AGRICULTURAL USE OF THE SNOWY WATERS:

III: AGRICULTURAL ASPECTS

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Some attempt is made in this paper to sketch in some of the factors in land utilisation that have had to be considered in planning to utilise the Snowy Waters for irrigation in the Murrumbidgee Valley. Following this some comments are made on the gaps in knowledge of soils, agronomy, crop utilisation, farm economics and management that have made the task of planners more difficult.

It is relevant to remind readers that the Snowy Mountains Investigation Committee[1] recommended that the Snowy waters should be controlled for hydro-electric power and for irrigation purposes, and that the greater part of the water available for irrigation should be diverted into the Murrumbidgee. The Committee also concluded that adequate areas of suitable land appeared to be available and that the main form of land-use under irrigation would be pastoral, largely for fat-lamb production. These recommendations were rapidly accepted by the Commonwealth Government and the commencement in 1950 of the Snowy Mountains Authority's works essentially committed the States to large-scale development of irrigation lands some time in the future.

Economic conditions have changed very considerably since then. Costs have increased and farm products, in excess of home market requirements, have been more difficult to sell. Even with wool-growing the return to capital has been greatly reduced.[2]

As a result there is a need for the collaboration of all agencies—State and Commonwealth—in providing data that can contribute to the successful settlement of these lands, that is, if the project is to continue.

In other countries today the economics of river basin development is investigated on a " whole valley " basis.[3] It is believed that the whole of the Snowy scheme should have been investigated in this way instead of being separated broadly into power and agricultural aspects. In

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*The views expressed are the author's. He has been a member of the Blowering Dam Investigation Committee since it was formed in 1953 by the N.S.W. Minister for Conservation to determine the most suitable location for irrigation development with the additional waters made available from the Snowy scheme and to flow down the Murrumbidgee. At present he is on secondment to the Reserve Bank of Australia.

[1] Final Report by Commonwealth and State Officers, *Proposals to Divert Snowy River*. Dept. of National Development & Works, Canberra, May 1950.

[2] Anderberg, F. and Moulden, J. O., " The Australian Sheep Industry ", *Quarterly Review of Agricultural Economics*, Vol. XII, No. 4 (Oct. 1959), pp. 169-176.

[3] See, for example, Eckstein, Otto, *Water Resource Development : The Economics of Project Evaluation*. Harvard University Press, 1958, pp. 300 ; and Krutilla, J. V. and Eckstein, O., *Multiple Purpose River Development*, Johns Hopkins Press, Baltimore, 1958, p. 301.

terms of resources for making such an investigation of the Snowy it is a pity that State-Commonwealth working parties did not continue to the farm development stage, and perhaps it is not yet too late to overcome the administrative difficulties to this end.

Irrigation Land Use

Walker[4] has dealt adequately with the history of irrigation development in N.S.W. between 1884-1940. Community irrigation schemes began with small fully irrigated horticultural farms giving high monetary return per irrigated acre. This era ended in the immediate pre- and post-war years with " extensive " or " partial " irrigation development where water was supplied for a small part of existing holdings. These districts were designed to stabilize existing forms of production—wheat and merino wool—and Walker, in 1941 wrote that some of the advantages that would surely result would be :—

1. Reduce drought losses.
2. Eliminate heavy expense of removing stock to country where feed is available.
3. Obviate expense in purchase of fodder for hand-feeding.
4. Increase the safe carrying capacity of the holdings.
5. Tend to the breaking up of large estates and to promote closer settlement.
6. Promote sound mixed farming on holdings originally devoted to wheat only.

" This, of course, (said Walker) will apply to every part of the State where water is to be supplied . . .".

England has pointed out in his paper that the districts have failed in their purpose, and, but for the introduction in the thirties of the annual self-regenerating pasture of wimmera rye grass—subterranean clover, the earlier district schemes might have failed absolutely. Fat lamb production has become the new industry of these districts. Public demand is for an increased water supply to enlarge and intensify the enterprise in the face of falling product prices and greatly increased costs. Where soils and other resources permit, the more intensive dairy enterprise has developed in sections of the districts. The real difficulty is that once designed and operated without adequate drainage, the farm pattern and irrigation works do not and cannot provide for greatly improved flexibility in land use.

Some relatively intensive schemes have been developed without any provision for drainage and the design of the supply system conflicts with any future drainage requirements. Even where drainage has been provided from the outset the design has been inadequate and has needed continual amendment, partly because of the inadequacy of the early data for establishing drainage standards and partly because of changing land use and subdivision which have led to intensification of irrigation.

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[4] Walker, L., " Irrigation in N.S.W., 1884 to 1940 ", *Royal Australian Historical Society Journal and Proceedings*, Vol. XXVII, Part III, 1941, pp. 181-232.

Drainage provision has been generally inadequate in Australian irrigation development. The States have provided funds for irrigation development on the basis of the direct and indirect social and monetary benefits that will accrue from the increased production. But it may be that in the past it has not been politically popular to advocate the concurrent additional expenditure on drainage where initially, at least, the benefits cannot be positively assessed in immediate increases in production so much as in indefinite future conservation of land and in a more stable agriculture. Prunster[5] argued that surface drainage for the region and provisions for sub-surface protection of the more permeable soils are minimum requirements in regions of " extensive " or " partial " irrigation if the project is to be permanent. More intensive development makes provision for subsurface drainage of paramount importance. The problem of reclamation following salting or water logging is distinct and will require deeper, much more expensive and slowly accumulated geological and hydrological information.

In some cases drainage problems have arisen quite soon after irrigation commenced, and in others more than 20 years have passed without trouble. The final breakdown in soil productivity, however, comes fairly rapidly (1939, 1955, 1956) with drastic consequences as far as the value of the land is concerned and generally with the need to revert to a less productive form of land use. Usually it is necessary for the State to provide special funds for subsurface drainage because of the loss in a farmer's ability to borrow and because the form of land use cannot itself carry the whole cost of drainage. Cyril Parker[6] of the U.S.A. Soil Conservation Service held that their experience was that the consequence of using irrigated lands beyond their capability was generally adverse, particularly in the drier regions. (There is some evidence of this in Victoria and New South Wales.) Of irrigated land that is abandoned in the U.S.A., 60 per cent is due to economic stress because of limited land use and/or the high cost of drainage. The remaining 40 per cent is abandoned because of land misuse or erosion damage. Though conservation can protect the land the cost is too high when the land is used beyond its capability. In the U.S.A., irrigated lands of shallow surface and flat grade have not been economically maintained under less than an 18 inch rainfall.

Christian[7] in dealing with the assessment of the potentialities for agricultural development in new areas, has drawn attention to the fact that while the existing methods of description and classification of such characteristics as climate, topography, soil or vegetation are helpful in explaining known happenings in areas where a good deal of experience in correlation is available and to some extent may place new areas in perspective, the assessment of potentialities must be regarded as a series of steps based successively on more precise knowledge and must be regarded as a continuing process always subject to revision as new knowledge becomes available.

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[5] Prunster, R. W., " Surface Drainage in Future Irrigation Areas ", *Discussion Group on Ground-water Hydrology.* Commonwealth Scientific and Industrial Research Organisation, Merbein, 1956.

[6] *Proceedings of the UNESCO Arid Lands Conference, Albuquerque, New Mexico, April* 1955. UNESCO ; Paris, 1955.

[7] Christian, C. S., " Eco-complex in Its Importance for Agricultural Assessment ", *Monographiae Biologicae*, Vol. VIII, 1959, pp. 587-605.

England has presented data showing that about 70 per cent of the irrigated acres in southern Australia is used for pastoral production. Since the available soils are mostly infertile, pasture legumes and grasses will be needed in new areas to improve fertility and soil structure for any form of arable farming. Equally important is it that our major experience in irrigation farming has been gained in pastoral production and it might be expected that farmer demand will be for irrigation farms based, initially at least, on stock husbandry.

Rutherford has recently[8] published two very comprehensive papers on the integration of irrigation and dryland farming in the southern Murray basin. Broadly they indicate the difficulties of lack of flexibility in land use in the " partial " irrigation districts and confirm the present trend to create properties with adequate soil and water resources to permit year-round irrigation and a diversity of enterprises.

The Problem of Assessment

The assessment of lands for irrigation purposes is quite complex apart from economic considerations and there are many gaps in our knowledge. The " irrigation district " type of development, where water is supplied to existing holdings has proved too inflexible in its possibilities for use of land and water resources. The major use in New South Wales of the Snowy waters is therefore planned for a more intensive use of land and water resources in the " irrigation area " type of development.[9] In Victoria it is understood that the major use will be to intensify the use of water on existing irrigation lands.

Though horticulture provides the higher return per unit of land area and probably also of water its demands are most exacting in terms of soil depth, texture, structure and underdrainage. Large continuous areas of such soils are not available in suitable topographic situations in Australia but the areas that are available have been set aside for these purposes. For the remaining lands of the Coleambally Area any intensive use of water and land calls for a great deal of detailed soils and hydrogeological information which it is not practicable to obtain before planning commences. Proposals for farm size and land use have therefore been based on more adverse conditions that might arise as a result of irrigation. This has led to farm sizes of 500 acres with at least 400 acres irrigable, the major land use to be associated with animal husbandry for meat and wool. Pasture legumes will be needed to build fertility and grasses to improve soil structure for an associated arable agriculture.

Rice, the only irrigation crop with an adequate profit incentive to attract farmers, may be grown in the early years to reduce capital deficiency during the period of heavy development expenditure. Apart from marketing problems that can arise from greatly increased production,

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[8] Rutherford, J., " Integration of Irrigation and Dryland Farming in the Southern Murray Basin ", *Review of Marketing and Agricultural Economics*, Vol. 26, No. 4 (December 1958), pp. 227-283. Vol. 27, No. 3 (September 1959), pp. 146-233.

[9] *First Report of the Committee Appointed by the Minister for Conservation to Advise on the Use of Additional Water available within the Murrumbidgee River upon Completion of Blowering Dam*, N.S.W. Government Printer, Sydney, 1956.

its long term future is uncertain because of the distinct prospect of water table and salting problems.

The areas of horticultural soils are topographically well located for under-drainage, and it is fairly certain that their hydraulic conductivity is reasonable for this purpose. These characteristics are not so well assured for all other lands in the area. However, the design of irrigation works will provide for surface drainage and the needs for deeper drainage, and characteristics of specific localities for these purposes will need to be investigated as the intensity of irrigation imposed, or the development of water tables may dictate in the future.

The investigations made during the recent review of farm size and land-use for Coleambally threw into high relief the deficiencies in our basic information concerning the economics of irrigation farming, of soils, irrigation agronomy, stock husbandry, and pasture management and the financial needs of " beginning " irrigation farmers. It also became clear that a laissez-faire attitude could no longer be taken to the marketing of increased agricultural production. The following comments are offered.

Soils

Apart from the horticultural sandy rises, the soil survey of Coleambally has defined and mapped five main soil groups and a number of sub-groups of them. The main differences are in depth, denseness and texture of the surface layer with minor sub-soil differences. It can be quite confidently surmised that each of these soils would be suitable for the less intensive form of irrigation use imposed by annual self-regenerating pastures. But for any more intensive use of these soils, such as summer pastures, cultivated cropping or horticulture the surface texture, depth and the water transmission qualities of the soils become increasingly important in controlling yield. At present only personal estimates can be made of these differences, and on such a subjective basis differences of opinion are certain to occur.

For these reasons irrigation authorities are limited in their selection and design of lands for large-scale irrigation by the soils information available to them. The pedological soil classification can define regions that are relatively *unsuitable* for irrigation and ensure that in the sub-divisional design the farm boundaries will enclose some variety of soils. When pedologically similar soils are known to have been successfully irrigated for many years in nearby and similar climatic regions, it can also be inferred—by " correlation ", as Christian puts it—that they can be used for similar forms of irrigation land use. But some elaboration is needed of the pedological data to provide an objective land classification for irrigation purposes. Details of the soil properties that need to be determined need not be raised here, but, combined with irrigated crop trials on different soils and the measurement of post irrigation change they could provide the basis for an objective irrigation land use classification.

No overall programme of research in these fields has been defined or commenced.

Irrigation Agronomy

The budgets prepared for the Blowering Committee made it clear that pastoral production and winter cereals could not provide nor service the capital needs for farm development. Rice seems to be the only profitable irrigation crop, and, apart from marketing considerations, its future seems uncertain because of water table problems.

It is more costly to produce crops under irrigation. It becomes important therefore to consider quite early the yields and productivity standards that need to be attained to provide the incentive to change to arable farming and the comparative advantage for obtaining markets. This appears more logical initially than providing some form of financial protection and incentive.

It would be fortuitous if the introduction and testing of a wide range of crop plants could provide material already tailored to the critical irrigation environment and without a vigorous plant breeding programme being required. Introductions should, however, be useful for defining the characteristics needed for the crop to succeed in that environment and provide material for a breeding programme to be instituted.

It will be equally important that resources be directed to developing the " know how " of tillage, soil and irrigation management and of fertiliser needs. Inadequacies in this knowledge have no doubt been the cause of abandoning many plant introductions in the past. Some plant introductions are being tested and selected, but as far as the author is aware no real programme of irrigation crop breeding has been instituted.

For the agronomist the greatest problem is to select the crops that are worthy of long term research, and he needs assistance in this. The first aspect is that of productivity standards mentioned earlier. The economist could assist by considering the cost of producing specific crops and the yields that would be needed under existing production conditions and anticipated prices to provide an incentive for growing these crops. In this way it might be possible to help define those crops which have production possibilities, or alternatively the minimum yields that plant breeders would need to attain to provide the incentive for changing present patterns of land use. In deciding on the crops that might be useful the following aspects suggest themselves.

Import Saving Crops

The Rural Bank[10] has published a short statement giving some perspective to the import saving potential of tobacco, cotton, tea, coffee, cocoa and the oil bearing crops linseed and peanuts.

Of these it seems that tobacco and cotton are very worthwhile prospects for the southern irrigation areas and oil crops (which can provide a high protein feed as a by-product) may be worth further investigation. Basinski[11] has produced a complete review of cotton growing in Australia

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[10] " Import Saving Crops ", *Trends*, Vol. 4, No. 9, September 1959, pp. 3-6.

[11] Basinski, J. J., *Preliminary Notes on Information About Cotton Growing in Australia.* Commonwealth Scientific and Industrial Research Organisation, Canberra, September 1959.

which suggests that the southern irrigation areas are well worth further enquiry for cotton growing, but a long term research programme is needed. The prospect of tobacco for the sandy horticultural soils is much clearer.

A Commonwealth inter-departmental committee has been considering the question of import saving crops, but its enquiries are in the preliminary stages. No recommendations have been made and no research programme has been commenced. The N.S.W. Department of Agriculture has for some time been testing cotton varieties and is confident of selecting some satisfactory types.

Industrial Use of Agricultural Products

A Commission has reported to the U.S. Congress on this subject.[12] Faced with costly programmes for restricting land use, controlling production and disposing of surpluses an equiry has been made into the prospects of developing profitable industrial markets to absorb some of the excess farm production.

Recommendations are made for greatly increasing utilisation research not only for existing crops but also for new crops that might replace them and so reduce surpluses. Among the new crops suggested are bamboo for high quality paper ; castor beans, safflower and sesame for industrial oil, edible oil and stock feed ; and the Mexican Yam (Dioscorea) as a source for cortisone, hormones and other drugs.

This raises the question whether highly productive irrigation crops might be developed for industrial purposes, and perhaps takes a step from the well worn pedestrian path of agronomic research possibilities.

Crop Uses Within the Farm

If productivity is made sufficiently high with irrigation, fodder and grain crops of high protein and/or energy value could become useful for stock feeding on the farm. They could provide the prospect, in the irrigation areas, of alternative supplementary means of feeding farm animals for meat. Protein feed cakes as a by-product of oil seeds, or fodder and grain of high energy from the summer grasses enter this group.

On these grounds and with empirical enquiry the following crops can be suggested as worthy of further discussion and enquiry :—

Tobacco, cotton, safflower, soya beans, sesame, castor oil, sunflower, winter cereals, and high energy summer grains and fodder like maize and those of the millet and sorghum groups. Castor oil and sunflower are now adapted for mechanical harvesting and high yielding hybrids are not only available for maize but for sunflower and grain sorghum.

Little has been said about irrigation pastures, mainly because much of the resources for research and experimentation in the irrigation lands are being used on pasture production. There is still, however, a big field for basic research on the utilisation of pastures and their supplementation with other foods if productivity standards are sufficiently high. It might also be suggested that the irrigation areas could be utilised for seed production as in California where irrigation farmers have made this a most profitable industry.

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[12] 85th Congress, 1st Session, Document 45. U.S. Govt. Printer, Washington, 1957.

Stock Husbandry and Pasture Management

The Blowering Committee is aware of the wide range in animal husbandry and general management practices in existing irrigational areas. There appears to be no technical reason why animal carrying capacity cannot be greatly increased. Adequate extension services on all aspects of farming enterprises seem essential for the new areas to raise productivity as rapidly as possible.

Lack of Economic Data

All investigations of farm development have been limited by the lack of factual information even for the preparation of budgets, and farm size and land use recommendations have been made with some reservation.

It is of interest to comment that there are not adequate data available to determine a production surface for the use of water at various product prices. As a result the agronomist is tempted to suggest that there is a need for the economist to consider the economics of the more intensive use of inputs such as water, land and labour.

The basic data needed cannot be adequately obtained by survey techniques and should need long term experimentation. But it should be remembered that the last Coleambally farm may be approaching full development 20 or 25 years hence. In the meantime data of sorts are available from Leeton Experiment Farm and from C.S.I.R.O. and they would no doubt appreciate having economic precision brought into their work.

Mr. England's paper indicates that irrigation areas are essentially closer settlement areas where—and I quote—" The land is resumed by the Crown and subdivided *de novo* in accordance with statutes governing the settlement of Crown lands generally and irrigation areas in particular into farms of " home maintenance " standards. As defined therein :— Home Maintenance Area means an area which when used for the purpose for which it is reasonably fitted would be sufficient for the maintenance in average seasons and circumstances of an average family."

This may be all very well when the State's interest is in putting people on the land and providing the funds for farm development. But when private funds are to be used, or the farmer must secure credit from normal sources one must use the quip that the average rainfall never falls. As a result of private consultations with economists who have investigated this, one is led to believe that a one man irrigation farm cannot adequately sustain its development costs and a family. This question has an important bearing on farm size and the real problem of scale appears to occur in moving from the first to the second labour unit. This may mean that some revision is needed of the present concept of " closer settlement ".

From the foregoing I would suggest the need for a helpful examination of the budgets that have already been used in determining farm size, and in view of the idea of providing for flexibility in land use that the techniques of linear programme analysis might be used not only to incorporate enterprises at present carried out on large area irrigation farms but some other enterprises have been suggested earlier in this paper and that of England.

There is a need for much more complete economic investigation and a possible review of the standards that have already been erected for

farm sizes and land use. Not only are these data needed by the land settlement authorities, but other agencies, including financial institutions, have a need of them in policy making. The Bureau of Agricultural Economics has been working in this field and it is understood that arrangements are being made to continuously collect data from the developing farms.[13] It is to be hoped that this will be undertaken in collaboration with those groups able to use the more recent programming techniques so that land settlement authorities, research organisations, extension authorities and the farmers themselves will be able to receive the most reliable and up-to-date economic as well as agronomic advice.

Planning to date has been done with a recognition of the need for flexibility in the farm enterprises that can be undertaken and so to provide for changing agricultural patterns to meet changes in home and overseas markets.

No comment is offered on the marketing of increased agricultural products : the prospects for grains, including rice, lamb meat, fruits and dairy products have been well publicised. Nor is any comment offered on farm investment and the financial needs of new settlers. A number of groups have prepared budgets, each using different assumptions. The answer always comes to between £25,000 and £30,000. It will take some years for the farms to reach full production and there is doubt whether farm income can service a debt of this magnitude.

Conclusion

A plea might be made for the collaboration of all agencies—State and Commonwealth—that can contribute to the successful settlement of these lands, that is, if the project is to continue. The plea can best be made by quoting from the Third Report of the Rural Reconstruction Commission, 1945.

> " It is essential therefore that occupancy and use (of land) must be profitable. The more profitable it is the greater the nation as a whole will benefit; if it is not profitable a burden is created which the nation must make up from its other resources . . .
> " The task of land settlement for agriculture is an extremely complex one involving a careful weighing of all the physical, economic, financial, social and political factors which influence the success or otherwise of settlement. It can only be accomplished by men fully conversant with all these complex problems and their implications. The real problem of land settlement is how to arrange the occupation of lands so as to make the most profitable use of them economically and socially without prejudicing the interest of future populations. . . .
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> " Probably the worst form of parochialism so far as settlement is concerned appears where different Government Departments are set up to handle different activities associated with land occupancy and there is no proper system of co-ordinating policies and decisions. Those responsible for land settlement policies are sometimes guided solely by desires to bring more people on the land, and may prove a menace to those responsible for guiding commerce, agriculture and finance, and even to those who are responsible for the provision of educational facilities, roads and other social amenities. Likewise, those responsible for water supply and irrigation policies may become a menace if they push schemes to bring water to land without regard to all the consequential happenings."[14]

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[13] *Riverina Continuous Farm Study—First Annual Report*, 1957-58. Bureau of Agricultural Economics, Canberra, 1959.

[14] The Rural Reconstruction Commission Third Report, *Land Utilisation and Farm Settlement*. Dept. of Postwar Reconstruction, Canberra, 1944, pp. 7-9.