PROBLEMS OF ADAPTATION OF PASTORAL BUSINESSES IN THE ARID ZONE*

KEITH O. CAMPBELL
University of Sydney

With emphasis upon Central Australia, an assessment is made of the economic problems of pastoral firms in meeting the climatic conditions of the arid zone. Analysis ranges over the responsibility for conservation and drought planning, the inadequacy of a purely physical approach to conservation, the difficulties of station organization and management in the arid zone, the array of possible managerial strategies for meeting these difficulties, and the effect of social institutions on the choices available to management.

Given the large proportion of the Australian continent which falls within the arid and semi-arid zones and the frequency with which even the better-watered sections of the country suffer adverse seasons, it is amazing that the Australian community should not by now have achieved greater mastery over the problems raised by fluctuating rainfall. In an earlier paper I speculated on the reasons why Australians, in framing their agricultural policies, adopt what at times appears to be a calculated unconcern for such problems.[1] On that occasion, I also reviewed such Federal and State emergency aid as is given to alleviate the effects of periodic drought and concluded that Australians, agriculturally speaking, had adapted themselves rather inadequately to the uncertainties of their natural environment.

The present paper is concerned with the same general problem looked at from a somewhat different point of view—from the standpoint of the individual business firm rather than from the standpoint of the community. It is concerned primarily to examine the various strategies available to pastoralists in areas of low and uncertain rainfall as they endeavour to conduct their businesses profitably and (probably what is more important in such an environment) as they endeavour to keep their businesses solvent during sequences of adverse seasons. The focus will be mainly upon the pastoral firm (because this is the dominant type of rural activity in the Australian arid zone) and upon the Central Australian pastoral firm in particular.

Individual Responsibility—To be or not to be?

In the Australian scene, the overwhelming tendency is to place the onus on the individual grazier to take measures to keep his business afloat during periods of drought. Implicit in this is a forlorn hope that thereby the maximum possible number of sheep and cattle will be saved so that the future income-earning capacity of the rural industries will not be

* Review paper presented to the Australian Arid Zone Research Conference at Alice Springs on 15th September, 1965.

[1] Campbell, K. O., "The Challenge of Production Instability in Australian Agriculture", *Australian Journal of Agricultural Economics,* Vol. 2, No. 1 (July 1958), pp. 1-23.

jeopardized. Even a cursory examination of Government pronouncements on the subject of drought mitigation reveals that Ministers of the Crown are not anxious for Governments to assume responsibilities in this area except in the gravest emergency.[2] They tend rather to argue, with some validity, that if farmers and graziers elect to carry on their businesses in areas which past experience shows to be subject to violent climatic fluctuations they should be prepared to accept such fluctuations as part of ordinary business hazards and not expect the community to bail them out when conditions get tough.

One finds this traditional view reiterated at a recent meeting of the Australian Agricultural Council. In an official press release it is asserted that "action by farmers themselves offers a more promising possibility of countering drought than does some centralized form of national fodder scheme".[3] The report continues "the major need for the future is for governments to provide the incentives to the producer and for the individual farmer to accept that it is his responsibility to provide against future drought emergencies".

Despite the overtones of confidence in the farmers' managerial ability in drought emergencies which are present in these statements and despite the evident belief in the superiority of the results that are likely to stem from decentralized management decisions, one can find other Government pronouncements which question the ability of the pastoralist to do a satisfactory management job and which would impose restraints on his decision-making powers. This point of view may be illustrated by reference to the report presented in 1964 by the Northern Territory Land Board with respect to the situation in the Central Australian pastoral industry after six years of drought.[4] This Board made its report after interviewing local pastoralists on their drought experiences and management practices, seeking evidence from several scientific officers and carrying out inspections in the affected areas.[5] This Board said it could "not agree with the contention that good management will be assured if left to the pastoralist . . . . Management is already left largely to its own devices but . . . . this freedom has not resulted in the maintenance of a viable industry but in its deterioration. The Board is therefore of the opinion that controls over management are essential to ensure that Centralian pastoral lands are not destroyed, and to enable the Centralian pastoral lands to be preserved".[6]

Conservation in an Economic Context

The observations and recommendations of this Board raise important questions about the objectives of land management and about criteria of evaluation which are worthy of discussion. I might add that the issues at

[2] E.g., Commonwealth of Australia, *Parliamentary Debates,* Vol. 192 (1947), pp. 2925-6.

[3] Department of Primary Industry Press Release, 12th July, 1965.

[4] Department of Territories, Northern Territory Land Board, *Report on the Centralian Pastoral Industry under Drought Conditions* (presented to the Administrator in Council on 4th December, 1964).

[5] See *Transcript of Public Meeting* conducted by the Land Board in Alice Springs, 24th, 25th and 27th July, 1964 (mimeo.).

[6] Northern Territory Land Board, *Report, op. cit.,* p. 6. Despite the evidence presented by pastoralists to the enquiry, the Centralian Pastoralists' Association subsequently endorsed the Land Board Report "as a reasonable statement of the position".

stake are not peculiar to Central Australia but have arisen in many comparable situations around the world. It would appear that, in disregarding the burden of the evidence put before it by the cattle industry (to the effect that property-holders were capable of managing these lands as well as the environment would allow), the Land Board was strongly influenced by a series of scientific reports, some of which are reproduced as appendices to the Board's findings.

Many of the observations made in these reports strike me as having little to do with what I take to be the main question at issue, namely the long-term economic viability of the Central Australian cattle industry. The ecological approach espoused by the scientists seems to me to lead people to ask the wrong questions. The object of the ecologist seems too often to be the preservation of native vegetation, the original vegetative cover prior to the advent of the cattle industry being one major benchmark, some subjective notion of what should constitute a "climax community" being another. Reference is made several times in the Land Board's report to the view that "the native vegetation has been in balance with droughts and native animals for thousands of years so that the imposed pastoral industry has been the main cause of pasture deterioration".[7] This comes very close to what Barnett and Morse have called the extreme conservationist view—the view that "nature without man was a world of optimal ecological balance".[8]

But the focal point is surely not some normative notion of plant ecologists as to what a climax community should look like or whether the vegetation has deteriorated since McDouall Stuart pioneered the way across these arid lands. Nor is it right to characterize the pastoral industry as an intruder. 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.[9] 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 and the redistribution of land. Still another very real possibility that must be faced is that the lands of Central Australia can only be economically used for pastoral purposes as a slow mining proposition.[10] 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 area, such a policy could be politically attractive despite its long-run implications. This serves to illustrate the fact that in social issues of this kind—and it is a social issue as well as a problem in pasture ecology—it is rare that there is a single clear-cut goal.

[7] Northern Territory Land Board, *Report, op. cit.,* Appendix H.

[8] Barnett, H. J. and Morse, C., *Scarcity and Growth* (Baltimore, Johns Hopkins Press, 1963), p. 78.

[9] It should be noted that Chippendale, to whom the views cited in footnote 7 were attributed, has elsewhere supported the point of view expressed here. In his evidence to the Land Board enquiry he said "We do not want to maintain country in its virgin state, we want to produce cattle and the only factor which should be considered is can we continue to produce them and continue *ad infinitum?*". See *Transcript, op. cit.,* p. 79.

[10] Some of the economic problems involved in decisions on range management over time are illustrated in Cotner, M. L., "Optimum Timing of Long-Term Resource Improvements", *Journal of Farm Economics,* Vol. 45, No. 4 (November 1963), pp. 732-48.

Several competitive goals may be involved and it may be necessary to accept something less than perfection in regard to one goal in order to give proper weight to another goal or other goals.

The Land Board report also raises other questions of a managerial kind. Despite its view that the policy of establishing minimum stocking rates, hitherto employed, has been ineffective and should be abandoned, the Board has recommended, as we have seen, other controls over management.[11] But given the variety of rainfall experiences even on adjoining stations and the diversity of vegetational distribution on different stations, it is difficult to see how any administrative arrangement could produce a superior result to that which would be achieved by a more flexible system which placed the responsibility squarely on the manager's shoulders. Moreover, given the heterogeneity of the bundle of resources in the hands of individual station owners, the cost of any efficient detailed control would most likely be totally out of keeping with the contribution of the industry to the national economy. Perusal of the relevant literature does not engender confidence that the scientists or administrators, at this stage in history at least, have the requisite technical facts or superior managerial skill to warrant substituting their judgment for the judgment of experienced managers on the spot.[12]

I would agree that it might be necessary to terminate the leases of managers who are patently incompetent or who repeatedly overstock their leases, provided that they are not forced into such practices through external pressures such as inadequately-sized holdings or an ill-adapted system of rural finance. I add this proviso because too often in matters of conservation the farmer is blamed for anti-social action, when external social institutions are responsible for the farmer's acting as he does. I feel that there is need for a better appreciation of managerial problems in the arid zone and more strenuous research efforts to provide the types of information needed to carry out this task efficiently.

The Pastoral Firm in the Arid Zone

In one sense the task of management in pastoral firms in the arid zone does not differ greatly from that of farmers in more humid regions or of managers of business firms generally. However, there are some features of arid environments which make the decision-making process in such areas somewhat different and, in some ways, more complex.

In the first place, the extreme variability of the rainfall and the greater significance in areas of low rainfall of the phenomenon of runs of favourable and unfavourable seasons mean that uncertainty looms very large and forces the operator to orientate his production decisions to a longer time-span than is necessary in a more favourable environment.

Second, the livestock enterprises, which constitute the major form of land use, have long production periods. Unlike the crop producer, a pastoralist who loses his breeding stock through drought suffers the effects in later years. He is also inhibited from taking advantage of more favourable seasons when they arrive, unless he has access to finance to restock from outside. In the eyes of some pasture ecologists, the enforced delay

[11] Northern Territory Land Board, *Report, op. cit.*, p. 7.

[12] It has been argued that the Administration would not use the proposed powers extensively, but would only use them in cases where all other administrative measures failed. Even if this were so, I would still question the philosophy underlying the Land Board's recommendations.

in building up livestock numbers is regarded as an advantage in that it is alleged it enables the vegetation to recover better.[13] However, the long production period limits responses to a fluctuating forage supply and thereby curbs income possibilities.

Third, the method of station organization, imposed by the low carrying capacity and the need to rely on underground water, seriously limits the scope for achieving uniformly desirable forage management. Though capital investment per acre is low, capital investment per beast is quite high. It has virtually to be accepted as inevitable that grazing areas around watering points will be over-stocked, and more distant areas under-utilised.

Fourth, the form of business organization means that fixed costs on pastoral properties are higher relative to variable costs and to gross income than in most forms of agricultural enterprise. As a consequence, there is little opportunity to curb costs as herd numbers are reduced in a drought.

Fifth, the fact that the environment permits only a single land-use deprives the manager of many of the methods of mitigating production uncertainty available in other areas, such as diversification and the production of fodder crops as drought reserves.

Sixth, space looms large in almost every managerial question. The large expanse of the stations necessitated again by the low carrying capacity of the country places the manager at a considerable disadvantage with respect to any activity involving transportation. Even if he wants to put his stock on agistment in more favourable areas, the cost of transportation is often a major deterrent. If he wants to buy in breeding-stock after a drought, he may have to move them great distances. He is largely precluded from taking advantage of short-term market shortages in his selling activities, because, by the time he can get his stock to, say, the Adelaide market, cattle producers located closer to that market may have taken advantage of the good prices.

There are still other features of the arid pastoral environment which could have an important effect on managerial decisions. For instance, the existence of leasehold tenure and the presence of development requirements within the leases could be onerous in some cases. These are considered later.

Let me return for a moment to the question of weather variability. If pastoralists are to make rational adjustments to their environment it would be helpful for them to have a better specification of the weather pattern that confronts them than they have at present. For instance, pastoralists would doubtless adopt different policies as regards the organization and operation of their properties depending upon whether the weather pattern was random or whether there tended to be bunches of "good" and "bad" years. Their management goals may even be affected.[14] If the weather pattern is random, stabilization of income and financial survival in the short run may loom large among the pastoralists' objectives. However, if bunchiness is apparent in the weather pattern, long-run

[13] E.g., Everist, S. L. (private communication) as reported by Powell, A. A., *A National Fodder Reserve for the Wool Industry,* University of Sydney, Department of Agricultural Economics, Mimeographed Report No. 3, pp. 90-1.

[14] Tefertiller, K. R. and Hildreth, R. J., "Importance of Weather Variability on Management Decisions", *Journal of Farm Economics,* Vol. 43, No. 5 (December 1961), pp. 1165-6.

capital accumulation may be a more important goal, because, by maximizing the amount of capital accumulated over time, the pastoralist will be better able to survive a series of "bad" years. A preliminary study of this question was undertaken by Rutherford with respect to the Western Division of New South Wales in 1950.[15] Though existing statistical tests for bunchiness have some shortcomings,[16] this is obviously a problem worthy of further investigation.

It would also be tremendously helpful for pastoralists to know at times when critical decisions are made, what the chances are that certain climatic conditions will occur. The probabilities of having to wait various periods for effective rainfall developed by Verhagen and Hirst would be a local example of this type of information.[17]

Obviously, long-range weather forecasts, if they can be developed, would also be valuable. Apart from this, it is possible that pastoralists might be given more specific advice on the probable nature of the next season, given climatic experience in the recent past. Such probability models can sometimes be developed even when the underlying causal relationships are not fully understood. Bostwick, working in Montana, has experimented with the use of the Markov chain process to predict the probability of yields, say, next year based on the yield this year.[18] Such a relation is reasonable where rainfall in one year may influence yield in the next. Bostwick has also used extreme value theory to calculate the probability that farmers will attain a yield of a specified size.[19] Studies of this type suggest that in time, with the development of better statistical techniques, it will be possible to give farm managers operating in areas of great weather risks a more precise picture of the climatic variables with which they have to deal.

In recent years considerable research has been directed to studies of decision-making in various spheres of human activity. Agricultural economists have endeavoured to apply some of the techniques developed to farm situations. It would appear that some of these developments may have considerable application to firms of the type being discussed in this paper. These techniques have not been developed to the point where the recommendations for action can be confidently substituted for those of the actual decision-maker, but they do serve to highlight the types of information which the human decision-maker needs to have in order to make rational decisions. As an example, I would refer to the work of Dillon and Lloyd in applying inventory theory to an analysis of the

[15] Rutherford, J., "The Measurement of Climatic Risk in the Western Division of New South Wales", *Review of Marketing and Agricultural Economics,* Vol. 18, No. 4 (December 1950), pp. 246-65.

[16] Tefertiller and Hildreth, *op. cit.*, p. 1165; Lin, Y., Hildreth, R. J. and Tefertiller, K. R., "Non-parametric Statistical Tests for Bunchiness of Dryland Crop Yields and Reinvestment Income", *Journal of Farm Economics,* Vol. 45, No. 3 (August 1963), pp. 592-8. The Alice Springs rainfall records for a 50-year period were tested for bunchiness using both the Wallis-Moore test and the Wald-Wolfowitz test. The results of the tests were conflicting.

[17] Verhagen, A. M. W. and Hirst, F., *Waiting Times for Drought Relief in Queensland,* C.S.I.R.O. Division of Mathematical Statistics, Technical Paper No. 9, Melbourne, 1961.

[18] Bostwick, D., *Management Strategies for Variable Wheat Yields in Montana,* Montana Agricultural Experiment Station Bulletin 585 (June 1964); and Bostwick, D., "Yield Probabilities as a Markov Process", *Agricultural Economics Research,* Vol. 14, No. 2 (April 1962), pp. 49-56.

[19] Bostwick, D., *Studies in Yield Variability,* Montana Agricultural Experiment Station, Bulletin 574 (January 1963).

drought-feeding policies of Queensland graziers.[20] Application of this type of analysis requires the determination of the probability distribution of seasonal rainfall and a more precise knowledge of the relationship between rainfall and available forage supplies and of the effect of the range conditions on stock survival.

Game theory also offers some insights into managerial processes, though at its present stage of development the usefulness of game techniques in the selection of management strategies to meet income variability in the arid zone is limited.[21] This is because in the case of games against "nature" assumptions are made about "nature" which are more severe than reality. In particular, the assumption is made that "nature" will play the strategy most disastrous to the farmer.

Some other recently developed techniques such as dynamic programming and simulation, which take some cognisance of the sequential nature of many management decisions and of the necessity to adjust production plans in the light of developing circumstances, also may prove useful in economic research into arid zone problems. The recently-published simulation studies by Halter and Dean in the United States and Zusman and Amiad in Israel, which deal specifically with livestock management in uncertain weather environments, are pointers in this direction.[22]

But these newer techniques in the management field, while they recognize the uncertainties and dynamic aspects of decision-making and *ipso facto* seem particularly pertinent to management research in an arid environment, also require that the relevant data be available for their use. As in other phases of agricultural production economics, the economist is usually dependent ultimately upon the agronomist and the livestock specialist for information about the underlying production relationships. Too often however he finds that the data available are cast in an irrelevant framework or that the research work from which they are derived has failed to take account of managerially relevant variables. These developments emphasize once again the need for scientists to frame their research enquiries in terms which are relevant to decision-making and point to the need for more collaboration between economists and agricultural scientists. They also suggest that more work aimed at making explicit the probabilities associated with various risk situations would be extremely helpful.

Strategies to Mitigate the Effects of Rainfall Variability

Recent developments in mangement science may have opened up new and challenging vistas for research on arid-zone problems, but agricultural economists have long been studying problems of management in areas of high climatic risk. A substantial part of this research has been

[20] Dillon, J. L. and Lloyd, A. G., "Inventory Analysis of Drought Reserves for Queensland Graziers", *Australian Journal of Agricultural Economics,* Vol. 6, No. 1 (July 1962), pp. 51-67.

[21] Hassler, J. B., "Notes on Elementary Game Theory", in *Management Strategies in Great Plains Farming,* Nebraska Agricultural Experiment Station MP7, August 1961, pp. 35-42 and Plaxico, J. S., "Discussion", *ibid.,* pp. 42-3. See also Dillon, J. L., "Applications of Game Theory in Agricultural Economics", *Australian Journal of Agricultural Economics,* Vol. 6, No. 2 (December 1962), pp. 27-8.

[22] Halter, A. N. and Dean, G. W., "Use of Simulation in Evaluating Management Policies under Uncertainty", *Journal of Farm Economics,* Vol. 47, No. 3 (August 1965), pp. 557-73; and Zusman, P. and Amiad, A., "Simulation: A Tool for Farm Planning under Conditions of Weather Uncertainty", *ibid.,* pp. 574-94.

done in the Great Plains of the United States—an area characterized by climatic hazards comparable to those encountered in this country.[23] I propose now to review some of the stratagems which have been put forward as a means of mitigating the effects of production uncertainty on the individual firm and more especially those relevant to pastoral activity.

(a) *Flexible Livestock Systems.* The keynote of any strategy for meeting weather variability is flexibility. Flexibility can be manifest in many directions, but one important aspect is the development of a system of livestock production which permits the pastoralist to contract his operations when the season becomes adverse and to expand promptly when forage conditions again become favourable. As one witness said before the Northern Territory Land Board enquiry in 1964, "the person who is not able to get his breeding numbers up when the season breaks would never see daylight".[24] Judging by evidence presented to the Board there is some difference of opinion among pastoralists as to how this goal might be best achieved.[25]

Typically, the effect of drought on cattle enterprises develops slowly at first, but gathers momentum as the dry weather continues. This stems from the continual hope of the pastoralists that the drought will break and their consequent reluctance to make quick adjustments to counter the drought as well as their fear that they may not be able to restock with suitable animals after the drought. As the forage supply diminishes, as fodder becomes increasingly difficult to obtain and as capital and credit reserves are exhausted, large numbers of cattle in poor condition are forced on the market. It is clearly desirable that a more flexible system should be developed which will effectively utilize available resources in both favourable and unfavourable years.

Several studies directed to these questions have been undertaken overseas.[26] An enterprise based on purchased cattle rather than upon the breeding of cattle usually has greater flexibility, though it has other drawbacks. Indeed, it is a characteristic of flexible systems that they are more costly to the farmer or grazier than less flexible systems. Nauheim has pointed out that even in the case where a breeding herd is kept, considerable differences in flexibility can be achieved depending on the composition of the overall herd.[27] Moreover, a livestock system which is flexible at the onset of a drought may be relatively inflexible when expansion becomes possible and vice versa. Though it is possible to devise a system which is flexible in both directions, pastoralists may not adopt it, because income maximization or other goals may be of prior importance to them.

(b) *Spatial Diversification.* Where crop or forage yields vary greatly between contiguous areas, spatial diversification is often advocated as an

[23] For a useful review of research done in this area in the past five years, see Bailey, W. R., *Organizing and Operating Dryland Farms in the Plains Environment,* U.S.D.A. Economic Research Service, Washington, 1964 (mimeo.) (preliminary).

[24] *Transcript, op. cit.,* p. 33.

[25] E.g., *ibid.,* p. 98.

[26] Boykin, C. C., Gray, J. R. and Caton, D. D., *Ranch Adjustments to Drought in Eastern New Mexico,* New Mexico Agricultural Experiment Station Bulletin 470 (December 1962); Gray, J. R. and Baker, C. B., *Organization Costs and Returns on Cattle Ranches in the Northern Great Plains, 1930-52,* Montana Agricultural Experiment Station Bulletin 495 (December 1953); Nauheim, C. W., "Flexible Live-stock Systems", in *Management Strategies in Great Plains Farming, op. cit.,* pp. 81-8.

[27] Nauheim, *op. cit.,* pp. 86-7.

appropriate strategy. Such geographical "spottiness" in forage production is encountered where rainfall is derived from isolated storms, as so often happens in Central Australia. Obviously, if two or more geographically separated holdings are operated by the same manager, he increases his chances of having at least some forage in an adverse season. There might even be a case in such country for graziers to have several small geographically scattered blocks rather than a single large block. The potential benefits and costs of spatial diversification warrant investigation. Some work has been reported overseas with respect to wheat production,[28] but I know of no case where the merits of such a scheme in grazing country have been systematically examined. Clearly what is required is a measure of the amount by which forage yield variability can be reduced as a result of various degrees of dispersion. The potential reduction in income variability has to be considered in relation to the reduced need for reserves, the increased costs of operation associated with dispersion, and the costs of achieving a comparable reduction in uncertainty by other means. The goals of the individual manager may be critical in deciding whether such a strategy is attractive. Its attractiveness may vary depending upon whether the manager looks for a measure of security or strives for maximum income.

Some Central Australian pastoralists already practise spatial diversification.[29] Whether they acquired multiple leases with spatial diversification in mind or simply to enlarge their businesses is not clear. The benefit of such an arrangement in dry times is acknowledged even though the consequent loss in managerial efficiency is regretted. There are also graziers who have properties outside of Central Australia who are consequently better placed to achieve a flexible policy with respect to stocking their Central Australian property, but again at some cost.[30]

(c) *Feed Reserves.* The use of conserved fodder to maintain livestock in periods of feed shortage is almost as old as the livestock industries themselves. However, in the arid zone storage of fodder in the conventional sense is out of the question. If stock are to be fed to keep them alive, it becomes a question of purchasing fodder from more humid areas. This is an expensive operation at any time and becomes even more expensive if other areas are suffering from drought at the same time. The economics of drought feeding, albeit in specific areas, is one aspect of drought mitigation in Australia which has received intensive study from economists.[31] The study of Dillon and Lloyd emphasizes the need to consider feeding policies in the light of the probable duration of the drought. These authors conclude that it would not pay most Queensland graziers to keep large reserves of harvested fodder.[32] Comparable information needs to be developed for other parts of the country. In so far as

[28] Bostwick, D., *Studies in Yield Variability, op. cit.,* pp. 38-47; Jensen, C. W., "Spatial Diversification of the Dryland Farm Unit", in *Management Strategies in Great Plains Farming, op. cit.,* pp. 91-5; Jensen, C. W. and Nash, D. A., *Farm Unit Dispersion,* Montana Agricultural Experiment Station Technical Bulletin 575 (April 1963).

[29] *Transcript, op. cit.,* p. 116 and especially p. 126 *et seq.*

[30] *Ibid.,* p. 159.

[31] See Dillon and Lloyd, *op. cit.,* and the references cited therein.

[32] *Ibid.,* pp. 66-7. Some indication of the unattractiveness of drought feeding in the Northern Territory is given by the fact that only £4,000 of the £74,000 paid by the Northern Territory Administration as freight concessions in 1964-65 was spent on the transportation of fodder (G. A. Letts—personal communication).

the purchase of feed is an economic proposition in arid zones, its practicability is tied up with the setting aside of financial reserves against such a contingency.

In Central Australia, there has been considerable interest in the concept of conserving range forage *in situ* by keeping stock off say one quarter of the holding as a drought reserve.[33] There are difficulties about the implementation of such a drought reserve policy. For instance, due to the uneven geographical distribution of the rainfall, it is possible that the sector of the holding put into reserve may be the very portion of the holding that does not get rain. In short, the system would work better if rainfall distribution were more uniform. Lack of fencing is also an impediment to the efficient operation of such a policy. In some cases, the closing off of part of the holdings to stock may simply be an invitation to predators to move in. It could moreover lead to a reduction in income with obvious implications for those with small holdings. Finally, the manager with such a reserve at his command would still have a similar problem to the man who had stored fodder—of knowing when to use it given the uncertainty of the future rainfall regime.

(d) *Agistment.* As an alternative to feeding cattle on purchased fodder, the stock can be placed on agistment. Even after six years of drought in Central Australia, there were still some properties able to take stock on agistment,[34] though the amount of this country was said to be limited. If local agistment were practicable on any scale and the charges were reasonable, such a policy might be regarded as, at least, a partial substitute for spatial diversification. However, graziers have definite reservations (from the standpoint of maintaining satisfactory interpersonal relationships) about putting cattle on agistment close to the home property, given the system of cattle management practised in Central Australia. On the other hand, when stock have to be moved long distances for agistment, the costs of transportation and the stock losses suffered are such as to cause graziers to regard this method of drought evasion as uneconomic.[35] It also has the disadvantage that finance must be found to make it possible.

(e) *Financial Reserves.* Given the impractability of storing fodder in the arid zone, the increased costs incurred in maintaining stock when seasons become adverse, and the need to purchase additional stock when the drought breaks, financial reserves loom large as a drought strategy in such areas. These reserves represent liquid or semi-liquid assets not directly committed as working capital but held for contingency purposes. Adoption of such a strategem is not open to the man who is heavily in debt nor is it relevant to the man with ample capital. But such matters are of importance to the general run of pastoralists who, if their holdings are large enough, are able to set something aside in good years for use in adverse periods. Indeed, it can be argued that unless holdings are adequate in size to permit the accumulation of such financial reserves the properties are too small. The question of desirable size of such contingency reserves is tied up with the "bunchiness" of seasons and the length of run of the "good" and "bad" years. Heisig's classic study on Montana wheat farms in which he traced a farmer's asset position over a 26-year

[33] *Transcript, op. cit.,* pp. 30, 62, 128 and 166.
[34] *Ibid.,* p. 137.
[35] *Ibid.,* pp. 34 and 123.

period assuming constant prices, is often quoted as an illustration of this phenomenon.[36] Clearly, research is necessary to establish the appropriate reserve in any particular situation. In cases where superior investment opportunities exist either on the property or elsewhere, the holding of such reserves involves a loss in income. It was reported to the Northern Territory Land Board enquiry that many pastoralists who had used the windfall gains that accrued in the 'fifties for the development of their properties were at the time experiencing difficulty making ends meet, having their investment in a very illiquid form.[37] This means that these pastoralists either under-estimated the size of the contingency reserves required or could not resist the temptation to use money which might well have gone into such reserves, in what appeared to be a more lucrative investment in the short run. Pastoralists who have exhausted their financial reserves through under-estimating the amount of finance necessary to meet expenses during a prolonged drought and who have in addition reached the limit as far as credit worthiness is concerned, are obviously ill-prepared to restock in order to take advantage of improved seasonal conditions when they arrive.[38]

The foregoing discussion of various management strategies reveals the tremendous scope which exists for economic research directed to evaluating the efficacy of individual strategies under the specific conditions of particular regions, and also gives some notion of the kind of information which pastoralists need if they are to be aided towards better decision-making. The fact that the goals of management are diverse and personal and the resources available to the individual manager vary so greatly, emphasizes the need for extension advice in this area to be directed to the provision of those facts and probabilities prerequisite to sound decision-making rather than to the offering of generalized advice or the issuing of *ex cathedra* prescriptions.[39]

The Effect of Social Institutions on Management Decisions

The choices which individual pastoralists are called upon to make between the various management strategies to mitigate the effects of drought are frequently affected significantly by external social institutions.

It has already been suggested that the size of holdings in some cases at least is too small, especially if the manager concerned is to be able to develop policies of financial management that permit him to establish financial reserves in good years to help the firm survive adverse seasons. The possibility that some leases below 600 square miles in area were insufficient in size for economic operation was recognized by the Land Board, but it took the view that "as all suitable pastoral lands in the area are already held under lease, it is not the task of the Crown to bring about pastoral lease aggregation . . . . Aggregation should be left to the normal supply and demand in the industry".[40] I would argue, on the contrary, that if serious errors of judgment have been made about the economic

[36] Heisig, C. P., "Income Stability in High Risk Farming Areas", *Journal of Farm Economics,* Vol. 28, No. 4 (November 1946), pp. 961-72.

[37] *Transcript, op. cit.,* p. 102.

[38] *Ibid.,* p. 35.

[39] See Campbell, K. O., "Farm Decision-Making and its Implications for Agricultural Extension", in *Australian Agricultural Extension Conference 1962: Reviews, Papers and Reports,* C.S.I.R.O., Melbourne (1963), pp. 296-300.

[40] Northern Territory Land Board, *Report, op. cit.,* p. 6.

size of holdings, it is the Government's responsibility to rectify these mistakes even if it does entail some expenditure on compulsory acquisition. Perhaps the whole concept of single family holdings is inappropriate in such a region and needs re-examination.

The fact that leasehold tenure may affect managerial decisions and particularly those concerning investment and conservation is well recognized. The Crown leases in the Northern Territory regularly contain clauses which could be restrictive to managerial action especially in a drought emergency. The specification of minimum stocking rates, which appears on the evidence to have been ineffective, could, if implemented, have seriously restrained the station manager in his efforts to adopt a flexible management policy. The Land Board, in any case, has recommended the elimination of such controls. However, it does envisage the continuation of the development clauses in the leases. It is conceivable that these requirements, perhaps admirable on other grounds, may have forced managers to put their income surpluses into development activities rather than contingency reserves, and thus increased vulnerability to a financial squeeze during the ensuing drought.

There is reason to believe that rural credit arrangements in the Northern Territory are somewhat inadequate. They have in fact recently been the subject of a special enquiry, the results of which have not yet been published. The evidence submitted to the Land Board enquiry suggests that canons of prudent financing developed in balmier climates are being applied rather inflexibly in Central Australia. On these criteria, credit tends to get tighter, as the drought intensifies. For instance, the representative of a leading trading bank reported to the Land Board enquiry that whereas in 1957 the debt-load per cow as far as his branch was concerned was £3 10s. 7d. per head, in 1964 it was £8 10s. 11d. per head. He added "If these [drought] conditions prevail, we will very soon come to the point where private banking will not be able to service the ordinary pastoralist's requirements".[41] A representative of a major pastoral finance house likewise expressed doubt as to whether firms such as his would be able completely to finance restocking after the drought, given the magnitude of their existing commitments.[42] To the extent that creditors put a limit on the amount of credit they will advance during the course of a drought and so force pastoralists to sell cattle, they thereby also reduce the recuperative power and debt-servicing ability of the properties in question when the drought comes to an end. All this suggests that the development of a credit system better adapted to the requirements of the arid zone could greatly assist the individual pastoralist.

It is evident that provision of better roads coupled with the greater use of motor transport, has facilitated the movement of stock, though at greater cost. Pastoralists can now move drought-stricken stock which may have been left to die in earlier days.[43] In short, improved transportation has opened up a wider range of drought-evasion strategies to the individual manager.

The decisions of individual managers are also likely to be influenced by any policies which the Government may adopt to provide drought relief. It has been the practice of the Northern Territory Administration to provide subsidies for transportation of stock and fodder in drought-

[41] *Transcript, op. cit.*, p. 64.
[42] *Ibid.*
[43] *Ibid.*, p. 72.

stricken areas, similar to those provided by State Governments. Long-term loans at low interest rates are also available for the sinking of drought bores. The freight concessions amount to (a) half the cost of transporting fodder by road and rail into areas where stock have insufficient feed and (b) half the transport cost of moving starving stock for sale or out to agistment areas and back again.[44] Clearly the existence of these subsidies on transport charges could be a determining factor in deciding whether it was economic to buy feed or whether to put stock on agistment or not.

It should be evident from the foregoing discussion that Governmental authorities, by their institutions, rules and procedures can either enhance or mar the ability of the individual manager to adjust to drought. Cases where the rules and regulations are an encumbrance demand attention.

History suggests that the greatest obstacle to the adjustment of a people to its particular physical environment is probably a lack of understanding of that environment. If research can be directed to removing some of the prevailing misconceptions and to clarifying the true situation, it can make a major contribution to fostering the adaptations of pastoralists, and indeed Australians generally, to their predominantly arid environment. Even better adaptation will be achieved if pastoralists can be encouraged to use this improved knowledge to make wiser decisions.

[44] As from 16th August, 1965, the Northern Territory Administration has subsidized 75 per cent of the cost of transporting fodder and stock in drought-affected areas and, in addition, has provided loans to graziers up to a maximum of $6,000 for approved purposes.