severe cost pressures are creating a difficult and uncertain situation for pastoralists.

It is against this background then that this paper will consider limits to growth of arid zone animal production and some of the options for the future.

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II. LAND USE IN THE ARID ZONE

Although the arid zone (figure 1) represents a large area 5,700,000 km²) about 2,000,000 km² is not used for production of any kind at present and the prospects for use in the future are not good. The settled or occupied lands amount to 3,500,000 km². Climatically, the zone is dominated by summer rainfall in the north and by winter rainfall in the south. In general, the summer rainfall areas are grazed by cattle and the winter rainfall areas by sheep although there has been some shift of cattle into traditionally sheep areas in recent years. (B.A.E. 1977)'. The relative movements in sheep and cattle numbers may be partly attributed to market prospects for wool and beef. The annual rate of growth in beef cattle numbers in the arid zone 'was 3.3%, about half that recorded in the non-arid regions (BAE 1976b.)

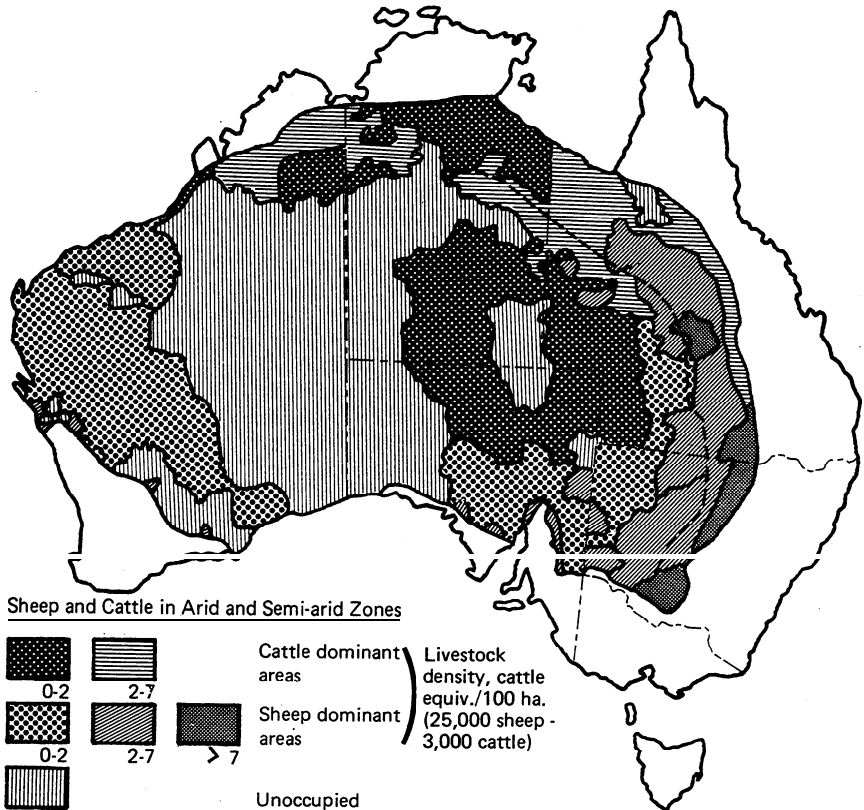


Figure 1. Map of Australia showing extent of arid zone, numbers of sheep and cattle, livestock density and areas of sheep — or cattle - dominance. (After Wilson 1974)

The grazing land carries about 30 million sheep and 6 million cattle, but these numbers are reasonably static and are declining in importance relative to livestock numbers in the more humid areas (Wilson 1978). On average, about 70% of the occupied area of Australia's arid zone is used for pastoral production; the proportion varies between states. The trend is for less land to be retained in pastoral use. Competing uses are mining, parks and wildlife reserves;

aboriginal lands, and marginal cropping in the semi-arid regions. No extension of pastoral occupation of the desert fringes seems possible except for minor incursions for short periods into selected areas. It is likely though that any gains here would be offset by losses through desertification (Campbell 1977). Desertification, as defined by FAO (1977), is "the diminution or destruction of biological potential of land, which leads ultimately to desert-like conditions. It is an aspect of widespread deterioration of ecosystems under the combined pressures of adverse and fluctuating climate and excessive exploitation."

(a) Changes in grazing capacity

The lands of arid Australia have been grazed by sheep, cattle or rabbits for periods varying from a few years in the most recently occupied areas to a little over a century in the oldest settled parts. In that relatively short period there has been considerable degradation (reviewed by Roberts 1976). Moore (1969) writes "In the simplest terms, the vegetation as it exists today, is less productive (in terms of animal production) than the original vegetation and degeneration is still proceeding. If a stable pastoral industry is to be maintained the process must be arrested and reversed." Generally, arid zone plant communities produce less dry matter per unit area for domestic livestock than previously and fewer animals per unit area are supported (Newman 1974). Despite this there are large tracts of land for which little change can be recognised as either degeneration or improvement attributable to management. The major question would seem to be that of determining whether the present balance between the pastoralist and arid zone ecosystems is a stable one, both biologically and economically, or whether such a balance can be found.

"In the arid zone, low rainfall remains an overriding restriction on production and any attempt to develop these lands along the lines of intensification and increases in production that may be envisaged for higher rainfall areas is not feasible" (Wilson 1978). Drastic increases in animal populations in the arid zone could lead to further desertification. FAO (1977) in their World Map of Desertification show one fourth of Australia as being in danger, almost all of it in the arid zone. Newsome and Corbett (1977) ascribe the present situation to stocking by livestock and to the impact of technology (Fig. 2).

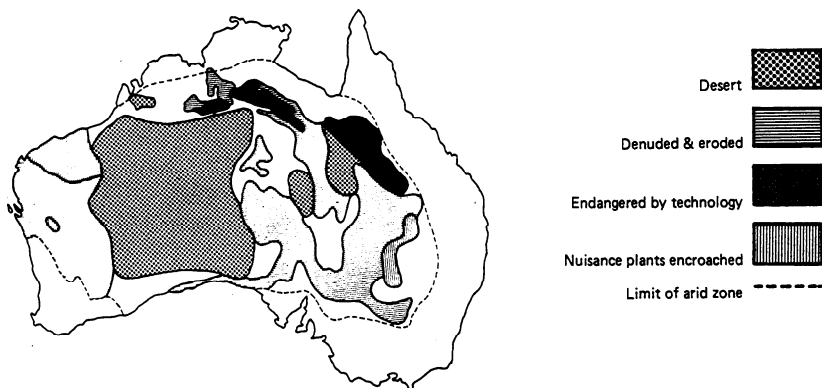


Figure 2. Sites of incipient deserts due to stocking by domestic livestock and technology (after Newsome and Corbett 1977).

(b) Multiple-use - options and conflicts

During the past decade we have witnessed a period of rapid expansion and interest in exploration, production and development of the mining industry in the arid zone. About 37% of the total value of mine production in Australia is derived from the arid zone. Accompanying the rapid growth in value of production was an acceleration in investment expenditure and employment (BAE 1976a). But overall, the mining industry is characterised by relatively few operators employing a low percentage of the national workforce.

A disturbing feature of mining legislation in some states is that it assumes that pastoralists have 'no rights to their land and that Crown lands held under pastoral lease have no value. No provision is made for compensation beyond the cost of improvements and it totally ignores the lessened value of improvements of the land retained.

In recent years awareness of opportunities provided by the arid zone for tourism and recreation has increased, culminating in a large number of people travelling interstate and away from traditional places of interest in coastal areas. Tourism has had little direct impact yet on the pastoral industry; impact is restricted to destination resorts such as Ayers Rock, and to narrow access corridors. But as the number of tourists increase and as technology (caravan design, off-road vehicles etc.) is applied to the tourist industry we could see the results of these recreational onslaughts manifest themselves over a wider area. On the positive side there is some scope for pastoralists to invest in tourism as a means of stabilizing their incomes.

Currently the relationships between mining, pastoralism and tourism appears to be relatively harmonious, with few land use conflicts. As time passes, conflicts can be expected to increase as land (space) becomes relatively more scarce. There is increasing pressure to set aside representative examples of arid zone ecosystems. These moves, if successful, would remove large areas from pastoral use. There is reluctance on the part of government to permanently alienate land for non-commercial purposes, and allocate the finance to promote the degree of research required to study arid zone ecosystems but perhaps this will change in the not too distant future. No form of land use has yet emerged which involved the large areas that the pastoral industry occupies. With the current economic circumstances of the pastoral industry some marginal operators may abandon their lease holdings. **Bushfire** risk, vermin and erosion control measures demand that any abandoned land be managed (Perry 1974). Feral cattle, horses, camels, goats, donkeys and pigs are extensively distributed throughout the arid regions of Australia (Leigh 1974). Feral animals are closely associated with domestic stock, particularly where the management of stock involves extensive grazing, and will undoubtedly play a major role in the spread of disease and in the creation of residual foci for major livestock diseases (Murray and Snowdon 1976). Abandoned lands could become a major refuge for feral animals. To date, land that becomes available has been used to augment the adjacent leases. If economic conditions deteriorate further some land may not be taken up by pastoral interests. In that case an alternative form of management will be required.

This last point becomes especially important in those parts of the arid zone which are subject to Aboriginal Land Rights legislation. In some instances aboriginals who acquire control of former pastoral prop-

erty will undoubtedly continue to run cattle for profit. In other situations a return to traditional usage is envisaged. The extent to which pastoral holdings in central Australia may be influenced by current and future claims under existing Aboriginal Land Rights legislation is not yet known.

Much of the land under claim adjoins existing aboriginal reserves and no alienated land under pastoral lease has yet been claimed (Fig. 3).

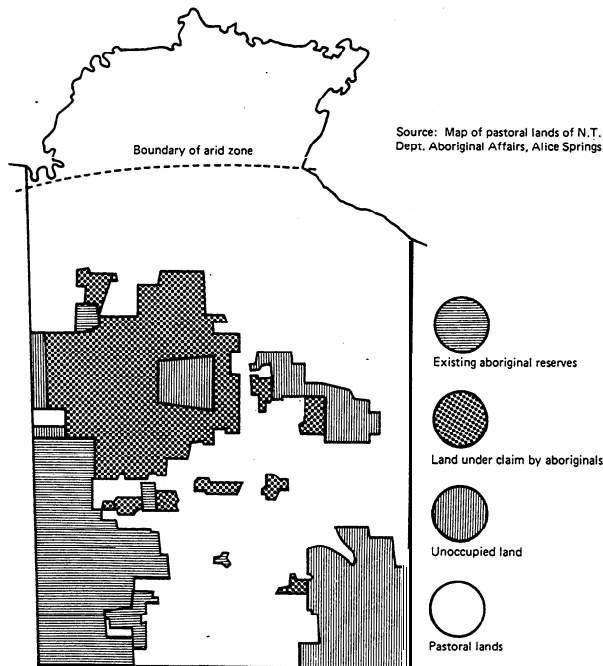


Figure 3. Map of the Northern Territory showing the areal extent of aboriginal reserves, pastoral lands and land under claim by aboriginals within the arid zone.

(c) People in the arid zone

The arid lands of Australia have about 3% of Australia's population and this proportion is declining despite the build up in centres like Mt. Isa and Alice Springs. Furthermore, the trend is toward declining rural populations e.g. the on-farm population in western N.S.W. declined by 16% from 1961 to 1971 (Davidson 1976). Even a major centre like Broken Hill is already experiencing a reduction in population (Parkes 1973). The implications in terms of **labour** for pastoral and other industry-related pursuits are far reaching. Seasonal **labour** for such operations as mustering, branding and shearing is harder to get. The proportion of the on-farm **labour** expended by the property operator or his family has risen over the past decade and now accounts for up to 21% of the total man-weeks worked on cattle stations in the Alice Springs district (BAE 1974). **Labour** can be considered as a scarce resource as the cost of **labour** increases and the number of people working in rural industry declines. Perhaps because of this scarcity of **labour**, or because of the extensive nature of the livestock enterprise, **labour** efficiency in terms of livestock units managed per man-week is high in the arid zone (BAE 1974). Technological advances such as aerial mustering and the replacement of horses by motor bikes are ways to reduce **labour** needs.

A factor of some importance is the projection for total population growth in Australia. If, as seems likely, we achieve or approach zero population growth by the turn of the century (W.D. Borrie, pers. comm.) we will continue to have an exportable surplus of red meat. This is a problem which will have to be faced. Despite a widespread optimistic view that markets will **always** exist for Australian farm products the reality is less comforting. It would require an Australian population of 25 million to consume all the beef produced in this country today, at the current Australian consumption of 110 g/person/day. It is likely that there will be an increase in cattle numbers as sheep raising is abandoned in many areas. This will exacerbate the problem of over production.

III. ANIMAL PRODUCTION IN THE ARID ZONE

(a) Cattle

Beef cattle production is the principal rural industry in northern section of the arid zone (Figure 1). The rate of growth in cattle numbers has been slower than in southern Australia. The relatively slow growth in numbers in the northern rangelands reflects the conditions under which the industry operates. There is virtually total reliance on native pastures subject to spasmodically recurring drought and there are management **difficulties posed** by extensive production in a sparsely populated environment; in contrast to southern Australia where the increase in cattle numbers has often been at the expense of sheep raising. Beef cattle properties in the Northern Territory have, on average, a herd size of 7,000 cattle. The main emphasis in the cattle enterprise is on breeding. Fat cattle are turned off in good seasons. Turnoff rates vary between regions but values of 22% and 26% are quoted for the Northern Territory as a whole and the Alice Springs district respectively (BAE 1974). The major proportion of the turnoff consists of steers between one and four years (50%) but females over one year of age represent about 30% of the **total** (BAE 1974). The relatively low reproductive efficiency of beef herds in the northern arid zone has been well documented (reviewed by Entwistle 1974). Unfortunately, comparable published data from beef herds in the southern regions are not available but Entwistle (1974) suggests that reproduction rates in beef herds in the arid and semi-arid regions of N.S.W. are higher.

(b) Sheep

Wool production from Merino sheep is the principal form of land use in the southern arid regions (Figure 1). The average size of sheep holdings in the arid zone is 15,727 ha with an average flock size of 3,900 sheep (BAE 1976b). Wool production per pastoral property was 22,975 kg in 1972-73 (BAE 1976b). Low reproduction rates in sheep are a characteristic of many areas of the arid or semi-arid regions, and marked geographical variations have been reported (see Entwistle 1974). The extent of variations in lamb marking percentages and in wool production and their relation to environmental gradients has been reviewed by Brown (1974).

Generally, wool production/head in arid areas is at least as high as in better - watered regions, but meat production is much less efficient (Wilson 1978). The viability of the arid zone as a livestock producer depends on its comparative cost advantage made possible by extensive grazing and a low input of-resources. There seems to be no viable alternative to the conclusion that the bulk of the arid lands will continue to be used for the extensive grazing of sheep or cattle. Turner (1971) has suggested scope for introduction of exotic breeds of livestock and there have been

advocates of possible new livestock enterprises based on newly domesticated animals (e.g. eland), or the cropping of wild animals (e.g. kangaroo, euro) but the prospect of any significant contribution to arid zone production is not good (Tribe and Pratt 1975).

IV. FUTURE CHANGES IN INDUSTRY STRUCTURE

What is critical to the future of arid zone land management at this time is that rangeland livestock industries are in a severe and enforced adjustment period at a time when the rural and urban economic systems are obviously uncoupled. Urban prosperity is now less dependent on rural incomes and the products of arid and semi-arid regions than ever before. Overall, it can be argued that operators in the rangelands are, in comparison with their urban brothers, deprived of many of the benefits of society and experience a much lower standard of community welfare. The quality of life of people in the arid lands is, by their own account, not equal to that of their urban brothers. Particularly lacking are medical and dental services, educational services, and the supply of the consumer items made so desirable by the media.

Mannetje et al (1977) conclude that "Australia's beef production, is particularly vulnerable and very dependent on world market trends. In the short term there does not appear to be much scope for greatly increased beef production but, given increased world population, increasing buying power and increasing shortages of energy and food grains, the long term outlook is one of greater demand for beef from low energy-input production systems on land that has no alternative use for food production." However, the much cited benefits of low-energy input that are a feature of rangeland grazing systems (McClymont 1974) may be more than offset by the generally higher off-farm costs of fuel and transport. As Wilson (1978) points out there is no real differential in favour of arid zone grazing industries.

Survival of a hard core of very large, efficient pastoral enterprises over the next decade or two of sharp price fluctuations can be expected: the exit of many producers who have reached an irrecoverable economic situation because of recent and current crises is inevitable (Williams 1976). The remainder of the producers between these two extremes will survive according to their ability to effect economies or become more efficient in the operation of their livestock operation.

Declining levels of employment in the pastoral industries have led to a decline in population and investment in the towns that serves those industries, accentuated by recent declines in beef prices. Conversely the recent shift of Aborigines from cattle stations to fringe settlements around pastoral towns has altered their character and function. In many smaller towns in the N.T. aboriginal welfare payments have become the principal basis for commerce in these towns.

One spin-off from increased tourism, mining and other non-pastoral industry-related economic activity in the arid zone is the improvement in communications, especially roads. Greater access to markets can't help but improve the ability of pastoralists to move livestock (for sale or agistment) in times of **adversity** or when market conditions are bouyant.

Better transport has advantages too; improving the prospects for a more integrated livestock industry where the arid zone concentrates on breeding and the humid fringe is responsible for finishing livestock for market.

v. RESEARCH PRIORITIES

(a) Land

Any improvement in animal production from the arid zone must involve studies on ways and means to achieve landscape stability. "There is a challenge for research to develop management standards which maximise for long-term ecosystem stability rather than short-term animal production. (Slatyer and Perry 1969). The questions posed by Campbell (1965) seem relevant in this context. "What we want to know is whether a new ecological balance can be established which will enable an economically viable cattle industry to persist indefinitely?" If the answer is no, then perhaps we should withdraw these lands from pastoral occupation and concentrate on more suitable areas of the continent. Perhaps the answer will be conditional - a viable industry is possible provided institutional changes are initiated such as enlargement of holdings or redistribution of land. Still another very real possibility that must be faced is that arid rangelands can only be used for pastoral purposes as a slow mining proposition. In other words pasture deterioration might be inevitable if the land is to be used at all. Given the private and social capital already invested in the arid zone such a policy could be politically attractive despite its long term implications. This serves to illustrate the fact that in social issues of this kind - it is rare that there is a single clear-cut goal.

(b) Animals

There would seem to be **five** main areas of animal-oriented research which have relevance to the arid zone.

(i). Forage and nutrition. Forage quality is the first limiting factor in ruminant production in many areas. Under rangeland conditions, most ruminants subsist wholly on forage and therefore the factors which affect forage quality in turn affect the quality and quantity of ruminant products. The nutritive quality of forage varies seasonally, in periods of rapid growth (spring or wet seasons), protein content may be more than 20% and total digestible nutrients can exceed 70%. In other seasons however, these values may be as low as 2% and 35% respectively. Some grasses are adequate during only brief periods of the year, or never. Because of this natural variability in forage quality, supplementary feeding may be necessary during non-growing seasons to avoid ruminant mortality. Supplementary feeding is often necessary to maintain reproduction level. However, supplementary feeding is not always profitable. Hence research to improve technology of ruminant feeding using molasses, urea, millings, and industrial by-products and wastes is especially important.

Plant introduction has had limited success in the arid zone of Australia. About 1,000 introductions have been assessed without any notable success (K.W. Hyde *pers. comm.*). It must be mentioned though that the tests have not encompassed the full range of soil types available. Establishment of exotic pasture species requires expensive techniques and it seems likely that some justification other than animal production may be required if such a program is to be initiated. Some merit might lie in trying to re-establish native perennial grasses in areas where these have been lost and in trying to retain them in areas where their survival is threatened. Rangeland management has a major role to play in maintaining forage for grazing stock.

(ii). Diseases and parasites. Losses from diseases and internal parasites are generally not a serious problem in the arid zone but perhaps more important is the moribidity and its accompanying depressing effect on livestock and livestock products (Yeates and Schmidt 1974). Diseases associated with reproductive losses (e.g. brucellosis) receive considerable priority **but non-transmissible** diseases also are a cause of concern. There is still scope for work on parasites such as the cattle tick (Boophilus microplus) and the sheep blow-fly. The recent work on chemical agents for **mulesing** of sheep (Pratt and Hopkins 1976) offers some promise in protecting sheep against the sheep blow-fly.

(iii) Reproduction and genetics. Ruminant reproduction rates in arid areas are about two-thirds of potential. Feed deficiency is the first limiting factor. Often first calves are born when the cows are 3-4 years old. Cows may calve in alternate years. Long periods of severe-under-nutrition may increase embryo, neonatal, and maternal mortality (Frisch 1973). Regardless of how the goal is reached, any improvement of reproduction rates will mean that a smaller breeding herd of more efficient animals can produce the same or even larger turn-off than a larger less efficient herd. Because the payoffs are cumulative, improvements in ruminant reproduction rate may be approached in so many different ways (entwistle 1974, Hopkins. and Pratt 1976).

(iv). Products technology. Recent advances in meat technology include mechanical deboning, meat protein concentrates, and food products from blood and visceral tissues, meat homogenisation and extrusion and texturization of resultant fibres (Walker 1976). The potential volume of such products is large especially from arid zone livestock. Wool and leather are two important products on which recent. research and technology can have major impacts. The rising costs of synthetic fibres (mainly **by-products of petroleum**) have made wool more competitive (BAE 1975).

(v). Socio-economic research. Because the way in which pastoralists and graziers organize and manage their resources affects the supply and cost of food to consumers, production-systems research **focuses** on the organization and structure of the grazing enterprise, including such aspects as efficiency of resource use, costs and returns, and economies of scale. Thus the socio-economic sciences are essential components of any research program to guide research resource allocation.

(c) Options

Ruminant productivity can be improved by giving research priorities to the following areas: (i) range improvement (ii) genetic resistance and vector management, especially for tick borne diseases and blow-fly control (iii) increased animal unit production through improved conception rate and decreased foetal and perinatal mortality (iv) development and evaluation of systems - biological, ecological, engineering, economic and social - for resource use, ruminant production, and product utilization (v) development of new products such as meat protein concentrates and texturized products from trimmings and edible offals (vi) improvement of meat production through genetic selection, and (vii) supplementary **feeding programs** designed to satisfy minerals, and other nutrient requirements of pregnant and lactating animal's, But one might seriously question whether this is enough. The scope for intensification of the industry is limited in a way that perhaps does not apply to the more **humid regions**. The allocation of research priorities is often difficult and with the current austerity measures it **is hard** to justify animal production research that is not compatible with long term resource stability. The return for research effort is likely to be lower in the arid zone than in the more favoured areas.

Resource stability is clearly important and in the long run is the type of research which is likely to pay off. Methodology for long term monitoring of change needs to be applied (Wilson 1978) since we already have the guidelines (Perry 1976). Part of the task is to get a higher degree of co-ordination among agencies responsible for research and extension services and to up-grade the level of extension personnel. A need which is becoming more apparent is to find out what the pastoralists think. Rural sociology, a discipline we more commonly associate with small farmers on the humid fringe, has considerable relevance to arid zone pastoralists.

As Mannetje et al. (1976) have said "the role of extension in the future is probably more one of aiming at improved efficiency and profitability than the encouragement of pasture improvement and improved animal practices per se. With the likelihood of continued uncertainty in beef markets and prices, one of the principal roles of extension might be to help producers offset the effects of fluctuations in income, by advising on **consolidatory** measures to be taken in periods of good incomes in order to be able to weather the poor **periods**".

VI. CONCLUSIONS

Despite the vastness of the arid zone and the large areas which are currently unoccupied **there is** no scope for large scale expansion of animal production. The cost/price squeeze is, if anything, going to favour the more humid areas, especially as higher fuel costs make transport expensive. The arid zone has, in the past, had a considerable comparative advantage and the extensive nature of the operation made for a high efficiency per man and per dollar invested. Some of this advantage may be lost in future. Intensification of production is not a viable option without greater safeguards to environmental stability. Research priorities should be toward rangeland management, especially toward multiple-use of these extensive public lands. The socio-economic sciences will play an increasingly important role in future.

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