Outlook

Food and water– enough for how many?

How many people can Australia support? There's no simple answer, of course; it depends on the country's ability to keep supplying the things people need and on how fast people consume these things: However, the question is clearly an important one. In Canberra, a group of biologists and physicists from CSIRO recently looked at possible limits to the amounts of food Australia could produce and water it could supply. Then they related these to population limits.

The scientists are Dr Roger Gifford and Dr Alan Aston, of the Division of Plant Industry, and Dr Jetse Kalma and Dr Richard Millington, of the Division of Land Use Research. They say that in the short term a continually growing population may be compatible with existing or improving standards of living, depending on resources and technological developments. But in the long term it certainly is not. They acknowledge that ultimate population limits can't be worked out now because nobody can predict future technologies and demands on resources.

The scientists suggest that a policy on population for Australia could be directed towards reaching, several decades hence, a stable target figure based on current technologies, consumption patterns, and assessments of resources. This long-term goal could then be adjusted as these variables change.

They stress the need for much more information if they are to arrive at firm figures on the population Australia could support with existing technologies and living standards. Rather than attempting to work out these limits, their aim was to examine some of the important grounds on which long-term population policy could be based. The study, one of the first of its kind in Australia, points to areas where more statistics are needed. The scientists suggest that similar projects should be undertaken every few years as new information becomes available.

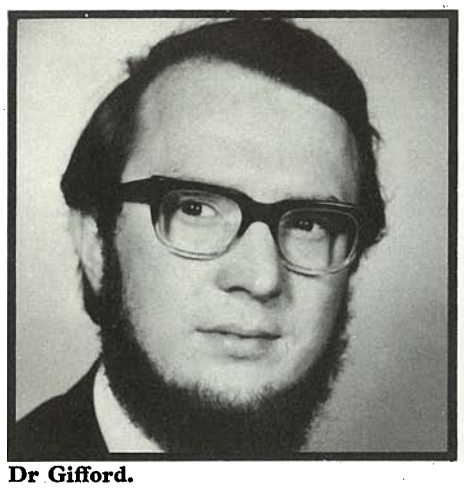
Suitable land

They began their study by looking at estimates made since 1940 of the area of land in Australia where crops and improved pastures could grow, and were immediately confronted by major uncertainty. The estimates vary enormously—from 51 to 147 million hectares. As about 45 million ha are now used for agriculture, on these figures something between 6 and 102 million ha remain available for development by farmers.

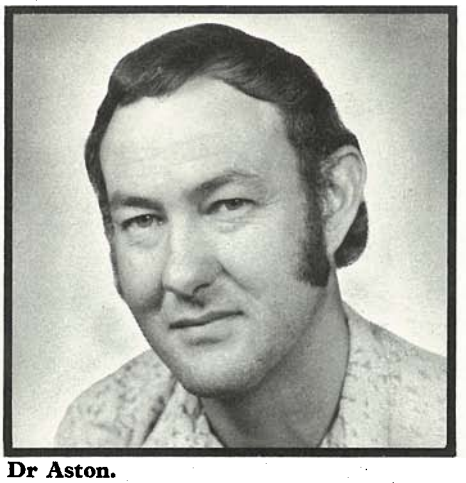
The most recent thorough study of the situation was completed last year by Mr Henry Nix of the CSIRO Division of Land Use Research, and the team used his results in their work. Mr Nix calculates that, if climate was the only limiting factor, 237 million ha of Australia would be suitable for agriculture. But when one subtracts land where the terrain isn't suitable for farming—mainly because it is too steep or rocky—the figure falls to 132 million ha. Then when one also takes out areas where the soil won't support crops or pastures, only 77 million ha remain.

After subtracting the 7 million ha estimated by agricultural economist, Dr Bruce Davidson, as the area of potential farming land taken up for other purposes, we are left with a total of 70 million ha suitable for agriculture. Only 25 million of those hectares are not farmed now. The scientists emphasize, however, that these figures are estimates; adequate information on land attributes is not available for precise calculations to be made. Until it is, they say, a thorough consideration of the limits of agricultural production in Australia is not possible.

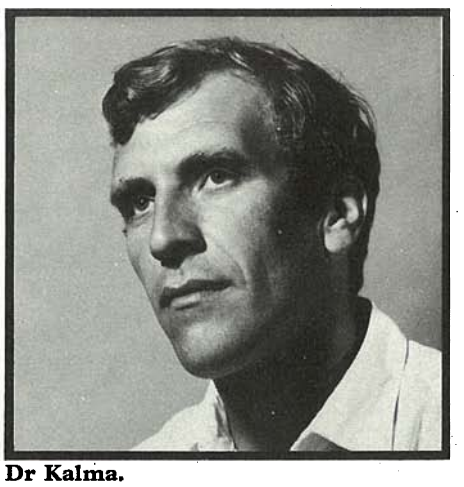
The team looked next at the prospects for increasing food output per hectare. For cereal crops, these don't appear bright. Up to about 1890, average wheat



Dr Gifford.



Dr Aston.



Dr Kalma.

Dr Millington.

yields in Australia dropped steadily; the reasons were probably depletion of soil nutrients, the spread of wheat-growing to less-fertile areas, insufficient fallowing of land, and diseases. The introduction of superphosphate and new wheat varieties bred in Australia reversed the downward trend, but average yields remained below those achieved by the early wheat-growers until the 1940s. Since then the practice of improving the soil by planting legumes before and after wheat crops has increased yields by about half. The yield history of other cereals—oats, maize, and barley—is similar.

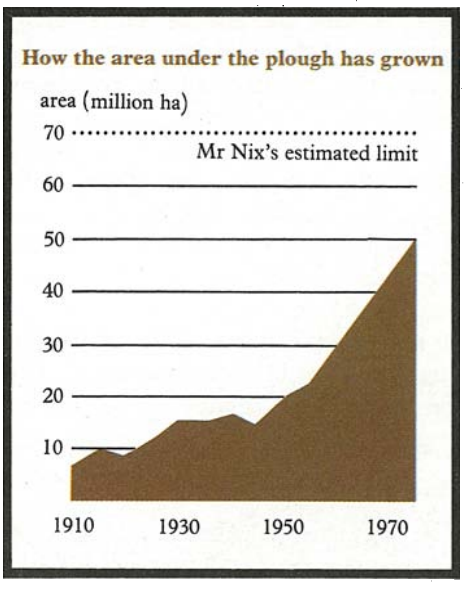
Future yields?

The scientists believe the data they have collected give no basis for concluding that cereal improvement through breeding has done any more than protect yields from decline due to disease and to the progressive cultivation of poorer land. And they don't see any technological breakthrough around the corner that may boost yields the way the introduction of superphosphate and legume-planting did. They conclude that it seems unwise to plan for the future with the expectation of any appreciable increase in per-hectare yields of wheat, oats, maize, and barley.

For vegetables, fruit, sugar cane, and other crops grown in high-rainfall or irrigated areas, the prospects seem considerably brighter. Yields have increased markedly over the years, but they are still well below those achieved in some countries. For example, Peru's sugar cane production per hectare is about twice Australia's, and the average potato plot in the Netherlands produces nearly twice as many tonnes per hectare as the average Australian plot. The scientists say it seems safe to assume that Australia's present average yields of vegetables and fruit could be doubled with intensive management.

The scientists believe that enough food and water for 60 million people could be supplied.

They stress the need for much more information if firm figures are to be arrived at.



Meat production per hectare of improved grazing land could also increase, the scientists believe. It has grown progressively over the years, as pasture-sowing, fertilizers, the provision of more watering points, irrigation, rabbit control, and so on have enabled farmers to increase their stocking rates. The scientists calculate from the statistics available that each hectare of sown pasture has yielded an average of 50 kg (dry weight) of animal product, including wool, since World War II. They regard 75 kg per ha as a reasonable, although perhaps optimistic, goal to aim for.

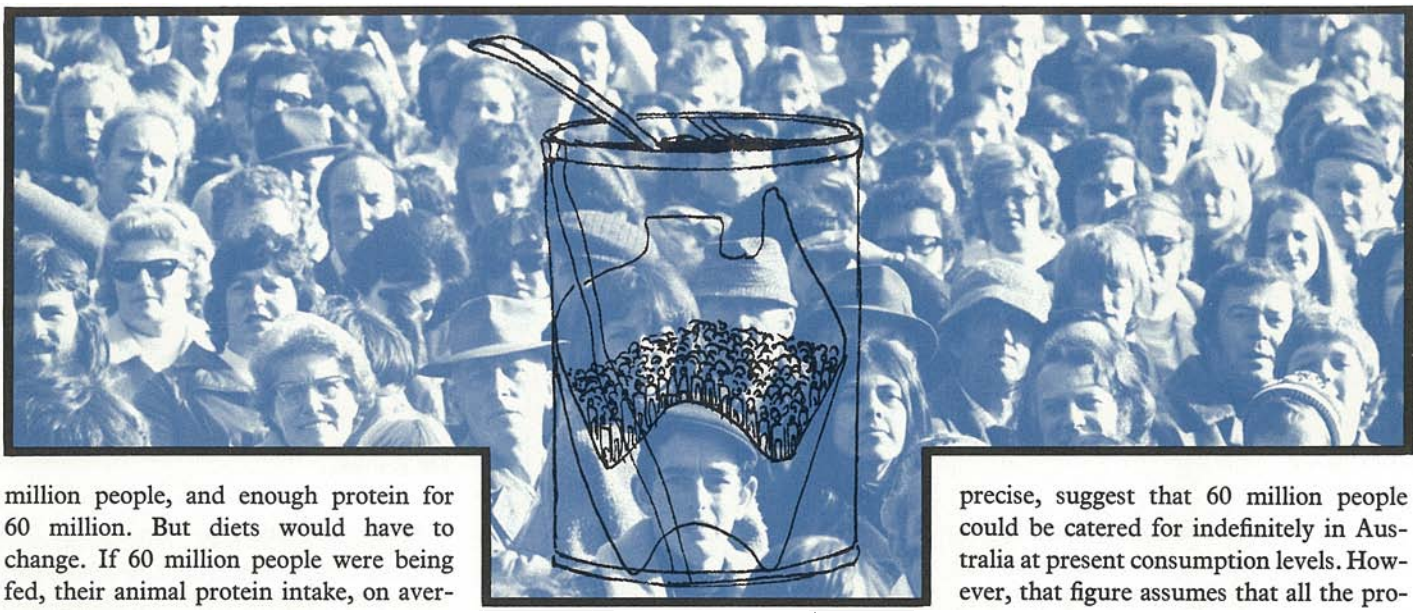
Energy and protein

Relating these figures to population, they worked out from food production and export data that the food produced in Australia in an average year between 1965 and 1969 would have met the present food-energy demands of 37 million Australians and the protein demands of 34 million. Only about one-third of this food was consumed here; the rest was exported.

Next they worked out how the population that could be supported would change if:

- the whole area suited to agriculture (using Mr Nix's figure of 70 million ha) was brought under the plough
- this area was divided among different agricultural activities in the proportions applying in 1965–69
- average per-ha yields of cereal crops remained constant, but those of sugar cane, vegetables, and fruit doubled
- yields from sown pastures averaged 75 kg of animal dry matter per ha
- unimproved rangelands continued to produce their present meat yield

The answer was that enough food-energy would be produced to satisfy 82



million people, and enough protein for 60 million. But diets would have to change. If 60 million people were being fed, their animal protein intake, on average, would be half as much as now; the difference would be made up by plant protein.

Water available

Turning to the limits imposed on population by water resources, the team drew on estimates by Mr Mick Fleming of the CSIRO Division of Land Use Research of the amount of river water able to be stored and used. About 67 000 million cubic metres of water are available each year—31% of it in Tasmania, 34% on the mainland south of the New South Wales–Queensland border, and 44% in the north. Only a small proportion of this—about 3%—is now used for domestic, industrial, and municipal purposes. Irrigated agriculture uses much more—about 20%.

They calculate that, if no new irrigation development occurs and water use per person in cities and towns remains at present levels, Australia has enough water for another 310 million people. But average consumption is increasing. If it reaches the United States rate, more than twice the present Australian urban rate, the population limit comes down to 130 million. If more water is used for irrigation purposes, of course the limit comes down again.

The scientists believe it should be possible to achieve a balance between irrigation and urban needs so that enough food and water for 60 million people could be supplied. However, severe problems would arise in distributing the water to where it is needed. They acknowledge that recycling, desalination, greater use of groundwater, improvement of the water-yielding characteristics of catchments, and other measures may augment water supplies in the future. But they say none of these possibilities can be counted on in formulating population policy now.

Fertilizer reserves

The scientists looked briefly at two other resources that could limit population if supplies became short—superphosphate and energy. They calculate that known phosphate reserves in Australia, Nauru, and Christmas Island—Australia's present sources of the fertilizer—are sufficient to keep a population of 60 million going for more than 300 years at current application rates. Although this seems a healthy-enough supply position, there is no substitute for phosphate, and they believe its long-term depletion should be taken into account in working out population policies.

On energy, the scientists say they can only assume that enough will be available to allow the present type of agricultural system to continue on an enlarged scale. They regard energy as even more fundamental than food and water supply, and say a realistic appraisal of future energy supplies and their distribution should be given top priority when population policies are determined.

Australia now has about 13·5 million people. In a report released last February, the National Population Inquiry chaired by Professor Wilfred Borrie estimated that without substantial immigration this figure would rise to just under 16 million by the year 2000. If 100 000 migrants came in each year, the total at the start of next century would be just over 19 million.

How many millions?

The scientists' calculations, which they acknowledge are very broad and imprecise, suggest that 60 million people could be catered for indefinitely in Australia at present consumption levels. However, that figure assumes that all the protein produced in Australia is consumed here. If 65% of the food produced continues to be exported, the estimate of the number who could live in Australia falls to 22 million.

The scientists left some factors out of their calculations, which they say may considerably reduce the population Australia could support. These are:

- use by an expanded population of more land that could be farmed for other purposes such as urban development, forestry, reserves of various kinds, transportation routes, reservoirs, and mining
- the possible use of some agricultural land to grow crops as alternative fuel sources rather than for food
- the possibility that climatic change may reduce the amount of food that can be produced

If Australia's population growth rate declined steadily from 1·9% per year at the beginning of the 1970s to zero in 50 years time and then remained at zero, its population would stabilize at just over 20 million. The scientists say that a slower rate of decline, resulting in a stable population of about 30 million, could probably be achieved by modest government measures if these commenced within a few years. They suggest that a smooth transition to a stable population without social disruption is improbable in the absence of a long-term population policy.

More about the topic

Biophysical constraints in Australian food production: implications for population policy. R. M. Gifford, J. D. Kalma, A. R. Aston, and R. J. Millington. *Search*, 1975 (in press).