



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

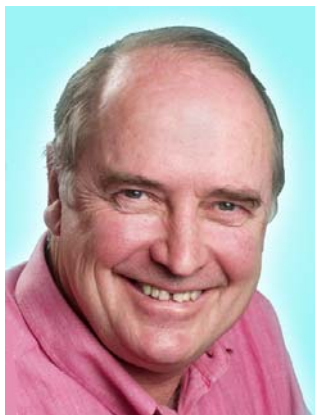
*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

## **Climate Change and Agricultural Mutation**

**Ross Garnaut  
Professor  
Australian National University**

*Paper prepared for presentation at the “Agriculture in A Changing Climate: The New International Research Frontier” conference conducted by the Crawford Fund for International Agricultural Research, Parliament House, Canberra, Australia, September 3, 2008*

*Copyright 2008 by Ross Garnaut. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.*



## Climate Change and Agricultural Mutation

**ROSS GARNAUT**

Research School of Pacific and Asian Studies (RSPAS)  
Australian National University  
Canberra

I had my introduction to climate change issues through the international agricultural research system a few years ago.

### Introducing IFPRI

The International Food Policy Research Institute (IFPRI), whose board I chair, started to undertake research — which has subsequently expanded — on the potential impact of climate change on global agriculture and particularly the agricultural food system. As we got into that work it became more and more arresting. It became clear that climate change itself was going to increase the old challenge of keeping abreast of the Malthusian spectre. It was also clear that the growing interest in bio-fuels, part of the mitigation solution of the climate change problem, was going to have very big effects on agriculture. These effects would exacerbate the food problem if supported by inappropriate policies.

The work that IFPRI has undertaken and published in recent years anticipated the large

PROFESSOR ROSS GARNAUT is a Distinguished Professor of the Australian National University as well as both a Professorial Fellow (Faculty of Economics and Commerce) and a Vice Chancellor's Fellow at the University of Melbourne. He is currently Chairman of a number of international companies and research organisations, including the International Food Policy Research Institute, and board member of several others. From 1985 to 1988, he was the Australian Ambassador to China. In April 2007, Professor Garnaut was commissioned by the Australian states and territories, and subsequently the Commonwealth Government, to review the impact of climate change on the Australian economy and potential medium- to long-term policies to ameliorate these.

increases in food prices that we've had over the last year. It attributed some of this increase to the competition between bio-fuels and food for scarce land resources, and in part to the emerging effects of climate change on production systems.

It is clear to me now, if it wasn't clear at the beginning, that climate change is in every way a science issue. It was work in the physical and related sciences that anticipated the issue of anthropogenic climate change. It is going to be science that helps us if we do succeed in adapting to the very large challenges of climate change. It is going to be science that helps us to develop the new agricultural approaches and systems that can feed the world and keep us in a range of other resources as the biological base for agriculture changes. Agricultural and forestry innovation and the development of opportunities for bio-sequestration has transformative potential in relation to the Australian as well as the global mitigation task.

The big increase in international agricultural research resources in the 60s and 70s was spurred by the early recognition of the large challenge of feeding a growing global population from expanding but ultimately finite agricultural resources. It was that challenge in India that led to the work in which John Crawford was involved in the 60s with the planning commission and the agricultural department in India, and which gave rise to what later became known as the green revolution. That success helped to shape the world's response to great international concern about food prices and new realisation of the Malthusian challenge in the mid-70s, when world prices for a wide range of foodstuff went to unprecedented levels. That crisis led directly to the establishment of the International Food Policy Research Institute with John Crawford as its first chairman.

Kissinger played a major role in marshalling resources for that initiative, seeing it as a strategic issue for a great power. That was also a period when there was a big increase in the resources applied to the international agriculture research system and a strengthening of its institutional base. It is well recognised that that increase in resources and that strengthening of the institutional base was very productive.

We have become complacent over the last couple of decades. Public-sector resources going into agriculture and related research in general have declined — in real terms, declined alarmingly. The amount of resources going into the international agricultural research system from the public sectors of the world has been stagnant. A renewed realisation — within the last year — that we face a large global challenge of food supply is beginning to get people thinking again about how we need to arrest the decline in that effort, to strengthen it and to strengthen the institutional base for it.

In this account I will share with you thoughts on these and other issues of science and research that have come out of my work over the last year. These will be reflected in the final report of my review<sup>4</sup> when I give it to the Prime Minister and the Premiers on 30 September.

## **An Australian analysis**

I have made heavy demands of the Australian science community in the course of my recent work. I needed a lot of very detailed analytic information about the anticipated impacts of climate change on various aspects of the Australian economy and Australian life. I learned that Australia has a great capacity in this area, but I also learned that it is nowhere near big enough to do the job that needs to be done.

### ***Greater scientific capacity is needed***

There are gaps in a number of areas. We need to do more and better at the higher-level climate science and modelling; this is really the foundation upon which a lot of the other work related to climate science has to be built.

We need that for two reasons. One is that if we are to interpret and properly understand the best work

that's going on in the rest of the world, we need our own people working at the frontiers. There is some Australian work at the relevant frontiers, but we would have much to gain if we ourselves were making a larger contribution to the global effort. Secondly, there are some distinctive features of Australia's location and situation that require a southern hemisphere and Australian-based effort. Some of our climate challenges are different from those of the northern hemisphere.

We have a different local climate system. There are no other substantial developed countries with strong science capacity in the southern hemisphere. The application of the lessons of climate science to anticipate the demands of adaptation is going to require a strong local research effort.

The Garnaut Climate Change Review team also became aware of the excessively large gaps in communication between the policy communities and the science community. I found myself being greeted with some surprise when I started asking precise questions about probability distributions for various possible impacts. There was a lot of reluctance by people in the scientific community to chance their hands at estimates of parameters that were fundamental to building an overall view of climate change impacts in Australia. It is not part of the culture of our scientific community to answer question of a precise kind about probability distributions until there is a high degree of certainty about the answer. The big policy tasks that we are involved in, however, entail making policy under conditions of uncertainty.

The alternative to having the best-informed and analytically strongest people making these judgements is to rely on people like me who don't know very much at all about it — and having a best guess at the probability distributions of scientific outcomes. So there was a cultural gap that has affected how far we've been able to take the analysis of likely impacts of climate change in Australia.

For example, on a very concrete and practical question, the international community is involved in a discussion of the appropriate ambition for the global community and mitigation of climate change. There is discussion of whether we should be aiming towards a concentration of greenhouse gases in the atmosphere of 550 parts per million of carbon dioxide equivalent or 450 or 400 or, as

---

<sup>4</sup> Garnaut, R. (2008) *The Garnaut Climate Change Review: Final Report*. Cambridge University Press, Port Melbourne, Vic. xlv + 634 pp.

part of the science community is inclined to say, somewhat less than that. But we don't actually have the sharp, well-informed view of probability distributions of impacts to make fine judgements about what would suit Australia best. Filling that gap — not only the high science gap but the capacity for policy communities, social science communities and biological and physical science communities to understand the questions each is asking — is going to be important to our making a success of the future related to climate change.

## A new focal institution?

One of the ideas that I have been discussing with the learned academies of Australia and other parts of the Australian science community is the need for a specialist institute for climate change policy research that will help strengthen some of the capacities that my own work has found to be weak. Part of what Australia needs to think about as it addresses the issue of climate change is how it contributes more and better to the international research effort in scientific areas that are closely related to our old interest in agriculture and forestry but which have new dimensions.

In my final report I will be saying something about relating the role of Australian participation in international agriculture research to cooperation between Australians scientists and developing country scientists in areas related to climate change.

I will also discuss the further development of the CGIAR system to assist the international community in meeting some of these challenges.

## Challenges for agriculture and forestry

We are already experiencing some impact of changes in climate on global markets. The limited amount of warming that is already apparent has had an effect on runoff and evaporation, for example in Australia in the south-west of the country and in the Murray Darling Basin. Climate change is part of the story of the challenges to agriculture in large parts of southern Australia over the last few years.

Australia is big enough in global food markets for those challenges in Australia to contribute to the problem of tightening global food markets over the last couple of years. We need investments in climate science and the capacity to interpret

ensuing results in terms of impact on Australia and our developing country neighbours to understand better what is happening to us. We are going to find that the rapidly changing world will require a lot of innovation, and innovation always makes demands on science. We have seen that right from the beginnings of the history of Australian agriculture.

Agriculture had to follow a hard road in this country. When Europeans first settled this ancient continent and brought with them ideas and plants and animals from Europe, nothing fitted very well. The success of subsequent Australian agriculture was very much a story of the success of innovation with a large science component. Australian agriculture has been successful over a long period because we have always been at the forefront of global work in agricultural, biological and related sciences.

In the period ahead, time and time we will face again the type of challenge that early Australian agriculture faced in adapting to a new environment. The future of Australian agriculture will depend on the success of that adaptation.

It is not going to be all negative. One of the interesting stories that I was able to study along the way to the draft report<sup>5</sup>, which we released on 4 July, was the complex interaction of the increased concentration of carbon dioxide in the air and Australian wheat production. There will be some regions with access to enough water to productively use the increased carbon dioxide in the atmosphere to increase yields — at least for a while. Eventually, however, temperatures will increase too much to take advantage of the carbon dioxide fertilisation effect. We had a careful study of that done for the review. Unfortunately most of the effects of climate change on production will be strongly negative.

The contribution of climate change to higher world food prices is going to make agriculture more profitable and attractive for those who are still able to remain productive: those in favoured locations who are able to keep abreast of change. I have no doubt that despite the challenges on the supply side, many Australian farmers will be taking advantage of those higher prices and in so DOING making our own modest contribution to

---

<sup>5</sup> Garnaut, R. (2008) *Garnaut Climate Change Review: Draft Report: June 2008*. Garnaut Climate Change Review, [Canberra], x + 537 pp.



easing the pressure on world food markets. The biggest of the new opportunities are probably going to be related to bio-sequestration.

Of the OECD countries, we are probably the country with the largest area of woodland and forest per capita. Different management of these vast areas will provide a very large potential for bio-sequestration of many kinds. Up till now the biggest focus has been on plantation forests, for which there is great potential. These are in some respects problematic, and there's a lot of work to be done in reconciling the negatives with the positives, but certainly there is a great positive there. But that is only part of the potential for bio-sequestration in Australia.

## **Changes in land use could transform the mitigation effort**

We consider opportunities for agriculture and forestry in chapter 22 of our final report. Better management of these opportunities could be generally transformative in the Australian mitigation effort — and potentially in the global mitigation effort. The opportunities are varied: different types of management of the northern Australian savannas has large potential. Climate models, crude though they tend to be in their estimates of future rainfall over the Australian continent, hold out reasonable prospects of higher rainfall through parts of northern Australia. That's not at all inconsistent with continued drying of southern Australia. There will clearly be opportunities for intensification of the growth of biomass in northern Australia.

We have in Australia huge areas of marginal pastoral country that are badly denuded from the original natural state. It has been denuded by relatively unproductive sheep and cattle grazing and by feral animals of various kinds. The sheep and cattle grazing was once more economically valuable than it is now.

Careful management and protection of growing forests — both areas that have been logged and natural forests — have much larger potential for bio-sequestration than is usually understood. There has been active discussion right across Australia over the last few years of bio-sequestration in the form of soil carbon.

## **Realising opportunities**

To realise these opportunities, we will need lots of good work in the biological sciences. We will need lots of changes in institutional arrangements. We will need big changes in the established international approaches to accounting for carbon in trading regimes, because neither the Clean Development Mechanism (CDM) set up by the Kyoto protocol nor the European trading system credits many of these forms of carbon sequestration. If we are going to realise anything like the potential that these opportunities have, the incentive structure must be right.

### **Food or fuel?**

Despite the problems to which I have referred, there is also potential to make use of the agriculture opportunities related to bio-fuels for mitigation. Bio-fuels have acquired a bad name over the last year or so, partly as a result of the work of IFPRI, because of their contribution to high food prices. That contribution is a result of poorly conceived policies.

When you specifically subsidise a particular form of mitigation or abatement of greenhouse gases independently of its cost, independently of the interaction between that and other areas of mitigation, large distortions are inevitable. The subsidies and the mandatory requirements to use a certain proportion of fuel from biological sources in parts of Europe and the United States led, over a short period, to shifting much land out of food production and into input for bio-fuels. This turned out to be very unproductive environmentally. Mandatory controls and crude subsidies encourage biofuel production even when the carbon and other greenhouse emissions saved from the use of bio-fuels are greater than the carbon emitted in the process of production.

That would not happen if incentives for biofuel production were integrated into general emissions trading schemes. It would not happen if carbon emissions in the inputs were taxed at the same rate as the emissions from fossil fuels that were replaced by the bio-fuels. It is a very simple error. The distortions in North America and Europe resulted from basic political economy forces that we all understand. The effects were powerful. We have to avoid that sort of outcome in future.

Bio-fuels do not have a good future on land which is currently highly productive for food. In the end, in the competition for land resources, food will

beat energy. Enough people will be prepared to pay prices that are high enough to keep land in food production. Unfortunately poor people can be damaged along the way. In the end, the important source of bio-fuel is going to be biomass that does not compete with food production. Sometimes bio-fuels will use by-products from food production. They will also use land which is not productive for valuable food.

## **Conclusion**

How well we manage a huge transformation, a mutation, in Australian agriculture and forestry in response to new incentive structures and new challenges associated with climate change is going to have a big effect on our rural communities and on our agricultural industries. It is also going to have a big effect on how painful our overall mitigation task becomes.

If we manage the land use mutation well, we will make the mitigation task much more manageable for Australia. We will also set standards and develop approaches that will make mitigation much easier for others. This will be especially important in our neighbouring developing countries where we have long-standing cooperative links in the bio-sciences, in agriculture and in forestry.

If we do all of this well, it will add up to a productive mutation of the Australian agricultural economy.