Food, Water and War
Security in a World of Conflict

Record of a conference conducted by the Crawford Fund for International Agricultural Research, Parliament House, Canberra

15 August 2000

Australian Centre for International Agricultural Research (ACIAR)

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Contents

THE HON TIM FISCHER MP is one of Australia's most highly regarded politicians. His long career in politics began after he left the Australian Army in 1970 and he began to raise the profile of rural Australia at the State, and then Federal, level. He was elected Leader of the National Party in 1990 and appointed Shadow Minister for Trade in 1993. In 1996 he was appointed Deputy Prime Minister and Minister for Trade. His interest and advocacy for Australia to become a trading super-power, especially in Asia, are well known. Mr Fischer retired as Deputy Prime Minister, Minister for Trade and Leader of the National Party in June 1999 and continues to serve his constituents in Farrer, while lending his considerable advocacy and political talents to chair the Crawford Fund's Board of Management.

What Does Food and Water Have to Do With War?

The Hon. Tim Fischer

The topic of The Crawford Fund's Year 2000 conference was a challenging and timely one. Despite the fact that many accept the concept of the beneficial returns to donor countries from investing in development assistance, few would consider that it might also contribute to peace in the developing world.

Can we add 'peace' to the more tangible returns to development assistance, such as growth in trade, goodwill between nations, greater cultural, educational and scientific cooperation, and technological gains?

The Crawford Fund believes that agriculture, food, and access to natural resources like water, play key roles in development for poor nations and in avoiding conflict.

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In the complicated matrix of the causes of conflict in developing countries we encouraged participants at the conference to think about security outside the military dimension.

Many think tanks around the world, including the world-renowned Peace Research Institute in Oslo, believe that the post-cold war era calls for new policies that will help avert conflict in the 21st century. These policies need to address a different paradigm for violence and conflict—that of supplying basic human needs.

The keynote speaker at the conference, Admiral Chris Barrie AO RAN, signalled a new shift in our understanding of what security is. Fighting for food, said Admiral Barrie, is a stronger driver than allegiances and politics. He believes that Australia must be prepared to do more to maintain peace and security in our region, and he advocated a multidisciplinary approach—a 'whole-of-nation'—approach as he termed it, to peacekeeping and conflict resolution in our region of the world.

Other Australian and international speakers highlighted a growing awareness of the potential for conflict over lack of access to resources. Most agreed that hungry people are more likely to become embroiled in conflict because they become discontented and disaffected and are ultimately easy prey for elite groups who see them as simply a means to their own selfish and greedy ends.

…there can be no peace in the world while people are poor and hungry.

Former US President Jimmy Carter said that there can be no peace in the world while people are poor and hungry. The take-home message from this conference was that we can solve the problems of the hungry, but this will involve increased support for agricultural research, national and international, to feed the world's growing population. We also have to solve the distribution problem so that hungry people have access to food in the market-place.

Ultimately a major cause of conflict in developing countries is poverty, and the best way to overcome poverty is through economic growth. The Crawford Fund firmly believes that agriculture is the engine that drives economic growth, and helps create peace in order for developing countries to grow and take an equal place in the world. Helping the agricultural sector to grow is essential to human destiny in the 21st century.

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THE HON ALEXANDER DOWNER MP is the Minister for Foreign Affairs. Mr Downer was elected Federal Member for Mayo in South Australia in 1984. In 1987 he became Shadow Minister for Arts, Heritage and Environment, before taking on the role of Shadow Minister for Housing, Small Business and Customs in 1988. In 1990 he became Shadow Minister for Trade and Trade Negotiations, a position he held until 1992 when he became Shadow Minister for Defence. In 1993 he took on the Shadow Treasurer portfolio, before being elected Leader of the Opposition in 1994. Mr Downer stepped down as Liberal Party Leader in January 1995 and became Shadow Minister for Foreign Affairs. In March 1996 he was appointed Minister for Foreign Affairs when the Liberal-National Party Coalition was elected to Government.

Sustenance and Security: Australia's Multi-Layered Approach

Opening Speech

The Hon. Alexander Downer

It is my great pleasure to be able to speak at today's conference. Please allow me to take this opportunity to pay tribute to the Crawford Fund for its fine work in directing the national strengths Australia enjoys in international agricultural research towards the alleviation of poverty. I've spoken at many functions organised by the Fund, and I am always struck by its very practical approach to advances in agricultural research to better the lives of millions of people in developing nations around the world. This conference is very much in line with that fine tradition.

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We Australians have long counted ourselves lucky to live in a relatively secure corner of the world. Although our neighbours have had their fair share of difficulties, until recent times years of political and economic stability had provided the basis for progress in many areas. Australians shared the benefits of this relatively benign regional environment with our neighbours in South-East Asia and the Pacific.

Recent economic and political events in places like Indonesia, East Timor, Papua New Guinea, the Solomon Islands and Fiji show how quickly old assumptions can change. Now, I don't want to exaggerate the region's problems—indeed, most of the positive factors contributing to stability and security have not altered—but the region's outlook is in some respects more uncertain than it has been for many years. We find ourselves, in the words of the Chinese curse, living in 'interesting times'.

Some of the uncertainty derives from a growing appreciation of the implications that environmental problems have for the vexed issue of food security. Of course, we need to be level-headed about our approach to these matters. Prophets of Malthusian doom have a long history, dating back to Malthus himself, of getting it wrong. Many of you will also remember the apocalyptic

predictions of the Club of Rome and Paul Ehrlich in the 1970s as to what our world would look like in the 21st century. But it is clear, I think, that development and population growth are putting severe pressures on natural resources, as well as causing severe air, water and industrial pollution. And water shortages are a growing problem.

Progress in agricultural technology has given the world the tools to produce sufficient food for everyone, yet over 800 million people around the world remain chronically undernourished today.

Progress in agricultural technology has given the world the tools to produce sufficient food for everyone, yet over 800 million people around the world remain chronically undernourished today. 200 million children under five have protein and energy deficiencies. The largest numbers of people living in poverty are in South Asia and East Asia. Both regions have over twice the number of people in absolute poverty as Sub-Saharan Africa.

More than most other donor countries, Australia has a direct interest in reducing poverty in developing countries. Our future security, more than any other wealthy nation, depends on the success of efforts to promote prosperity in our region. For a number of years, the Australian Government has placed a high priority on helping developing countries achieve food security, an aim that is consistent with the focus of our aid program on reducing poverty.

This conference will hear from a number of eminent speakers on how these problems are linked with the seeds of conflict and how international research and development cooperation might play a role in underpinning international security. I don't propose to steal their thunder, but I do want to outline some of the steps the Australian Government is taking to address food security, using a multi-layered approach that encompasses security, trade and development assistance efforts.

Non-Military Threats to Security

The question of non-military threats to security is one that has probably received insufficient attention to date, so I particularly welcome the Crawford Fund's efforts in convening today's conference and helping to focus our minds on the important issues involved.

Those issues also tend to fall between some of the categories we use in thinking and talking about the security challenges facing our region. But I might mention briefly here the experience of the ASEAN Regional Forum (ARF), the annual meeting of which I attended last month in Bangkok, as an example of how these issues are being taken up by governments, and of some of the initiatives that are under way.

The ARF, as many of you will be aware, is the pre-eminent multilateral security forum in our region. To date, its deliberations

have tended to focus on so-called 'traditional' security issues such as tensions on the Korean Peninsula, territorial disputes in the South China Sea and the proliferation of weapons of mass destruction. Last month's meeting also included constructive discussion of some of the difficult communal and separatist issues facing Indonesia—with all ministers present committing their governments to support for Indonesian territorial integrity—and recent political turmoil in Fiji and the Solomons.

Those issues are, of course, extremely important ones for Australia, and the region. But the meeting also allowed discussion of issues such as the impact of globalisation on countries in the region. Clearly many in the region are concerned, particularly after the recent financial crisis, about the potential for some aspects of globalisation to exacerbate the economic gap within and between countries, and for traditional social structures to be adversely affected.

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These concerns need to be seriously addressed, and I welcome the attention the ARF and other forums are according to them. But as the Bangkok meeting recognised, we need to look at both the opportunities and the challenges that come with globalisation, and also at what nations can do, individually and collectively, to maximise the benefits and minimise the negative effects of globalisation.

I am encouraged that the ARF agenda has broadened in this way. Australia very much welcomes this growing sophistication and maturity in the regional security debate.

Globalisation and Trade Liberalisation: Positive Factors for Food Security

The debate in Bangkok on the challenges of globalisation leads me to the first, and very fundamental, point I want to make about food security. It is this—that the building of economic and social walls is as illusionary a defence of national wellbeing as were the walls of the Maginot Line for France in 1940.

We must remember that the expansion of international trade and commerce over the past few decades has enabled many Asian countries to make the transformation from essentially agrarian societies to prosperous industrialised economies in less than a generation. That same process took Europe and North America centuries to complete.

With prosperity has come improved access to education, information and technology for millions of people, in turn encouraging democratisation, accountability in government, and respect for basic human rights.

Today, unfortunately, simplistic and counterproductive approaches to ensuring food security continue to hold wide sway. And it is the most prosperous nations—I'm thinking in particular of the EU, and the United States—that are, sadly, guilty of some of the practices and policies most pernicious to achieving a more equitable distribution of critical resources, including food.

The simple fact is that no single measure will do more to promote food security in developing countries than a reduction in trade barriers.

The simple fact is that no single measure will do more to promote food security in developing countries than a reduction in trade barriers. Australia strongly supports food security based on self-reliance rather than self-sufficiency, as only through trade can food move from areas of surplus to areas of deficit. Equally importantly, access to wealthy markets allows developing countries to obtain the income to buy food and other goods.

Australia has been at the forefront of trade liberalisation through the reduction of protection and subsidies, particularly those involving agriculture. We continue to take an ambitious but pragmatic approach in international forums to champion the interests of free trade in agricultural products.

Why does this matter to developing countries? It matters because an organisation like the European Union spends around 50 per cent of its budget on agricultural subsidies. How can developing country exporters ever hope to compete on the international market when the Europeans artificially depress commodity prices through subsidies to their own agricultural production, marketing and export?

I now want to touch on some of our Government's many programs to help countries in our region establish greater food and water security. Those programs are important, and an essential part of Australia's multi-layered approach, but I cannot emphasise too much the need to reduce trade barriers. Only through such action can we truly give developing countries a fair chance to compete, earn income, and import the goods their people need.

Agricultural Research

The first area of activity in this regard is international agricultural research. Australia has a long record of achievement in the field of agricultural research, and our research community has actively taken our technological achievements to the world. That is something of which all Australians can be proud.

The Australian Centre for International Agricultural Research (ACIAR) is the main focus for Australia's contribution to international agricultural research. Bob Clements and his team are doing an excellent job in matching Australian expertise to the needs of

our developing country partners and supporting the work of the international agricultural research centres.

Of course, I must also commend the work of the Crawford Fund itself, which not only provides well-targeted workshops and training for developing country scientists, but also convenes excellent conferences like the one that has attracted us all today. At last year's conference, in this very room, I indicated that the Australian Government would continue to support the Crawford Fund, and in the May Budget we allocated $610 000 for its work for the year 2000–2001. I am today happy to announce that our Government has decided to commit to that level of support for the Fund for a further four years, until 2004–2005.

Food Security Activities

Our second avenue of effort aims to increase the food security of our development partners through targeted activities funded by the aid program. I have made a pledge of $1 billion for food security for the four-year period from July 1998. The pledge covers not only immediate food aid needs, but also aims to boost agricultural production, research and development, and skills and systems. Activities include developing food mapping systems and enhancing women's access to resources. Two years into that program, we are on track to meet that target.

I have made a pledge of $1 billion for food security for the four-year period from July 1998. The pledge covers not only immediate food aid needs, but also aims to boost agricultural production, research and development, and skills and systems.

The challenge now facing us is to find sustainable ways to increase yields without causing further damage to our fragile environment. The complementarity between research and other aid activities must be fully and wisely exploited. Developments in biotechnology and genetically modified crops could deliver a second Green Revolution, and these new technologies must be safely put to use in the battle against world hunger.

But increasing yields is only part of the answer. Globally there is at present no shortage of food. There are, however, distribution problems. There is also a serious shortage of income to buy food—in other words, a poverty problem.

Income growth is particularly important in marginal rural lands where poverty is rife and agriculture remains the predominant occupation. People in these areas need money, industries, markets and communications, and the support of sound government policies. Two months ago, I released a rural development strategy for the Australian aid program that provides a framework for Australia's rural development aid activities that focuses on income generation for the rural poor.

Water Security

While the theme of food security has been with us for some time,

international concern is increasingly turning to the analogous theme of 'water security'.

There has been much speculation in recent years about the potential for future international conflicts to arise over competition for water resources and in particular over shared river basins. One recalls the 1995 remark by Ismail Serageldin, Vice President of the World Bank, that 'the wars of the next century will be about water'.

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On the face of it, there is certainly cause for concern. Globally, the availability of fresh water has declined 37 per cent in per capita terms since 1970 as population growth and degradation of water supplies has outstripped global capacity to develop new sources. Almost half of the world's land surface lies within watersheds shared between two or more countries, and there are 260 rivers which cross international boundaries.

Not all commentators are worried by the prospect of conflict over water resources. In an article published last year, Aaron T. Wolf poured cold water (if you'll pardon the pun) on the idea of looming international conflict over water. Although there have been some minor conflicts, his exhaustive search of historical records yielded only one example in history where states had gone to war over shared water resources, and that was over 3,000 years ago!

In fact, shared water resources by their very nature have often encouraged cooperation between states, even in times of great tension. For example, the Working Group on Water Resources in the Middle East was the one mechanism that continued to function throughout the Middle East peace process, when other forms of dialogue faltered. Wolf cites the example of the Mekong River Commission, which continued to operate right through the enormous upheavals of the Vietnam War.

We should of course remain alert to the potential for conflict over water, particularly for conflict within states, but we do need to keep this question in perspective.

If claims of tension arising from water's availability might be open to challenge, problems derived from water quality are not. Between 10 and 25 million people die each year because of lack of clean water and adequate sanitation. This is where problems with water resources really hit hard, but it is an area where Australia can make progress, investing over $40 million last year on improving water supply and sanitation infrastructure in developing countries. Our approach is based on Australia's long experience of dealing with water scarcity and the expertise we have developed as a result.

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Conclusion

Ladies and gentlemen, Australia is very conscious of the need to come to grips with the problems of food and water security, particularly in our own neighbourhood. Our multi-layered response attacks these problems at every level. Under our development assistance program we've developed a series of activities to address those problems directly. These are practical responses that take advantage of the expertise that we Australians have garnered over the years in dealing with our own agricultural and resource problems—expertise we are happy to share with our neighbours.

Australia has also taken the lead in fostering a more expansive debate on regional security issues, such as in the ARF, and in developing new mechanisms for security cooperation.

Finally, and most importantly, Australia remains committed to breaking down barriers to world trade, barriers that distort the distribution of food and other resources, and limit the access of developing countries to export earnings. The best guarantee of food and resource security lies in freer markets, and our Government is committed to ensuring that developing countries share equally in the benefits that globalisation and trade liberalisation can offer.

…Australia is very conscious of the need to come to grips with the problems of food and water security…

ADMIRAL CHRIS BARRIE AO RAN was appointed Chief of the Defence Force on 4 July 1998. He entered the Royal Australian Naval College in January 1961. In addition to a range of positions in service at sea, Admiral Barrie has served ashore as a member of the Directing Staff at RAN Staff College and Director, RAN Tactical School, Force Development Planning Staff. In 1990–91 he held an appointment as Defence Adviser, New Delhi, India, and then served as Director RAN Surface Warfare School and Commanding Officer HMAS WATSON; Deputy Maritime Commander and Chief of Staff at Maritime Headquarters in Sydney; Deputy Chief of Naval Staff; and Vice Chief of the Defence Force. Admiral Barrie obtained a Bachelor of Arts degree in 1993 with a special focus on International Relations and Politics, and was awarded a MBA in 1996. Admiral Barrie's military service was recognised when he was made a Member of the Order of Australia in 1994, and promoted to an Officer of the Order of Australia in 1998.

Food, Water and War: Security in a World of Conflict

Admiral Chris Barrie

I appreciate very much the opportunity I have today to speak at this Crawford Fund conference on food, water and war. Although I do not profess to be an expert at all on the very complex issues of international agricultural research and poverty relief I do, nonetheless, have some thoughts on the possible sources of conflict and Australia's involvement in conflict to date, particularly as these may have implications for our own future security, as well as relevance for our region and the world at large. This is a wonderful opportunity to engage in a discussion on security, particularly what I call the broader definition of security.

Moreover, I think it is also timely, not only in a policy sense as we move through the Defence White Paper process, but also because we now have a tangible regional context for this very important discussion. For Australia this has been lacking, which I think has tended to make the whole issue of security a little abstract in nature, rather than a real 'here and now' issue.

Minister Downer has outlined the fundamental relevance of food and water security in our region and the multi-layered approach Australia is taking to meet these challenges.

I would like to talk to you specifically about some of my ideas of where we need to head in the coming years to deal with the problems the world confronts, and more specifically where professional military activities can contribute to solving these problems.

It is also a mark of a maturing approach to these issues that a Chief of the Defence Force would be invited to speak at a forum which not so long ago would have been the purview of NGOs, government aid providers and academics only. After all, it was not that long ago that a Victorian Government agency characterised Defence Force personnel as 'harm workers'. I put it to you that this is far from the case in Australia where our defence force draws

its very professionalism from the fact that it strives to be a 'force for good'.

So I believe that the Australian Defence Force has a legitimate, and in some cases, central part to play along with other government and non-government agencies in contributing to our thinking on these issues.

If, as I suspect, I am the first Defence Chief to be involved in a public seminar held in Australia on the important links between diminishing access to resources and conflict, I certainly hope I am not the last!

In my view, my presence is symbolic of an important change in our national approach to security issues, bringing with it recognition that security must be addressed at least on a whole-of-government approach, but preferably in the end on a whole-of-nation approach. I contrast this position with what we used to do, that is deal with security problems separately through the traditional channels of defence, diplomacy and aid. This is because many pressures now shape a Government's judgement as to what is, or is not, in the national interest, and many of these pressures, though interweaved in complex ways, have little regard for political boundaries.

Today, other factors such as poverty, infrastructure development, living standards, the impact of globalisation and access to life's essentials are becoming important dimensions to States and their national interest. A reflection of the recognition of the interdependency of basic factors such as food, water and war can be seen on the Internet—the number of web sites devoted to this subject is astonishing.

Food and Water

In affluent societies we take ready access to food and water for granted, but in their absence people are driven to do whatever it takes to get them.

Let us just consider one basic element of human existence—food. In affluent societies we take ready access to food and water for granted, but in their absence people are driven to do whatever it takes to get them. Yet, as we have already heard, there are a number of reports which conclude that the world can support the present population we have quite comfortably if only we could get the distribution right, and there are even projections that we can do so well into this century.

So what has any of this to do with war you might ask. Well, let me give you one example of how this can work.

In the Russian Civil War in the early 1920s, many of the Bolshevik soldiers in Central Asia were Austro-Hungarian ex-POWs. The reason? There had been a large POW camp in the vicinity of Tashkent, and when the armistice was concluded between the Germans and the new Bolshevik regime in 1917, the

POWs were released into the chaotic circumstances of the time. No one bothered to arrange for them to be returned home or even fed. So they joined the Bolshevik Army, which guaranteed them a uniform and at least one meal per day. And the rest is history!

To me this has obvious relevance to the present day experience of warlord-prone regions like Somalia and militia-prone regions like Timor. If the circumstances of life are precarious enough, it is easy for the bad guys to recruit young people to their cause for a uniform and some food, however squalid or ill-defined the particular cause might be.

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Why then are people starving and suffering famine in so many places, particularly Africa and Asia? Why do inequality and conflict continue to grow? The message that comes through loud and clear from many studies all over the world is that, while physical or climatic factors play a role in famines, the primary factor that tips the balance and causes the malnutrition and death of so many people is political or man-made.

It is war and civil strife that I am talking about. Just as this occurred in Russia in the 1920s, we are witnessing numerous situations like it today. Furthermore, many of the problems associated with lack of food, including hunger, poverty, unemployment and social unrest, highlight the circular nature of the argument about the causes of major conflict in the post-Cold War period.

I know we will hear from many experts today on the role of development in trying to solve these problems, and in particular, the importance of international agricultural research in advancing that development. This emphasis is important and must not be underestimated. Science and agricultural development have important roles to play in both reducing the likelihood of conflict and assisting with nation building post-conflict. But development alone will not be enough!

There are also some who say that if we stop spending money on military forces and channel those resources into aid and social improvement programs, then the problem would be solved. I regard this approach as very simplistic, and at the same time I wish it was that easy to solve. In my opinion the fundamental difficulty we face can be summed up quite simply. We need to understand human nature and get people to behave appropriately towards each other, at both the individual level, and collectively up to the state-on-state level.

We need to understand human nature and get people to behave appropriately towards each other, at both the individual level, and collectively up to the state-on-state level.

This is THE problem for the international community in our time. How are we going to deal with people who do not abide by basic ethical rules? With our current system of nation states, we seem incapable of solving this problem unless there is a dramatic

change in the way we all behave. When we no longer need police forces in our communities to deal with dangerous and inappropriate behaviour, that is the day we can afford to disband our military forces.

Let me emphasise that I am not advocating interfering in the internal affairs of other countries here, or disbanding the institution of the nation state. But what do we do about nations or sub-national groups deliberately misbehaving and acting illegally, or how do we deal with the collapse of nations that have basically dissolved into a disparate bunch of warlords?

It takes months to gather a crop. If marauding bands are going to trample that crop or steal the harvest, what is the point?

At the most basic level, some degree of law and order (even if imposed by an autocrat not himself subject to the law) is a fundamental requirement of subsistence agriculture. It takes months to gather a crop. If marauding bands are going to trample that crop or steal the harvest, what is the point? If you have little hope of harvesting a crop, you might as well join one of the marauding bands.

Often one of the most obvious means of enhancing food security is the ability through appropriate investments in infrastructure to control the seasonal and/or irregular flow of water both in order to irrigate crops and to prevent the harvest from being wiped out by floods.

The great empires such as those of Egypt, Tigris-Euphrates, and Rome, for example, have had this capability at their heart since time immemorial. One of the reasons they developed such large and capable bureaucracies and codified systems of law was to enable the infrastructure to be designed, constructed and regulated, land and water rights to be apportioned, harvests to be gathered and sold, and taxes on production to be levied. The taxes in turn provided the financial resources to the central authority to provide the means, such as armed forces, to maintain the peace both within the empire and at its borders.

The total absence in places like Somalia of a central authority which is able to organise the investment required to release the villagers from the vagaries of the weather means it is difficult to conceive of even the commencement of the basic wealth creation process that will enable a start to the development of improved living standards.

At a higher level of development, investment in manufacturing and service industries is needed in order to create sufficient employment to enable opportunities for those who do not grow their own food to purchase it for cash. Many of the most important investment decisions are made by global corporations, who will not sink their capital in countries where property rights are not secure. This means that there is an almost inevitable

vicious circle of connection between war and poverty. This cycle must be broken for conditions to improve.

While I am on the subject of investment let me talk a little about water. A very important by-product of the capacity to control water is the question of access to clean drinking water. A large proportion of the third world population has difficult access to safe drinking water, and a very large proportion has no access at all. Apart from this leading to great problems with endemic disease, the infant mortality rate is a great incentive to having large families, the children being the only social security fall-back that their parents have in old age.

Environmentalists have done a lot to expose us to the dangers of many things that we have done in our daily lives which endanger our quality of life or threaten our children's future. However, in relation to the development of infrastructure for the control of water flows for irrigation, electricity and the provision of safe drinking water, I think some of them are way off the mark.

We have been encouraged to think that Africa is overcrowded, but it is not. For its size Africa carries an astonishingly small proportion of the world's population, whereas Holland is what you would call crowded, and so is Germany. Yet some people campaign so vociferously and successfully against the construction of dams that international financial institutions are very reluctant to invest in them even when the local political situation permits.

Such investment is important, so we must couple the requirement to use aid funds for construction projects, with the need to provide emergency relief, and other means of alleviating short-term poverty, such as handing out sacks of rice. Both are important. From an Australian perspective I think this emphasis on the value of infrastructure investment can be no better demonstrated than the recent opening of the lower Mekong Bridge.

From an Australian perspective I think this emphasis on the value of infrastructure investment can be no better demonstrated than the recent opening of the lower Mekong Bridge.

Apart from internal stability, the quality of national institutions is becoming an increasingly important issue in economic development. Where poor quality national institutions exist countries are forced to borrow short-term money for long-term investment, and as the Asian meltdown showed, the situation can collapse with frightening rapidity when investors lose confidence.

I conclude from this analysis that what many of these strife-torn regions need above all else is peace and good governance, neither of which are likely to come from within. The building of countries which can stand on their own feet and look after their people responsibly seems to me to be the fundamental problem which the international community has to come to terms with if food and water shortages are to be overcome successfully for all people.

A New Framework for Security

Let me say from the outset that our understanding of the causes of conflict has grown considerably in the last 20 years. Up until the late 1980s, the debate on development, conflict and security was dominated by the traditional concerns of history, ideology and geography and viewed through the prism of East/West relations. In turn, this reinforced a crude ontology about the nature of 'power'.

Today, other factors such as poverty, infrastructure development, living standards, the impact of globalisation and access to life's essentials are commanding more attention in a more rigorous discussion. This is a serious debate that we need to have because our future security may depend on it.

Australia's Role and Responsibilities

As I said earlier this is not an abstract issue for Australia. It is important because it is an issue, which should be at the heart of our vision of ourselves as a nation and our role in this very rapidly changing world.

We are fortunate to enjoy a living standard, which is the envy of most of the world. However, our basic character is formed from making the most of a harsh environment, leading to a 'can-do', innovative culture.

We are fortunate to enjoy a living standard, which is the envy of most of the world. However, our basic character is formed from making the most of a harsh environment, leading to a 'can-do', innovative culture. Many of us travel and we have managed to create successfully one of the world's more advanced multicultural societies. Our young people have always been, and still are passionate about getting out there and making a difference to shape a better world.

We have no territorial disputes with our neighbours. But, we are also located in a region which features developing economies, infant democracies and increasing political instability from tensions pre-dating the end of the Cold War. I believe that our region is in a state of transition, which will fundamentally challenge many assumptions that have guided the way business has been done in Asia.

Presently, regional security cooperation is limited. Even where that cooperation does exist, in such bodies as APEC, the ASEAN Regional Forum and ASEAN itself, events like the Asian economic downturn have demonstrated the challenges facing the region. Recent regional initiatives such as ASEAN + 3, the ASEAN troika proposal and Minister Downer's 'Good offices' role for the chair of ASEAN Regional Forum all have great potential. But it is still uncertain as to whether these initiatives will provide the genuine beginnings of 'regionalism' such as we have seen in other parts of the world.

As far as my own role as CDF is concerned, I am convinced that defence forces, in concert with other government agencies and

businesses, committed to working cooperatively with other nations, can be a force for positive social and political development. This is where I see the Australian Defence Force as a prime example of being part of the solution rather than part of the problem. We have shown by our professional behaviour that some of those challenges can be solved. We have also set an example to other military forces on how to achieve success by behaving appropriately and lawfully—what I call a 'force for good'.

We have also set an example to other military forces on how to achieve success by behaving appropriately and lawfully—what I call a 'force for good'.

An important challenge for all first world governments, multilateral agencies and non-government organisations will be to reconsider their traditional roles and approach in the development of security policy.

If countries such as Australia seek to take a prominent and useful role in a region dominated by developing countries, they will need to be prepared to mobilise all aspects of government if long-term benefits are to be gained. As the demand increases on traditional emergency organisations, exit strategies must become mandatory elements of our planning. Therefore the planning to hand-off to other government and non-government agencies will need to be deliberate and start as early as possible. This more comprehensive approach will also place an onus on governments to convince the domestic constituency about the benefits of active, long-term involvement with the developing world.

Currently, in the Australian context, there is an excellent opportunity for the Government to be informed on these issues through the community consultation process on defence and security issues that is being undertaken by the team led by Andrew Peacock. And I would encourage everyone to contribute to that process. It should lead to a better understanding between the Defence and non-Defence community and a more open debate on what is required and appropriate to secure our interests and to meet future challenges.

There is a real need for our community to understand that there is a whole range of commitments involved in successfully solving our security concerns in our region, and indeed, around the world. Furthermore, there is no doubt that security and economic development are linked. This requires us to address our security concerns across, not only the government, but also the nation, in a coordinated way to maximise the chance of success. Moreover, we must work with responsible members of the international community on these issues, too.

In many ways this approach is already under way. Australian governments have for some time been very vocal advocates for the region through good times and bad. Examples include Cambodia, Bougainville, the IMF, and tsunami and drought relief. However,

we will need to do better at creating a continuum between the traditional elements of security and the 'softer' sectors of the new security environment.

Our response to regional tensions typically takes the form of aid and, depending on the crisis, military intervention, with very little continuing integration between the two once events take a turn for the worse or the initial crisis is over. There are currently few processes to link the two at the policy level and it is usually left up to the people on the ground to work out suitable arrangements. This ad hoc approach does not always result in the efficient and effective delivery of assistance in the sometimes long transition to peace and stability.

I also believe that there is a role to be played by Australian industry. In Australia, we enjoy a level of transparency and accountability in business that can give us the confidence in the ability of Australian organisations to play a positive role in developing countries. The efforts of our telecommunications carriers in East Timor is one such example.

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By working collaboratively to create stable, democratic nations in our immediate region, we can simultaneously improve our strategic environment and create the pre-conditions and stability required for nation building. If left unchecked, power vacuums, institutionalised injustice and economic stagnation become a recipe for declining security for everyone concerned. Hence the relevance of our topic today—food, water and war.

The Australian community already has a long history of supporting our alliance and United Nations obligations. The East Timor deployment clearly demonstrated the Australian public's expectation for us to continue that approach. However, I do not believe that there is a comparable understanding or appreciation in the community for the non-military aspects of our commitment to the East Timorese people. After the hand over to the United Nations Transitional Administration in East Timor (UNTAET) in February, there was a palpable sense in the Australian community that our job was done, and that the deployment of our defence force was the sum total of our involvement.

As you would know, this is clearly not the case. The Australian Government and non-government agencies will, in unison with UNTAET, provide long-term development and aid assistance well into the future. The involvement of the ADF is only one dimension. As an example, AusAID and the Australian Centre for International Agricultural Research (ACIAR) are assisting with the rehabilitation of East Timor's agricultural sector. This is a crucial body of work which can ensure a successful transition of the East Timorese to nationhood if successful.

It is worth noting that the Australian defence personnel serving in East Timor are currently doing their bit, too. They are facilitating a range of activities from confidence building on the border, to delivering food to schools, repairing roadworks and basic infrastructure, and helping out in specialised areas such as communications, which cannot always be met by aid agencies.

The lessons from East Timor, Bougainville, Cambodia and Somalia are clear. If we are to play a role in bringing security and prosperity to nations under stress then the commitment will be far more complex than just a military response—which I might add is complex enough!

East Timor has again demonstrated the truism that security is a necessary precondition for economic and social development. Once a society has descended into destructive violence, none of the public works, health assistance, or food aid is going to work until there is basic security for the population.

On the other side of the coin, however, just as much effort and resources should go into using our experience to assist our neighbours to prevent these situations spiralling into inevitable military conflict. To cite some relevant cases: sudden increases in food prices led to riots in Indonesia in 1998; environmental concerns are a cause of on-going tensions in West Papua and Bougainville; and, most recently, the events in Fiji and the Solomon Islands are partly the result of disputes over access to profitable land and resources.

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As such, the need for a strong sophisticated ongoing role in our region is all the more apparent. I believe Australia is well positioned to confidently grasp this opportunity.

The Role of the ADF in the New Security Environment

This brings me to what I see as the specific role for the ADF within this more complex security environment.

In the military sense the ADF has been at the vanguard of regional engagement over many years. I believe the men and women of Defence have made a real contribution alongside other government and non-government agencies to fostering peace and stability in our region.

Since the 1950s we have been actively involved in military exchanges, defence cooperation programs, joint training and operational deployments through such initiatives as the Five Power Defence Agreement, and information sharing.

We have been a learning organisation, too. In many ways, Defence has been in the lead pack, which has included the

business sector and other government agencies, in creating long-term relations of trust and understanding throughout the region. Capitalising on this unique skills base in Defence is a valuable dimension of any government's strategy for constructive engagement with the region.

But it is becoming expected in our communities that professional military forces will have the flexibility to make major contributions in operations other than war, deploy for long periods of time to stabilise the security situation in the post-conflict environment, and to deal with unconventional forces and non-State actors such as refugees, illegal immigrants, smugglers and criminals. The ADF is no exception.

It has played, and will continue to play, a positive role in nation-building and inter-agency cooperation in our region. This is an enormously valuable and sophisticated contribution to our Government's ability to operate effectively in a complex security environment.

Today, in addition to our core military skills we are also expected to provide humanitarian assistance, whether it be protecting the welfare of non-combatants, performing basic law and order tasks, arms monitoring, mine-clearing in the post-conflict period, or distributing basic medical and food aid. We have shown on numerous occasions that one of our strengths is relating successfully with local people and helping them help themselves to improve their lot.

Before the East Timor deployment, I made the comment that 'While there is no doubt that our core business is to provide traditional military options to Government, the Defence Force has also become an important resource which provides Government with a range of options not associated with force-on-force considerations.' In short, we have a dual role—we must actively work for peace, as well as prepare for war.

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Whether we like it or not, armed force is still a dominating feature of international relations. Military capability is still a major determinant of a nation-state's ability to influence events and outcomes.

If Australia is to shape regional development in favour of security and prosperity, then we need to ensure our place at the negotiating table and our ability to act in times of crisis. That will require an appropriately structured ADF. As I have argued, it will also depend on the degree of cooperation between the military and non-military dimensions of our security policy.

Conclusion

History has shown us that better access to life's essentials, basic infrastructure and political democracy diminishes the likelihood of inter- and intrastate conflict, although it can never dismissed outright. But, as we all know, the road to development is a difficult one.

In his book, 'Preparing for the 21st Century' Paul Kennedy points to a more fractured and unpredictable world despite the absence of the large state-on-state conflicts that typified the 20th century. The lesson is clear—we must be prepared to do more, rather than less, to maintain peace and security.

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The key question before this conference is how much investment in 'security' should be made in areas like access to food, agricultural development and the environment, which lie outside the classical military dimension. I believe that as our appreciation for the new framework for security grows, governments will be more inclined to explore the possibilities of creating a closer relationship and mission between defence forces, aid organisations and development agencies. This need will become even more demanding as we see an increase in the number of defence forces deployed in pre-emptive, multi-agency operations aimed at addressing basic humanitarian needs.

What is absolutely clear, is that Australia has a role to play in nation building and security in our region. By way of our material advantages and our conviction as a nation concerned with human rights, this will inevitably involve both military and non-military components. That is why I am looking forward to the outcomes of the conference. The aspects of the security debate which are the special focus of this conference have real relevance to government and the future conduct and capabilities of the ADF.

Because there is no doubt in my mind that it does not matter how much research we do, or how many resources in particular areas we devote to these challenges, if we have no comprehensive and coordinated national and international security and law and order mechanisms to address these fundamental problems of human behaviour, they will not be solved.

I thank you for giving me this opportunity to make my contribution.

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Cultivating Peace

Dr Indra de Soysa

In the report, 'To Cultivate Peace: Agriculture in a World of Conflict' (de Soysa & Gleditsch 1999), my co-authors and I examined the ways in which food production was related to the outbreak of civil violence. We concluded that conditions affecting agriculture were important for understanding how conflicts, which are overwhelmingly located in rural settings, can be generated and sustained. Our conclusions are that an overall policy environment that harms agriculture determines the degree to which the loss of livelihood occurs, which in turn affects the opportunity structure of individuals and groups for engaging in armed conflict which is primarily located among the poorest countries. Food is an important part of the entitlement set of poor people and high food prices are usually associated with urban riots.

In this paper I will focus on the loss of livelihood in rural society as a cause of endemic violence. The basic argument is that the loss of livelihood lowers the opportunity costs of a large segment of the rural population for joining violent movements. In our 1999 report we compiled a list of conflicts that had obvious links to the primary sector around such issues as land distribution. It is clear, however, that such issues are not the sole drivers of all armed conflict.

Our critics argued that conflict is usually a result of a complex of factors and that we unduly vilified poor people in rural communities for being the primary initiators of conflict. I welcome this opportunity to set the record straight. Conflict is most often initiated by elites (rural or otherwise), but the people who actually form the armed groups, and are perhaps the net losers, come from the poorest segments of society. It is this factor that is ultimately important for understanding the endemic nature of conflict in some settings. Poverty and stagnation in the countryside allows

'conflict entrepreneurs' to engage in warfare on the cheap. In other words, the ready availability of manpower (or cannon fodder) is what makes conflict endemic. There are an infinite number of causes around which to organise violence, but such costly actions happen only if they are 'feasible.' Today, I want to reiterate the centrality of the livelihood explanation for understanding conflict from an economics approach to studying the causes of civil war. It is such an understanding that potentially serves policymaking best. First, I will briefly outline the nature of the problem.

During the first decade of the post-Cold War period (1989–1999), intrastate conflicts accounted for the bulk of violence. Out of a total of 108 armed conflicts in 73 locations around the world, 92 were purely domestic conflicts, with 9 classified as 'civil wars with foreign intervention' (Wallensteen and Sollenberg 1999). During the same period there were only 7 interstate conflicts. Most of these conflicts have been at relatively low levels of violence, while many of the intrastate conflicts have been comparatively quite bloody. Of the 92 intrastate conflicts, 47 are classified as having had at least 1000 battle-related deaths, signifying the intensity of fighting. The UNDP (1999) and World Bank (1998), however, estimate that as much as 90% of the casualties in recent conflicts have been civilian, mainly women and children. As we speak, there are more than 35 conflicts going on around the world. These conflicts are taking place within some of the poorest countries.

…as much as 90% of the casualties in recent conflicts have been civilian, mainly women and children. As we speak, there are more than 35 conflicts going on around the world. These conflicts are taking place within some of the poorest countries.

It is impossible to tackle the problem of development failure without tackling armed conflict. Conversely, it is quite clear today that we will fail to contain conflict if we do not tackle problems stemming from the failure of development. From this perspective, it becomes clear quite quickly that ignoring the role of agricultural development would in fact be fatal. Let me summarise the changing views on the causes and nature of internal conflict and link some relevant empirical findings on the causes of civil war. These suggest that improving conditions facing agriculture and thereby the livelihood of rural society could help greatly to break the vicious cycle of poverty and violence.

Economic Stagnation and the Viability of Conflict

Armed conflict is not some autonomous process of human interaction, nor is it automatic, but results from individuals making a conscious set of decisions to undertake such a course of action. It is often forgotten that there are agents behind the phenomenon. People who participate in violent action decide on that particular course of action over alternatives. Why may this be so? Conflict as

a strategy requires organisation and is costly, in terms of both materiel and psychological costs. Thus, the pay-off from a strategy of conflict must in fact be greater than alternative courses of action. If one thinks in terms of economic gain, then conflict is one strategy with which individuals seek to be better off. Some (Collier 2000; de Soysa 2000) have framed such thinking in terms of 'loot-seeking', as opposed to 'justice-seeking,' which is selfless and thus occurs regardless of unbearable costs. Conflict may also be a strategy for seeking 'justice', if all other less costly alternatives are unattainable. The problem with justice-seeking conflict is that individuals who are faced with the decision of engaging or not engaging in violence have a strong incentive to free ride, since justice is a public good. Despite this logical problem, the standard wisdom is that conflict is driven purely by grievance and irrational hatreds, not rational expectations.[1] Conflict occurs and recurs because some stand to gain enormously from using violence, often at the expense of the many. It is little wonder that two out of three peace processes in the post-war years have broken down and resulted in continued fighting. War tends to benefit a few (who are well organised) at the expense of the many.

It is little wonder that two out of three peace processes in the post-war years have broken down and resulted in continued fighting. War tends to benefit a few (who are well organised) at the expense of the many.

Recent scholarship finds little evidence that objective grievance generating factors such as ethnicity and income inequality predict conflict. Rather, there is strong evidence to suggest that 'loot-seeking' is the most salient factor generating violent conflict (Berdal and Malone 2000). In the language of business, groups using violence as a strategy have to make this enterprise viable. At the same time, it is in fact in the interests of the largest segment of society to contain costly conflict, but this segment faces the logic of collective action.

'Peace,' like 'justice,' is a public good, thus individuals have an incentive to free ride. It is at this point that economic backwardness and stagnation, low social trust, poverty, and bad policies intersect in the explanation for conflict. Under these circumstances, economic payoffs from 'militarised' conflict rather than from regular civilian activity are more likely to be far greater. In other words, the conditions favour 'predation' over production. Simultaneously, under these conditions, state authorities are weak in terms of legitimacy, finances, military strength, and international reputation, and can only struggle to contain such activity, and the large segment of the population interested in peace face high organisational costs. To use a term in vogue among social scientists nowadays, 'social capital' and normal routine social

[1] I refer here to conflict as organised violence that results in large numbers of battle-related casualties, and not to large-scale protests and riots which happen more spontaneously, although they are often well organised.

defences are bound to be weak or non-existent. The obvious answer to this dilemma in a policy sense is to make peace more 'viable' than war. From this vantage point, rehabilitating the conditions facing agriculture and making the primary activities of the majority of people in poor countries profitable is likely to yield the highest dividends. First, however, how to explain the standard wisdom?

In the past, internal war was discussed almost exclusively in terms of rebellion and insurgency, and as highly orchestrated politico-military action against the superior power of a state. 'War', it was often said (after Carl von Clausewitz) 'was the continuation of politics by other means.' Ordinary peasants became the foot soldiers of collective movements that brought together disparate, disaffected elements by the promise of a revolution of the existing political and economic order. In Mao's words, it was 'a people's war'. Ideology was a potent factor in collective organisation for seeking justice.

The tactics of the insurgents were designed to capture the seat of government according to the principles of guerrilla war to change the 'corrupt' political order to addressing the needs of people. In military terms, therefore, the centre of gravity of guerrilla movements was located in the people, whose passive and active support constituted the lifeblood of these justice-seeking movements. Similarly, counterinsurgency strategies of governments were built on winning the 'hearts and minds' of the populace. For these reasons perhaps, the old insurgencies were relatively moderate in terms of the level of violence against non-combatants, the level of criminality, and the degree to which general injustice against non-combatants was practised by both sides. Both insurgents and counterinsurgent forces in general showed themselves up to the society at large to be the most desirable side to support, which intensified the war of words over deeds. Thus, conflict was 'politics by other means' which of course shaped the discourse of conflict.

The violence that was perpetrated in many instances was explicitly designed to win political support at home and abroad. In fact, one of the primary ways in which political entrepreneurs persuaded peasants to risk their lives for political movements was by providing selective incentives, which included various acts of benevolence and justice within rural communities (Popkin 1979). The old wars, although on the surface they seem to have been qualitatively different, can of course be explained by the same economic rationale. The discourse of ideology and grievance notwithstanding, these conflicts occurred because they were viable—most of them existed because of external funding and were in fact proxy wars of superpowers. For many conflict entre-

preneurs, such as Charles Taylor, Jonas Savimbi, and various Latin American guerilla groups such as the Contras, the payoff from a strategy of violence proved to be quite lucrative.

The end of the Cold War has had two effects on civil war situations around the world. First, they have ended because the cut-off of external funding has made many no longer viable (the largest decline in conflicts taking place in Central America). Secondly, many organisations have been forced to resort to self-financing through the criminalisation of war, which is one of the main factors that explains the appalling level of violence in today's zones of conflict.

The wars today are qualitatively quite different. Restraint in the use of violence has now given way to utter brutality, which is often committed on the most vulnerable of non-combatants (Project Ploughshares 1997; Carnegie Commission on Preventing Deadly Conflict 1997). In fact, violence and the threat of violence are 'business strategies.' Perhaps the long and bloody conflict between *Sendero Luminoso* (the Shining Path) and the Peruvian government foreshadowed what has followed. Although clothed in Marxist jargon and promises of economic and social emancipation for the Indian peasants of the Upper Hualaga valley, the Shining Path seems to have been motivated mainly by the desire to profit from supplying cocaine to the drug cartels in Colombia and Peru. A mixture of threat and rhetoric ensured the compliance of the Indian peasants. A similar pattern of apolitical violence occurs in Colombia between various guerrilla groups and military and paramilitary forces and is certainly the dominant feature of the warlord politics of Afghanistan, the numerous conflicts in Africa, and also of the conflicts that has involved Australia recently, such as East Timor.

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The violence in Sierra Leone and Liberia resembled gang-land warfare where youths armed with automatic weapons terrorised civilian populations and each other over the control of diamond mines and other natural resources that promised quick profit. It is said that organisations such as UNITA control over $4 billion in assets and benefit enormously from the war economies of the region. Resources much greater than that are controlled by warring groups in such disparate war zones as Afghanistan, Angola, Sri Lanka, Colombia etc. In many of these conflicts, violence is viable. The organisational barriers and the costs of war are surmounted because of this viability. If one thinks for a moment of what transpired closer to Australia in East Timor, the politics of the situation notwithstanding, the appalling level of violence was highly organised. It is suggestive of the potential losses that were faced by the criminalised elements who did not want to see an end to their highly profitable activities during the

period of control by the Indonesian military. Only such an analysis can shed light on the reasons for the complicity of some factions of the Indonesian armed forces in the violence there, armed forces that were ostensibly getting orders from civilian authorities in Jakarta.

Many of the new conflicts persist through pillage, extortion, illicit trade, labour exploitation, land grabbing, illicit resource extraction, and other criminal activities.

Many of the new conflicts persist through pillage, extortion, illicit trade, labour exploitation, land grabbing, illicit resource extraction, and other criminal activities. The mafia-style criminal activities common in most states of the former Soviet Union fit this pattern, as do narco-terrorism, gun-running, hostage-taking, and terrorism for hire by various organisations. While the underlying reasons for peasant dissatisfaction, such as the availability of land and threats to livelihood, may have carried over from the Cold War years, the new conflicts are integrally linked to conditions affecting the rural sectors. The new conflicts may be traced to the loss of livelihood, the hopelessness of surviving at the margins, and the alternative life of crime and banditry. The bulk of the rural population seem to be non-participant victims rather than active and passive supporters of utopian revolution, as has been the case in the past.

As David Keen (1998, 45) has written recently, for many of the unemployed youth, 'it may … be more dangerous to stay out of an armed band than to join one.' Ironically, the foot soldiers of much of the armed violence witnessed today might in fact just be trying to stay alive. Poverty and economic stagnation drive conflict because for many (especially young men), the use of violence ensures a 'pay-check'. In effect, these people are not 'free to choose'.

The new conflicts may be traced to the loss of livelihood, the hopelessness of surviving at the margins, and the alternative life of crime and banditry.

Taking advantage of dismal conditions in the countryside, conflict entrepreneurs make war on the cheap. Making agricultural livelihood viable will not only enhance the prospects of bottom-up development, but in the short-term it will raise the costs for 'warlords.' In fact, the South-East Asian region is already beginning to see the effects of the rationality of conflict in many of the conflict areas in this region. The situations in Burma, Cambodia, Indonesia, and the Philippines already contain very heavily criminalised movements who consistently use violence in their activities. Australian defence authorities would do well to heed the warning of rational expectations in conflict, despite the heavy discourse of ethnicity and ideology in many of these conflicts. These movements are viable because the terrain is suitable for escaping some of the cost of violence, which is that the likelihood of sanction by government troops is low (after all, piracy is a traditional occupation in the coastal areas in this region). However, the biggest problem is going to be the high

unemployment stemming from economic crises and the youth bulge. Good economic aid policies should be viewed in the long-term as good defence policies.

Amartya Sen (1999) views 'development as freedom,' and he explains freedom as an expanding set of choices for people, but as mentioned earlier, the optimum choice for many is still the use of violence. Clearly, development failure must be blamed for such a choice. I will leave it to those gathered here who are eminently more qualified than myself to explain the importance of agricultural development and food production for the development of other sectors. What many see today as 'bottom up' violence cannot be affected adequately until we address the problems of agricultural development.

Food aid may fill bellies in the short-term, but it is the comprehensive development of livelihoods that prevents aimlessness and rootlessness upon which all kinds of profit-seekers make violence on the cheap. In many respects it is not the handout of food aid that people need, and many have documented the ravages of such policies, but it is the comprehensive assistance that is necessary for self-help, which is the best strategy in the long-run. This is not just true for post-conflict reconstruction but also for pre-emption. The only viable path to peace is to help poor societies develop their own mechanisms of social defence. Australian defence policy will do well to adopt a proactive strategy for prevention, which, in the long run, is far cheaper than the cure. Ensuring viable livelihoods is the surest path to achieving this end. Food production is an obvious place to start.

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FOOD, WATER AND WAR: SECURITY
IN A WORLD OF CONFLICT

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Food, Water and Security: What are the Connections?

Alan Dupont

Food, like the soil, water, and atmosphere that sustain it, is a renewable resource. As with all resources food is linked to security by scarcity but the idea of 'food security' has many different interpretations. The UN World Food Programme defines food security to mean that 'all people at all times have access to safe and nutritious food to maintain a healthy and active life. Others, like Indra de Soysa and Nils Petter Gleditsch (1999), focus on agriculture's importance in alleviating poverty and the subsistence crises that drive internal conflicts in developing states. In their view, 'the inability to meet food requirements and other basic needs drives people to adopt alternative survival strategies, one of which is to join rebellions and criminal insurgencies.' The traditional security literature, on the other hand, is more concerned with the possibility that food-rich states might use food as a 'weapon' in pursuit of foreign policy goals, reflecting a wider, historical concern about dependence on foreigners for strategic resources (Christensen 1977).

What is the Concern about Food Security?

While all these themes feature in the contemporary debate about food security the overriding concern is that population growth, environmental degradation and rising demand for a range of essential foodstuffs will lead to future food shortages that could result in widespread political and social unrest. The world is expected to consume twice as much food in the next 50 years as it has in the past 10,000 years. In order to meet this need, world grain production will have to increase 40% by 2020. Some food economists believe that this target can be comfortably met through trade and the promise of modern biotechnology, exemplified by advances in genetically modified (GM) food. However, there is good reason for caution, if not scepticism, about

such best case scenarios. The corrosive effects of environmental degradation on agriculture and the fishing industry are often underestimated and just as frequently ignored. There has been a steady fall in grain yield increases since the spectacular improvements in productivity recorded during the agricultural 'green revolution' of the 1960s and 1970s and many species of fish, which are a vital source of protein, are over-exploited or in decline. East Asia's food problems are a microcosm of those of the developing world. The ability of East Asian governments to feed their people will have a major bearing on global food security because of the region's size, population and geostrategic importance.

Confounding the predictions of pessimists, food production actually outpaced population growth by 20% in the thirty years after 1960, causing average food prices to fall by 60% in the same period

Today's food security anxieties are redolent of those of an earlier era when there was also much apprehension about the emergence of a gap between future global food production and consumption. As populations began to soar in developing countries, and incomes rose in the wealthy, it was argued that more grain would be needed both as a food staple and to feed the growing demand for animal protein associated with more affluent diets. If these demands could not be met, there were fears that violent conflict over diminishing food supplies would result. A major 1974 UN conference on food held in Rome captured the prevailing mood of the time. Pessimists predicted that steeply rising food prices and free-falling food stocks were harbingers of a looming food crisis that would result in mass starvation in the absence of urgent remedial action.

None of this came to pass, however, largely because the green revolution dramatically improved crop yields in the developing world. Confounding the predictions of pessimists, food production actually outpaced population growth by 20% in the thirty years after 1960, causing average food prices to fall by 60% in the same period. Both seafood and grain output registered healthy increases. The seafood catch went from 22 to 100 million tonnes between 1950 and 1990, while grain production virtually quintupled in the 20th century, from 400 million tonnes in 1900 to just under 1.9 billion tonnes in 1998. Much of this increase was due to the expansion of agricultural land and technological advances in farm machinery, higher yielding grain varieties, the use of fertilisers and the spread of irrigation. Chemical fertilisers accounted for 40% of the growth in grain production while land under irrigation has increased six-fold since 1900 (Brown 1995).

By the mid-1990s, however, the green revolution had largely run its course.

By the mid-1990s, however, the green revolution had largely run its course. Agricultural and marine yield increases had begun to slow or stagnate, while demand continued to spiral upwards. In 1994, only four years after record global grain and marine harvests, the UN observed that:

'Global agriculture's steady gains in production over the past

several decades have not fully overcome the problem of rising demand caused by soaring population growth and uneven production progress among regions. The challenge is immense: by the year 2050, global demand for food may be three times greater than today. Moreover, during the past two decades the production growth rate has declined, dropping from 3 percent annually during the 1960s, to 2.4 percent in the 1970s and finally to 2.2 percent in the 1980s. In 1991, global agricultural production actually fell, the first decline since 1983…'(World Resources 1994–95).

The challenge is immense: by the year 2050, global demand for food may be three times greater than today.

The UN's Food and Agricultural Organization (FAO) reported in 1996 that per capita food production had declined in over 50 developing countries since the mid-1970s, while food imports had increased. In the same year, the Rome Food Summit reminded the international community that, despite optimistic predictions made by Henry Kissinger in the 1970s, that within a decade no child would go to bed hungry, some 840 million people still suffered from malnutrition. Without more determined action, 680 million people are forecast to be without sufficient food to meet their basic nutritional needs in 2015. Population pressures account for some of the decline in per capita food production while rising living standards have increased the overall demand for food, especially grain. By the late 1990s, crop yield increases had begun to level off as technology was diverted to the higher priority areas of information technology, telecommunications and urban infrastructure. After rising by 38% in the three and a half decades between 1950 and 1984, per capita grain production declined by 7% between 1984 and 1998. Demand, on the other hand, continues to climb. As a result, net cereal imports by developing countries will probably need to almost double by 2025 to around 200 million tonnes while meat will have to increase eightfold.

Without more determined action, 680 million people are forecast to be without sufficient food to meet their basic nutritional needs in 2015.

Environmental degradation has played a central role in slowing the growth in food productivity by reducing the global 'carrying capacity' of the land and sea, defined by Paul Ehrlich as 'the number of people that the planet can support without irreversibly reducing its capacity to support people in the future'. Rampant commercial and industrial development, soil erosion and loss of soil fertility through over-logging and intensive pesticide use have led to the steady disappearance of farmland. It has been estimated that nearly half the 29 million tonnes gained every year from advances in technology and investments in irrigation, fertiliser and other inputs, is lost because of environmental degradation. Since 1981, the area given over to grain production has shrunk from 732 million hectares to 690 million hectares, while the per capita grain area has halved. Protein derived from fish and other marine resources is under threat from pollution and over-fishing. Less

water is available for irrigation globally because of falling water tables and the insatiable demand of urban dwellers and industry for fresh water. The green revolution ultimately petered out because it transgressed many of the principles of sustainable development. There was too much reliance on irrigation, chemical fertilisers, pesticides and expensive farm equipment that were not compatible with the environment or the needs of poorer countries.

The green revolution ultimately petered out because it transgressed many of the principles of sustainable development.

East Asia's Food Situation

Food availability in East Asia has closely paralleled global trends. From 1960–1990, food production exceeded population growth. Grain output doubled in China, Indonesia, the Philippines, Vietnam and South Korea in the twenty years between 1970–1990 and East Asian cereal production averaged 270 kilograms per person, 46 kilograms more than the world average. Asia increased its share of world cereals by 8% in 1966–1990, from 33% to 41%, and rice yields rose by over one third, from 2 tonnes to more than 3 tonnes per hectare. However, these gains slowed significantly during the 1990s. At the end of the decade over 500 million Asians did not have enough to eat, due to chronic poverty, population pressures on agricultural land and environmental degradation (Takahashi 1997).

Although less important than it once was, rice is still a vital food staple providing 60% of the carbohydrate and second class protein consumed by Asians. By 2020, East Asia will need to produce 50% more rice than it did in 1998, but the region's rice yields have levelled off or declined from their peaks in the 1980s. Asian rice production in 1998 was 526.3 million tonnes, 16 million tonnes less than 1997, a fall which prompted a warning from the FAO that the region's food security is precariously balanced. Few regional states seem likely to achieve self-sufficiency in rice. Population growth in the Philippines is expected to outpace rice production early this century. Domestic shortfalls have forced Manila to import increasing quantities of rice since the late 1980s. After briefly attaining rice self-sufficiency in the mid-1980s, Indonesia has returned to its previous position as the world's largest importer of rice as well as becoming an expanding market for other food staples. By 2025, China may have to import as much grain as the world produced in 1998.

By 2020, East Asia will need to produce 50% more rice than it did in 1998, but the region's rice yields have levelled off or declined from their peaks in the 1980s.

Fears about the impact of China's rising demand on world grain markets lie at the heart of the debate about food security in East Asia. Lester Brown, the iconoclastic President of the Washington-based Worldwatch Institute, argues that China may soon emerge as 'an importer of massive quantities of grain—quantities

so large that they could trigger unprecedented rises in world food prices.' As China's consumption patterns change and the Chinese eat more livestock products and grain, subsequent price rises will overwhelm global markets, causing widespread shortages and 'an unprecedented degree of insecurity', especially in the developing world. Thus food scarcity, 'rather than military aggression' will become the principal threat to security. (Brown 1995)

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In support of these conclusions, Brown points to the four-fold expansion of China's economy since 1979. Never before in human history have the incomes of so many people expanded at such a rate. As incomes rise, China is beginning to follow the same pattern of consumption as wealthier Japan, Taiwan and South Korea, all of which diversified their diets away from a starch staple, rice, to one that included much greater consumption of meat, eggs, milk and other livestock products. However, it takes two kilograms of feed grain to produce a kilogram of poultry; pork requires four kilograms of feed and beef needs seven. Brown calculates that if 1.2 billion Chinese eat more of these products, as seems likely, the country's grain imports will outstrip the world's exportable level of grain, driving up prices. 'In an integrated world economy, China's rising food prices will become the world's rising food prices. China's land scarcity will become everyone's land scarcity.'

Brown is not the only one to take a pessimistic view of China's capacity to feed itself. The Czech economist, Vaclav Smil, has documented in considerable detail China's loss of farmlands to environmental degradation. Smil calculates that 40 million hectares of farmland have been denuded since the 1950s, approximately the equivalent of all the fields in Argentina and enough to feed 350 million people. With one-fifth of the world's population, but only one-fifteenth of its arable land, China can ill afford losses of this magnitude. Changing farming practices, such as substituting synthetic chemicals for natural fertilisers, have exacerbated the problem by moving 'China's agroecosystem further away from sustainable practices' (Smil 1996). Even Beijing concedes that a land crisis is approaching as farmland loss reaches record levels. In February, 1995, Jiang Chunyun, a member of the Communist Party Central Committee conceded that: 'In the long run, China's agriculture faces, on the one hand, the tremendous pressure of population growth and fast improvement in living standards and industrialisation and, on the other, the severe restrictions imposed by a dwindling farmland, shortages of water resources, and a weak infrastructure.'

Even Beijing concedes that a land crisis is approaching as farmland loss reaches record levels.

Is a Food Crisis Likely?

Although recognising that ensuring sufficient food production is a long-term challenge, the Chinese Government has hotly disputed Brown's contention that the country is on the verge of a food crisis and points to the bumper grain harvests the country enjoyed at the end of the 1990s (Information Office 1996). In 1999, Premier Zhu Rongji optimistically declared that China had put an end to the situation of chronic grain shortages. Chinese spokesmen have complained that Brown's arguments are merely a further example of the West's reluctance to come to terms with China's rising power. Most Chinese economists, while agreeing that demand is likely to rise roughly in line with Brown's forecasts, contest his judgement that there is little scope for increases in grain production. They argue that China only has to lift its annual production of grain by 1%, which would see grain production rise from 500–640 million tonnes by 2030 when the country's population reaches its peak population of about 1.6 billion. In their assessment this target is attainable from either an economic or technical point of view based on the past performances of the country's agriculture and the potential of resources. The Chinese predictions are generally in line with those of the majority of international food economists. The consensus of these experts is that while developing countries will increasingly become net importers of food, there will still be an increase in global food production into the 21st century, with cereals expected to grow at a rate of about 1.5 % per annum. Pessimists, on the other hand, believe that the growth in cereals will not exceed 1%.

Brown's focus on trends in grain production obscures the fact that China has been a net exporter of food since the mid-1980s, more than offsetting its imports of grain. The country's net food exports were valued at $2.3 billion in 1985 and had increased to $3.8 billion in 1995. By the mid-1990s, China imported only 0.4 % of its annual grain requirements, down from 3% in the early 1980s. Grain imports are expected to rise to somewhere between 5 and 10 per cent of demand but they will be offset by increases in the production of other agricultural commodities. There is, therefore, considerable reason to question the worst case predictions of a major food crisis developing in China and other developing East Asian states. Given sufficient political will by governments, and financial incentives for farmers, shortfalls in food production could be avoided. The US Department of Agriculture has argued that, were China to adopt world-class agricultural technology, it could improve yields by as much as 30%. The Chinese government calculates that 10 per cent of the nation's grain crop is lost due to mishandling and inefficiencies in administration and distribution; other analyses put the losses as high as 30

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%. If Beijing can halve these losses, it could reclaim 20 million tonnes annually for consumption by 2030.

While Brown and his fellow pessimists may have overstated their case there are, nevertheless, grounds for concern that the balance between supply and demand is more delicately poised than many food economists are prepared to admit. At first glance, the apparently small discrepancy between low and high estimates of cereal production seems relatively minor and hardly the basis for concerns about the world's ability to feed itself. However, the difference becomes quite critical when compounded over several decades, producing a far less sanguine food outlook than optimists envisage. Chinese estimates of future grain output exceed those of many independent studies by a sizeable margin while its projections for grain imports are understated. A major Sino-US research project on China's future food, which reviewed the major models used to calculate Chinese grain needs, concluded that China will need to import increasingly large quantities of food over the next 25 years.

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Highlighting the uncertainties about making accurate long-term food projections, given the number of variables involved, the project nevertheless assessed that China would be forced to import between 50–200 million tonnes of grain a year by 2020. Since the current world grain market averages around 200 million tonnes, China's grain requirements will clearly have a major impact on the world grain market. China cannot be self sufficient in food grain as well as feed grain and livestock. With demand for beef, pork and poultry all rising there will have to be a trade-off between grain self-sufficiency and domestic meat production. Chinese subsidies costing nearly $25 billion keep the cost of domestic grain artificially high and obscure the fact that a large percentage of Chinese grain exports bring in only about one third of what they actually cost to produce. Millions of tonnes of Chinese hybrid rice are barely edible and go to waste. (Asia 2000 Year Book)

The FAO believes that China and East Asia's looming food shortfalls could be met by increasing domestic production and earning sufficient foreign exchange to import the rest. However, relying on the market carries its own risks. It assumes that the export earnings of regional states will be sufficient to meet the cost of importing food. As the Asian economic crisis demonstrates, sudden economic collapse and deteriorating foreign exchange rates may preclude the import of expensive foreign food. In addition, food projections are particularly sensitive to the assumptions on which they are based. For example, a 10% fall in expected wheat yields, or a 20% increase in rates of population growth

would probably result in a price rise of 30% in the cost of wheat (Hunter 1997). Relatively small changes in world output may thus generate large changes in volume and price fluctuations. As the gap between global supply and demand for a range of primary foods narrows, price volatility on world markets is likely to increase and will be exacerbated by the reduction in food stockpiles mandated by the implementation of the Uruguay Round Agreement. Without the moderating influence of substantial grain stocks, a confluence of unfavourable political, economic and climatic influences could create local scarcities. Higher prices weaken current accounts as governments strive to maintain prices at affordable levels in order to avoid sparking food riots and domestic unrest. This was precisely the situation Indonesia faced as the economic crisis took hold in early 1998, eventually forcing President Suharto's resignation.

Food security is considered so important that it has been designated as one of the six major policies designed to achieve comprehensive national security.

Food economists are inclined to ignore or discount the widely different national approaches to food security. For historical and cultural reasons Asian states commonly equate minimum levels of food self-sufficiency with national security. China and Japan, for example, promote measures aimed at achieving self-sufficiency in basic foods, especially rice, and rely upon strategic food stockpiles to manage price fluctuations. As one Chinese economist has argued 'it is imperative for the government to ensure a high rate of grain self-sufficiency as a necessary condition for stability'. With a rural labour workforce of 400 million and mindful of the lessons of its own history, China sees grain production as crucial to maintaining the incomes of farmers and stimulating employment in the countryside. Japan, although an inefficient producer of many primary foodstuffs, has resisted fully opening its agricultural markets for domestic political and security reasons. Food security is considered so important that it has been designated as one of the six major policies designed to achieve comprehensive national security. East Asia's approach to food is further complicated by its symbolic and cultural importance. Rice is seen by many Asians as possessing a 'spiritual' quality that transcends its simple nutritional function.

By one estimate China alone loses 12 billion kilograms of food each year from polluted farmland.

The more optimistic forecasts of East Asia's future food production have failed to factor in the detrimental effects of environmental degradation. More than a quarter of Asian farmland is either moderately or severely degraded, 'the victim of over-cultivation, soil erosion, salinisation of irrigated lands and desertification' (Rambo 1997). By one estimate China alone loses 12 billion kilograms of food each year from polluted farmland. Even if it were possible to put more land under cultivation the increase would be marginal and add little to levels of food production. Biotechnology is the key to improving yields and

reducing the cost of expensive fertilisers and pesticides. Genetically modified organisms (GMOs) offer the promise of higher yielding crops that are disease resistant and require minimal or no pesticides and chemical fertilisers. They may also be genetically enhanced to include nutritional supplements for communities that are deficient in vitamins and iron. Although the East Asian track record in using and adapting biotechnology is poor, GM crops are probably the region's best hope of reversing falling yields and attaining the order of magnitude increases in food production that will be required this century. Modern transgenic technology is particularly suited to the tropics because it can help to reduce the huge crop losses (often amounting to 30%) from insects and plant disease.

Although the East Asian track record in using and adapting biotechnology is poor, GM crops are probably the region's best hope of reversing falling yields

However, it is doubtful whether biotechnology is yet capable of creating another green revolution. The main contribution of genetic research to agriculture in the foreseeable future will be to make plants more resistant to disease. Despite impressive advances, current biotechnology is beginning to approach the upper limits of the yield increases that can be obtained in cereals. Although new rice strains being developed at Los Banos in the Philippines are expected to improve yields by 10–25%, increases of this order are still well short of the 250% gain in yields obtained in the second half of the 20th century and they may not be enough to arrest the decline in per capita grain production that has occurred in the 1990s. So far only the United States, Argentina and Canada are making extensive use of GM seeds. The backlash against globalisation that was evident at the 1999 World Trade Organization Meeting in Seattle suggests that GMOs are likely to be aggressively opposed by a coalition of environmental groups, NGOs and some European governments. Opposition to GMOs has already spread to East Asia. Although China and Singapore look set to wholeheartedly embrace the new technology, consumer movements and leftist groups in Japan, Thailand and the Philippines are demanding controls on the use of genetically modified crops, while religious factors may proscribe their use in Muslim Indonesia and Malaysia.

Perhaps the greatest constraint on future food production will be the availability of water for irrigation. The expansion of land under irrigation has been a boon to agriculture and a major factor behind the impressive rates of growth in grain production recorded during the 20th century. In the first half of the century, irrigation doubled from 48–94 million hectares, and then virtually tripled again to 260 million hectares by the end of the 1990s, allowing multiple cropping, higher yields and turning previously arid areas into productive farmland. Irrigation now accounts for some 40% of world food production. However, irrigated land per

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person has declined since 1978 and will continue falling for at least the next half century because of population growth and natural limits to the amount of usable water. Water tables are dropping across the globe and major rivers are beginning to run dry before they reach the sea as their flows are tapped for hydro-electric power and irrigation.

The reduction in the water flow of China's Yellow River is a warning of the fate that awaits other major river systems in Asia should usage exceed sustainable levels. The Yellow River provides a significant proportion of central China's irrigation requirements and food production. After flowing uninterrupted for thousands of years the Yellow River ran dry in 1972 for the first time in recorded history and then flowed intermittently in every year between 1985 and 1997. Water shortages are likely to affect food production in East Asia more than any other region of the world because of the greater dependence of Asian states on irrigation for growing rice and cereals. China, for example, relies on irrigation for almost 70% of its grain harvest. In an era of declining water availability East Asian governments will have to carefully choose how they allocate what was once an abundant resource. In a contest between agriculture and industry, the other main user of water, agriculture may be the loser because water used for irrigation generally produces a smaller economic return than water diverted to industry.

After flowing uninterrupted for thousands of years the Yellow River ran dry in 1972 for the first time in recorded history and then flowed intermittently in every year between 1985 and 1997.

Food Shortages in North Korea

Marxist and isolated North Korea is the most troubling example, in East Asia, of a state chronically unable to feed its people. Televised images of peasants scouring the countryside for edible roots and grass in the mid-1990s first alerted the world to the possibility that North Korea was suffering food shortages. Reports of widespread starvation were initially discounted, partly because of suspicions that Pyongyang was playing upon the sympathies and fears of its neighbours and the wider international community to extract political concessions and food aid in a bid to strengthen its hold on power. The regime's obsessive secrecy and the lack of even rudimentary data on the population, economy and agriculture also made it difficult to judge the seriousness of food shortages.

Nevertheless, by 1997, it was clear that North Korea was in the throes of a prolonged and severe famine, the worst in its modern history. The state's food shortfall had increased steadily throughout the 1990s, and was compounded by adverse weather conditions in 1995–97. Cereal harvests in this period were consistently 1–1.5 million tonnes short of the 5 million tonnes needed

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to provide a minimal level of calories. The country recorded a grain shortfall of about 1million tonnes in 1996, with the average diet down to a little over one bowl of rice a day. In 1997, at the peak of the famine, North Koreans were subsisting on a daily ration of 100 grams of corn, one-fifth of the daily minimum requirement. According to the UN's WFP, many city-dwellers in North Korea were receiving only 15% of the daily ration given to refugees in Africa's camps. Some 800 000 North Korean children were malnourished, 80,000 of them seriously. This was despite the fact that international relief agencies spent more than $1 billion on food aid for North Korea between 1995–1998. By 1999, an estimated 2–3 million people, or between 10–15 per cent of North Korea's entire population, had died from malnutrition and starvation.

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The seeds of North Korea's food problems were sown decades earlier, when the *juche* (self-reliance) philosophy was first developed by 'Great Leader' Kim Il Sung. It is, however, doubtful whether North Korea could ever have become self-sufficient in staple foods given its generally inhospitable terrain, climate and population density. Deep-seated flaws in agricultural policy were compounded by the decline in the non-agricultural sector, which reduced the availability of key fertilisers, agricultural machinery and irrigation flows. Overshadowing this policy failure was a number of self-inflicted environmental disasters. Collectivisation was accompanied by large-scale land clearance and deforestation designed to expand the area available for cultivation. Once trees had been felled, rain washed away a large proportion of the replacement crops, causing soil erosion and serious flooding. The rate of deforestation accelerated as peasants felled trees for fuel, chemical fertilisers were over-used and soil fertility decreased. By the mid-1980s, exhausted soils had forced North Korea into dependence on food imports, sowing the seeds of the famines of the late 1990s (Natsios 1999). Without major agricultural reforms North Korea will be unable to feed its people, but improvements are unlikely while Kim Jong Il remains at the helm of the North Korean ship of state. Fundamental economic reform would risk ushering in political change that could well prove fatal to Kim's regime.

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Fish Shortages

North Korea aside, the relationship between food scarcity and security is most evident at sea. Asians are heavily dependent on the Pacific Ocean for food and it has been aptly described as the region's 'rice bowl' for the 21st century. Fish is the main source of protein for an estimated one billion Asians and fishing supports

more people than in any other region of the world. Over half the world's fish catch is taken in Asian waters, and five of the top ten fishing nations are in East Asia. Unfortunately, the Pacific is showing signs of environmental degradation from coastal pollution, over-fishing and unsustainable exploitation of other forms of living marine resources. Asia has already lost half its fish stocks. The depletion of fish species is a major concern in the North-west Pacific, which provides nearly one-third of the world's marine harvest. Fish yields in the Yellow, South and East China Seas fell significantly in the 1990s (Asia 1997 Yearbook).

The decline in East Asia's reserves of fish is part of a worrying global trend.

The decline in East Asia's reserves of fish is part of a worrying global trend. In the past 50 years the world's fish catch has risen five-fold, but because of increasing demand per capita fish consumption has remained virtually unchanged since the late 1960s. It is clear that many fish species are now at risk. In 1994, a World Bank study concluded that 'the current harvesting capacity of the world's fleet far exceeds the estimated biological sustainability of most commercial species'. According to the FAO, around two-thirds of the world's major fish species are either fully exploited or in decline. Another 20–30 million tonnes of fish will probably be required to meet demand by 2010, a target that will be difficult to achieve as over-fishing and poor fisheries management threaten the ability of many species to recover and regenerate (Feidi 1999). While aquaculture may meet some of the shortfall in supply, it is unlikely to become a substitute for marine fishing. Fish farming requires far more resources than harvesting fish caught in the wild; depends on an adequate supply of fresh water, which is in increasingly short supply; and can cause significant environmental damage.

… 'the current harvesting capacity of the world's fleet far exceeds the estimated biological sustainability of most commercial species'.

State subsidies, illegal, unregulated and unreported fishing (IIU), flag of convenience operations and the expansion in fishing fleets are exacerbating the global and regional shortage of fish. Despite clear indications that world fisheries are in trouble, governments still provide $45 billion worth of annual subsidies to their fishing industries. The practice of registering ships in countries that are not signatories to fish management regimes and treaties allows owners to fly flags of convenience and complicates efforts to control IIU. 136 000 new ships have been added to the world's fishing fleets since 1989, accelerating the decline in fish numbers and causing prices to rise, a sure sign of scarcity. In 1998, the bulk of the 1.2 million vessels in these fleets operated in Asian waters. China alone has an estimated 450 000 fishing boats and like many other Asian states has developed a sizeable deep water fishing fleet.

Conflict over Fish

As traditional fishing grounds are exhausted, competition for remaining stocks has intensified. Countries which once welcomed foreign fishing fleets now restrict their access and quotas, while fishing nations have become much more protective of their own resources. In 1981, Japan, which relies heavily on fish as a dietary staple, was allowed to catch 1.2 million tonnes in the 200-mile US EEZ; by 1988, quotas had been cut virtually to zero. South Korea and Taiwan have suffered similar reductions, and their trawlers have been forced well into the South Pacific to make up the shortfall. The fishing fleets of South-East Asia have also been compelled to move further afield, and the Chinese seem likely to join the hunt for dwindling stocks by building more ocean-going trawlers. As fishing fleets grow and venture further into the Pacific, the area of ocean open to international fishing is shrinking. A large percentage of the marine resources of the Western Pacific are either claimed or contested. As a result, the frequency and seriousness of incidents at sea have steadily increased as foreign trawlers have illegally encroached into other countries' EEZs and territorial waters. Gun battles have broken out between the navies of regional states intent on defending the activities of their national fishing fleets or preventing perceived territorial violations by others.

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Fishing Disputes in South-East Asia

In South-East Asia, competition for fish and other living marine resources has historically been most intense in the Gulf of Thailand. With the third-largest fishing fleet in East Asia, Thai fishermen had begun to exhaust stocks in their traditional fishing-grounds by the late 1970s and to encroach into the EEZs and territorial waters of neighbouring states. In the 1980s and 1990s, seizures of Thai fishing vessels became more common throughout South-East Asian waters, particularly in the Andaman Sea, the Gulf of Tonkin, the Luzon Strait and in the waters off Indonesia. Illegal fishing by Thai vessels has been a worsening source of friction between Bangkok and its neighbours during the 1990s. In the Andaman Sea, hundreds of Thai fishing vessels regularly plunder Burma's EEZ. Burma's navy has minimal capability to protect the country's extensive coastline. The larger Thai vessels commonly carry heavy machine guns and rocket-propelled grenade launchers which they seldom hesitate to use if challenged. Thai fishermen also enjoy better intelligence information from radio centres that warn of approaching patrol boats. In late 1998 and again in early 1999, disputes over fish threatened to escalate into serious military confrontation between Thailand and Burma

following two fatal naval clashes which resulted in the deaths of several Thai and Burmese sailors. Both incidents occurred when Thai naval vessels intervened during Burmese attempts to intercept Thai fishing vessels in contested waters of the Andaman Sea. On the second occasion, the Thai National Security Council considered deploying a squadron of F-5 fighter aircraft to the area.

Since 1995, Thai fishing vessels have also clashed with the navies of Malaysia and Vietnam. On 31 May 1995, Thai and Vietnamese gunboats exchanged fire after the Thai Navy attempted to protect Thai fishing vessels from being seized by the Vietnamese Navy: a Thai fisherman and two Vietnamese sailors were killed and five of the six Thai fishing boats impounded, along with 62 of their crew. Bangkok was forced to caution its own fishermen about illegally fishing in Malaysia's territorial waters after 6 trawlers were impounded by Malaysia and 80 Thai fishermen were arrested in April and May of 1999. Thailand, which earned $3.4 billion from fish exports in 1993, may be the worst offender, but it is not the only culprit. The fishing vessels of virtually all South-East Asian states regularly intrude into neighbouring EEZs and territorial seas. Vietnam has fired on fishing boats from China, Malaysia and Taiwan, and the Philippines has seized Chinese and Taiwanese trawlers. The collision between a Philippines' naval patrol boat and a Chinese fishing boat which sank in July 1999 off the island of Palawan is a further illustration of the potential of these disputes to damage broader political and security ties. China condemned the Philippines' action and claimed that the fishing vessel was deliberately rammed (Asia 2000 Yearbook). In an earlier 1997 incident in which the Philippines arrested 23 Chinese nationals for illegal fishing it warned that Manila ran the risk of ruining the 'friendly relations' between the two countries.

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Fish are central to the Spratlys dispute; according to one UN study, the waters around the Spratlys yield 7.5 tonnes of fish per square kilometre a year. The abundance of commercially valuable tuna and shrimp has created lucrative fishing industries in virtually all the South China Sea littoral states, providing employment for millions of people as well as substantial foreign-exchange earnings. Malaysia, for example, earns about $50 million a year from harvesting one species alone; the country puts the total value of tuna resources around the island of Layang-Layang in the Spratlys at around $600 million. States in the region have also enacted laws and established institutions to protect their marine resources from foreign poaching. The Philippines Senate passed legislation imposing large fines on foreign poachers on 6 August 1997. In the same year Indonesia gave notice that it would ban foreign fishing vessels from its 6.5 million square kilometres of

territorial waters from 2000 and inaugurated an 18-member National Maritime Council to 'protect the wealth and potential' of its seas against 'illegal exploitation by foreign parties'. Such 'exploitation' is estimated to cost the country over $4 billion annually. In the Council's inauguration ceremony, President Suharto made it clear that the protection of marine resources was closely linked with national security and defence. When Abdurrahman Wahid came to power in 1999, he created a new Ministry for Marine Exploration and Fisheries and nominated illegal fishing as one of his government's chief priorities.

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Fishing Disputes in North-East Asia

During the 1990s, illegal fishing, territorial/EEZ encroachments and maritime incidents in North-East Asia have become increasingly regular. The risk of significant political and military confrontation over competition for diminishing fish and other marine resources has emerged as a genuine security issue for China, Japan, the two Koreas and Russia. In March 1999, officials at Japan's Maritime Safety Agency revealed that fishing boats, mainly from China and South Korea, had penetrated Japan's territorial waters 'several hundred times each year' and had been intercepted or chased away by Japanese patrol boats. In 1996, Seoul placed its navy in the Yellow and Eastern Seas on alert following an attack by Chinese fishermen on a South Korean trawler in which 11 people were injured.

North Korean patrol boats have crossed the maritime buffer zone separating North and South Korea on several occasions to protect their fishing fleet. North Korean fishing vessels in search of crab during the height of the crab-fishing season crossed the buffer zone in the Yellow Sea on 15 June 1999, accompanied by torpedo boats from the North Korea Navy. Despite repeated warnings from challenging South Korean naval ships, the torpedo boats refused to turn back, precipitating the most serious armed clash between the two states since the end of the Korean War in 1953. In the ensuing fire-fight, one North Korean torpedo boat was sunk with the loss of its entire crew, while two others were damaged. 'Fraternal relations' between the Chinese Communist Party and the North Korean Workers' Party failed to prevent North Korean gunboats from firing on a fleet of Chinese trawlers in 1992. In 1994, Russia despatched a Kara-class cruiser to the East China Sea to halt what the Russian Foreign Ministry called 'pirate' attacks on its vessels. Russia has also detained Chinese trawlers for illegal fishing near the island of Sakhalin.

Maritime incidents involving fish resources are linked to North-East Asia's most intractable territorial disputes.

Maritime incidents involving fish resources are linked to North-East Asia's most intractable territorial disputes. While most commentators have emphasised the geostrategic significance of the Diaoyu/Senkaku or the presence of oil as the underlying causes of the dispute over the islands, few seem to have recognised the importance of fish resources (Diaoyu Dao means 'fishing islands' in Chinese). Taiwanese President Lee Teng Hui made clear in August 1996 that the real importance of the Diaoyu/Senkaku was fishing rights. Taiwan's national fishing association estimates that the country's ships bring in about 40,000 tonnes of fish worth some $65 million a year from the waters around the islands. Enacting the Territorial Waters Bill in January 1999, Taiwan reaffirmed its claim to the islands by specifically declaring them to be an integral part of the Republic of China.

In the North Pacific, the Kuril Island group is the subject of a long-running territorial dispute between Japan and Russia. The islands have important strategic and emotional significance for both countries because of the way in which they were 'acquired' by Moscow at the end of the Second World War. However, fish are also central to the dispute. The Kurils lie at the heart of one of the world's richest fishing grounds. Russia's ownership has allowed Moscow to claim an EEZ of 100 000 square kilometres containing fish, invertebrates and water-plants with an estimated market value of $1billion. Around 25% of Russia's annual fish catch of 6–7 million tonnes comes from the southern Kuril region. Japan's determination to reclaim the Kurils has been reinforced by the knowledge that the region's rich marine resources would reduce the nation's dependence on more distant foreign waters.

As the cost of deep-ocean fishing rises and other fish reserves near exhaustion, Japanese vessels have been more willing to risk penetrating the Russian EEZ around the Kurils. The Russian Navy has seized Japanese fishing boats on numerous occasions since the end of the Cold War. Tensions between the two states over fishing disputes reached a peak in 1994, when Moscow allowed its Border Guards to open fire on foreign vessels trespassing in Russian waters. A month later, the Russian Coast Guard sank a Japanese fishing boat. In an attempt to reach a political accommodation, an agreement was signed in 1998 allowing Japanese vessels to fish in the area around the South Kuril Islands for the first time since the Second World War, provided they are accompanied and supervised by Russian Border Guard boats. Although the risk of military confrontation has been reduced, the potential for conflict remains. Only a few weeks after the agreement went into effect, several Japanese vessels intruded into Russian waters in the South Kuril region and began fishing

illegally using the presence of 'legal' boats to disguise their poaching. Senior Russian Border Guard officials branded the poaching as a 'provocation' and part of a deliberate strategy by Tokyo to maintain its claim to the Kuril Islands and their bountiful marine resources.

Until 1997, Japan had refrained from delineating fishing zones in the East China Sea and Sea of Japan to avoid aggravating historical disputes with China and South Korea over the Diaoyu/Senkaku and Tok-do/Takeshima islands. The government took this position despite intense pressure from the powerful domestic fishing industry, which had complained vociferously about Chinese and South Korean illegal fishing and attacks against Japanese fishing boats. Tokyo has since moved to tighten control over its own fishing grounds, while seeking to maximise access to the resources of disputed areas. In 1997, the Japanese government declared a 200 nautical mile EEZ that incorporated the Tok-do/Takeshima group. South Korea, which has a small maritime resource base, responded swiftly by declaring its own 200 mile EEZ. When asked to clarify the status of Tok-do by reporters, South Korea's Foreign Minister, Yoo Chong Ha, stated that the zone 'starts from the limit of South Korea's territorial waters' and that Tok-do was 'within South Korean territorial waters'.

Seoul's subsequent actions underline both the capacity of these disputes to escalate, and the increasing links between maritime food resources and territorial issues in post-Cold War East Asia. Accusing Japan of violating the terms of a 1965 accord by unilaterally altering agreed fishing boundaries, Yoo Chong Ha demanded in July 1997 that Tokyo revoke its EEZ declaration until a new fishing agreement could be negotiated. The South Korean National Assembly subsequently passed a unanimous resolution protesting against Japan's 'illegal' change of the fishing boundaries. Between 8 and 15 June 1997, the Japanese Maritime Safety Agency seized four South Korean fishing boats for allegedly penetrating the newly declared maritime boundary, further angering Seoul, which warned that such incidents would have grave consequences for the bilateral relationship. In retaliation, South Korean trawlers continued to fish in contested waters especially near the northern Japanese island of Hokkaido. Leaders of Hokkaido's fishing cooperatives branded the Korean actions as inflammatory and 'an act tantamount to a declaration of war.'

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A breakthrough in the dispute came when the Kim Dae Jung government signed a new fisheries agreement with Japan in late 1998. The accord, which came into effect on 23 January 1999, shelved the territorial issue and established a joint fishing zone around Tok-do/Takeshima. Resistance in South Korea to the new

agreement remains strong, however, and the opposition Grand National Party (GNP) succeeded in delaying its ratification for several weeks. The GNP claimed that 70% of South Koreans disapproved of the agreement because of the belief that it would damage the local fishing industry and does not recognise Seoul's sovereignty over Tok-do/Takeshima. Many influential Japanese are also dissatisfied with the outcome of the negotiations and see potential for future disputes over the linked issues of sovereignty and fish quotas. A Japanese Foreign Ministry official conceded that: 'If another dispute between both countries over fishing stocks and operation regulations were to occur, it might affect the issue of Takeshima, I'm afraid.'

China and South Korea have also become embroiled in disputes over fish. In contrast to the vitriol that accompanied South Korea's verbal attacks on Japan, Seoul has been relatively restrained in its response to Chinese illegal fishing. Nevertheless, evidence of a harder line emerged during talks in 1997 aimed at renegotiating fishing agreements to accommodate both countries' newly declared EEZs. The South Korean delegation urged China to crack down on illegal fishing in South Korean waters, and President Kim Young Sam's Cabinet banned foreign fishing vessels from entering designated prohibited zones in the West Sea from 7 November 1997. After protracted negotiations China and South Korea eventually signed a fisheries agreement on 11 November 1998, that established a regime governing each country's fishing activities and marine catches in previously contested areas of the Yellow Sea.

Conclusion

Inter-state confrontation over fish and other marine living resources is emerging as a significant long-term security issue for East Asia. The declining availability of fish is a global problem, but East Asia's dependence on the oceans for food suggests that disputes over fish may trigger wider conflicts between regional states unless steps are taken to manage and conserve fish stocks nationally and internationally. The number and severity of incidents at sea generated by the competition for fish has steadily increased since the end of the Cold War, notwithstanding the signing of a raft of important bilateral fishing agreements. Major wars over fish are unlikely; but as the remaining stocks of wild fish have diminished, regional states have come to regard them in the same light as oil and gas—high value resources that are worth contesting and defending, if necessary by military force. The competition for fish in the Pacific is also complicating and making more difficult the resolution of several festering territorial and

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island disputes of which the Kurils, Tok-do/Takeshima, Diaoyu/Senkaku and the Spratlys are the most prominent and intractable.

More generally, food is destined to have greater strategic weight and import in an era of environmental scarcity. While optimists maintain that the world is perfectly capable of meeting the anticipated increases in demand for essential foodstuffs, there are sufficient imponderables to suggest that prudent governments would not want to rely on such a felicitous outcome. East Asia's rising demand for food and diminishing capacity to feed itself adds an unpredictable new element to the global food equation for several reasons. The gap between production and consumption of key foodstuffs globally is narrowing dangerously and needs to be reversed. The 1996 fall in the world's grain stocks to their lowest level ever recorded and the drawing down of cereal reserves below safe levels in 1999 should be seen in this context. While due mainly to short-term and probably reversible factors, grain and cereal stocks are the world's first level of defence against short-term supply disruptions. An unanticipated rise in consumption or fall in production caused by climatic variables, political and social disturbances, economic mismanagement, shifts in government policies and environmental stress is more likely to precipitate food shortages when buffer stocks are low.

The gap between production and consumption of key foodstuffs globally is narrowing dangerously and needs to be reversed.

Food scarcity most commonly becomes a security issue as a result of sudden and unexpected fluctuations in supply and demand or, as in the case of North Korea, of political and economic failure. North Korea should be seen as a salutary, but extreme, example of what can happen when man-made environmental degradation, adverse weather conditions and misguided government policies combine to undermine a state's ability to feed its citizens. Nonetheless, the country's difficulties illustrate several broader points about the connections between food scarcity and security. First, even localised and relatively short-term food shortages can generate social and political tensions within states which may be the precursors of more serious conflict. Second, while there is a direct link between environmental degradation and the region's declining agricultural productivity, the relationship between the environment and security is more complex: food shortages have rarely been a primary cause of major conflict between states. However, they can contribute to state failure and death on a massive scale in developing states and aggravate interstate tensions by stimulating refugee flows and resource conflicts. Third, food shortages are generally symptomatic of flawed political and economic systems, policy failures, and lack of access due to the uneven distribution of food or income inequalities. Elites rarely suffer from hunger even in the

…food shortages are generally symptomatic of flawed political and economic systems, policy failures, and lack of access due to the uneven distribution of food or income inequalities.

poorest countries. A meaningful definition of food security must therefore incorporate people as well as states.

Neither a sudden fluctuation, nor a failure on the North Korean scale, is in prospect elsewhere in the region nor is East Asia likely to encounter insurmountable problems in feeding itself in the immediate future. Although friction over diminishing fish supplies will increase, food shortages are most likely to threaten the security of states and people when they coincide with other threats to political and economic stability. Earlier fears that food would be used as a 'weapon' by food rich states have faded because of the liberalisation of agricultural trade and diversified world grain markets. The real food security issue for East Asia, in the long term, is the cumulative and accelerating destruction of the region's food-producing capacity due to population pressures, urbanisation and environmental degradation. Anxieties over China's future food requirements must be seen in this light. Even though food production in China has kept ahead of population growth and further improvements in agriculture are achievable, a deteriorating physical environment in conjunction with political instability and economic failure may endanger China's food security and have global repercussions. Many developing countries in South-East Asia are similarly vulnerable. For this reason, preserving arable land, protecting coastal and marine habitats and managing natural resources in a sustainable way may become intrinsic to conflict prevention.

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Note: This paper is a substantial revision and update of Chapter 4 of my Adelphi Paper 319 entitled The Environment and Security in Pacific Asia, (Oxford University Press for the International Institute for Strategic Studies, London, 1998).

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Peace Through Development How Can Australia Help?

Dr Stein W. Bie

Australia is a country of internationally high living standards in a sea of underdevelopment. History made it that way, and the Australians did their homework. I come from a country that is about as far away that you can get, Norway, yet Australian willingness to work for peace and justice internationally has not been questioned there for almost one hundred years. Australia has made major human sacrifices to keep the global peace, and Australia has been a major contributor to the global food basket. The papers this morning recognise a historic willingness by Australia to continue to participate on military and food security issues.

They also recognise that the challenges now are different from the time of the two world wars, and the wars in Indo-China. Global political power is no longer an obvious focus for conflict. Most conflicts are local; in fact most of them are internal rather than between nations. Most conflicts are fought by irregular groups, not armies. Many conflicts are loot-seeking conflicts, even if they are occasionally shrouded in justice-seeking arguments. Whilst in the past a common loot was 'the people', the most common loot fought over now belongs to the family of natural resources—the loot is fish, diamonds, water, fertile land, drugs and crops. The irregular armies no longer receive their weaponry from official or clandestine government sources but buy them in a private arms market. These are bands of rough people or people led by rough people who have not heard of the Geneva convention, who scarcely recognise a Red Cross or a Red Crescent, and whose aims are not to win the minds of people, but to get the diamonds, the fish or the raw heroin. Clearly there are also more classic conflicts around, and there will continue to be. The disturbing development is, however, that piracy on land, and to a lesser extent on the seas, is growing dramatically, and that civilians constitute the main victims.

The papers this morning have carried messages of realisation that, in addition to more conventional conflicts for which the Australian Defence Forces are normally trained and employed, there is a global epidemic of new loot-seeking conflicts, gruesome at the local level, and sometimes developing into a scale that engages the global community (such as that in Sierra Leone and East Timor), and therefore also Australia.

As an agricultural scientist I have little to contribute to thoughts of prevention of large-scale justice-seeking conflicts. I do have a conviction, however, that the current and medium-term agricultural production figures can yield enough food for most people to avoid a large-scale food war. I do believe China will largely feed China, and that China will continue to both sell and buy food, and will continue to be a food trading partner with Australia. It will continue to be a major purchaser of Australian agricultural commodities, and presumably on fair trade terms. There are problems of the purchasing power at household level, but there is not a question of massive food aid. The growing world population needs more food, for sure, but the message that I also get from this morning is that agricultural science holds a reasonable promise that, given reasonable investment in the research, it will be able to produce the increased food required, in a significantly more sustainable and environmentally-friendly manner. I also sense that there is no precondition that all this has to be done by introducing genetically modified crops and animals on a large scale, and certainly not in developing countries.

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Australia, unlike many other industrialised countries, has an environment and an agricultural industry which are more relevant to developing countries than those of others. There is probably more known in Australia about sustainable use of natural resources than most other places. Programs with a lot of people's participation, such as the Australian Land Care initiative, is arguably most relevant to neighbouring developing countries striving to produce food in an economically and ecologically sustainable way. Australian experience is therefore important, and knowledge generated in Australia is a potentially important tool for Australia in building better relations both with its close and more distant neighbours.

An important point was made this morning, namely that security goes much beyond military security. Keeping law and order is just a prerequisite for real development. Whilst security forces and law enforcement must be there, so must many other ingredients be brought in place. In the rural world rural knowledge is the long-term answer. International agricultural knowledge, whether generated in Australia or together with

Australia's international partners in research, is arguably one of the most important ingredients in providing stability.

Another point that came through very clearly this morning is the changing nature of conflict. If a significant number of conflicts have their roots in loot-seeking rather than justice-seeking, then the frequently very costly policing of looters is at the tail end of a vicious chain that can be more cheaply broken earlier than by intervention of security troops. The bands of bandits who roam towns and countryside, although recruited by the rich, are themselves most often very poor, in need of employment, and with little hope, whether their roots are in the countryside or in the cities. In countries that are predominantly agricultural, it is the failure to sustain and increase productive agriculture that forces them off the land and into even grimmer situations in the urban slums. The child soldiers are becoming a fact of life, and the indiscriminate maiming and slaughtering of civilians are not undertaken by regular armies. So many, but not necessarily all, conflicts have their recruitment base among the discontented young. Many developing countries have shown how agricultural productivity can be sustainably increased and form a base for development, spreading improved food security and increased living standards to many.

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Australia is well advised to analyse this new pattern of conflict, because there are countries close to your shores, where it is happening. Australia has shown the world with its UN and Indonesia-agreed intervention in East Timor that it has a mastery of the security operation. It has followed it up with civilian actions, where the military has also been credibly involved. All these operations are risky operations, also to Australians. The conflict in East Timor had many of the traits of those of Somalia and Sierra Leone, but did not become one. Lessons have been learnt. But there is another question: do such conflicts need to arise at all, or go that far? It is immeasurably cheaper and with zero risk to life to introduce new higher-yielding varieties of crops, find appropriate soil fertility measures, introduce a veterinary service, work on erosion control, improve water efficiency in irrigation systems, and support the building of efficient agricultural marketing, than it is to send an expeditionary force. The introduction of such services, and again Australia has so much of the knowledge, and research capability, costs only very moderate amounts. The military capability may always need to be there, so there has been no suggestion this morning of turning swords into ploughshares. Instead there has been a plea for a realisation of where the evil begins and who, because of rural and also urban poverty, will be using those guns and those machetes.

In my view few other countries are in a better position to draw obvious conclusions on the new conflict issues than Australia. You have the agricultural knowledge base, you have a strong international network of research, both in the public and private sectors, and you have a military that has acquitted itself in an exemplary fashion as the sword behind the door. The message from the researcher to the admiral this morning was clear: you appreciate better than most that a holistic approach to peacekeeping and conflict prevention is necessary. Australia has the experience of sustainable agricultural development, often because you did the unsustainable things first and learnt through research, to change. You have a rural population with much knowledge and regional centres with scientific clout in tropical and subtropical agricultural research. Why don't you use it? Why do you not seek to form a new Australian alliance between agricultural development, environmental sustainability, and the military peacekeepers? May I personally add that it is my belief that Australia could probably get much more value from its—at least seen with Scandinavian eyes—very modest investment in development assistance, by such innovative methods.

Why do you not seek to form a new Australian alliance between agricultural development, environmental sustainability, and the military peacekeepers?

We have also heard about the fish wars, and we will hear more about them this afternoon. It may be more appropriate to comment on this later. But we see some of the same pattern developing. In addition to the state-organised fishing, or normally overfishing, in territorially-disputed waters, there is an armada of rogue shipowners equipping themselves with heavy machineguns and grenade launchers alongside their fishing nets in order to intrude into undisputed waters of others. The solution is arguably not to be found in attempts at mass sinking of these modern loot-seeking pirates but a review of the whole fisheries sector. I come from one of the biggest fishing nations in the world, yet our fish farming now has a greater value than the wild catch, and, as a bonus, it has probably saved the Atlantic salmon from the fate of the Tasmanian tiger. Research properly applied does not only create food, it creates livelihoods, prosperity and protects the environment—the salmon story has many of these ingredients. Again Australia has a big role to play, for in the archipelago of the Arc of Instability, these fisheries battles are now being fought, and the spillovers lead to reckless hunting on the high seas.

Research properly applied does not only create food, it creates livelihoods, prosperity and protects the environment…

We are also going to hear a lot more this afternoon on freshwater quantity and quality. Decreasing quantities of high quality water in a period of declining competitiveness of agriculture, compared to non-food users, for that water, gives rise to concern. Australia is well placed internationally for the development of conflict-resolution methods for water issues. You have these issues at home.

Ladies and gentlemen, as an agricultural scientist it has been a fascinating morning. I was trained as a scientist to help to increase productivity, and I wrote my doctoral thesis partly on material on soil surveys of the soldier settlements along the Murray and the Murrumbidgee, and in the Goulbourn valley. Part of my thesis was compiled on the hill next door, in the early compound of CSIRO on Black Mountain. I have followed the Australian success stories in agricultural research. I have seen the increasing awareness of the environment and concerns about biodiversity. I have seen Australia discuss land and water development as a Northern Myth 33 years ago, and I have seen Australia taking responsibility for regional security north of Darwin. The combination of these capabilities seems to me to give Australia a unique chance to stabilise the unstable through careful use of both ploughshares and swords. Ultimately the integrity of Australia depends on its ability to protect its own vital interests through ensuring development among its neighbours, to help them to build futures linked to their own lands, and become more valuable political and trading partners. This, ladies and gentlemen, is my reflection on four excellent and unusually innovative presentations this morning.

PROFESSOR DR ADEL EL-BELTAGY was born in Cairo in 1944 and is presently the Director General of the International Center for Agricultural Research in the Dry Areas (ICARDA). He graduated from, and is a Fellow of the University of Wales, Aberystwyth. Stress physiology is his area of specialisation, and his major research and development interest is arid land agriculture. His past professional and academic activities include Professor, Arid Land Agriculture, Faculty of Agriculture, Ain Shams University, Cairo; First Under-Secretary of State for Land Reclamation, Egypt; Director/Board Chairman of Agricultural Research Center, Egypt; Chairman of Executive Board, Arab Center for the Studies of Arid Zones and Dry Lands; Chairman of Scientific Technical Council of the International Sahara and Sahel Observatory; Chairman/Secretary General of the International Desert Development Commission; and Member of the CGIAR Genetic Resources Policy Committee.

Strategic Options for Alleviating Conflicts over Water in Dry Areas

Professor Adel El-Beltagy

I would like to thank Crawford Fund for giving me the opportunity to be with you today and to speak about the very source of our life—water, which, unfortunately, is also a cause of conflict. This meeting is especially timely because the Middle East, an important part of the West Asia and North Africa (WANA) region, is currently undergoing the huge challenge of making the peace process successful. In the late 1980s and early 1990s several visionaries predicted conflicts over water in this region. They were not entirely wrong, because tension prevails in several parts of the region over sharing water resources. On the other hand, we are witnessing unprecedented will and momentum among the people of the region to establish peace. Although 'land for peace' is what we hear repeatedly as the basis for a solution, sharing the water resources, by implication, is an important element in the peace process. We need to mend our ways to address the 'thirst-driven unrest', where it exists, and keep water as the essence of life and a vehicle for peace, not war. In this context, let me quote from the May 1993 issue of *National Geographic*: 'If there is political will for peace, water will not be a hindrance. If you want reasons to fight, water will give you ample opportunities.'

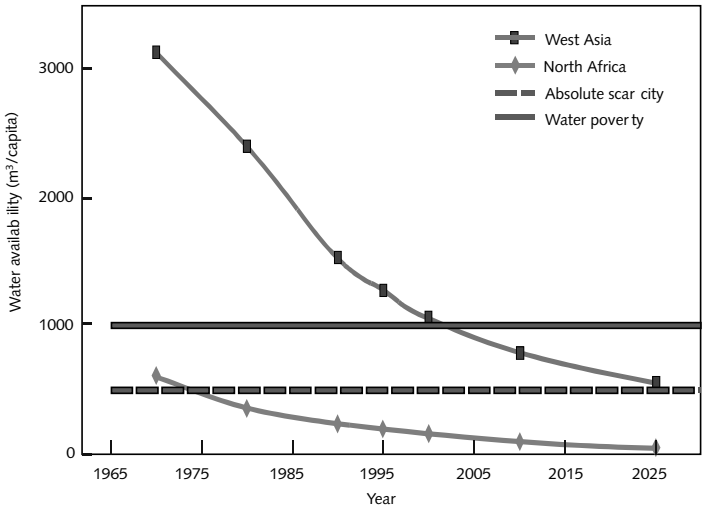
'If there is political will for peace, water will not be a hindrance. If you want reasons to fight, water will give you ample opportunities.'

Water Scarcity in Dry Areas

Water in the Middle East has shaped up some of the greatest civilisations in the history of mankind along the Tigris, the Euphrates and the Nile. Over the years water has always played a crucial role in the development and stability of this region. The demand for water, however, has increased with ever-growing population and economic development. Currently, water is the scarcest natural resource in the region.

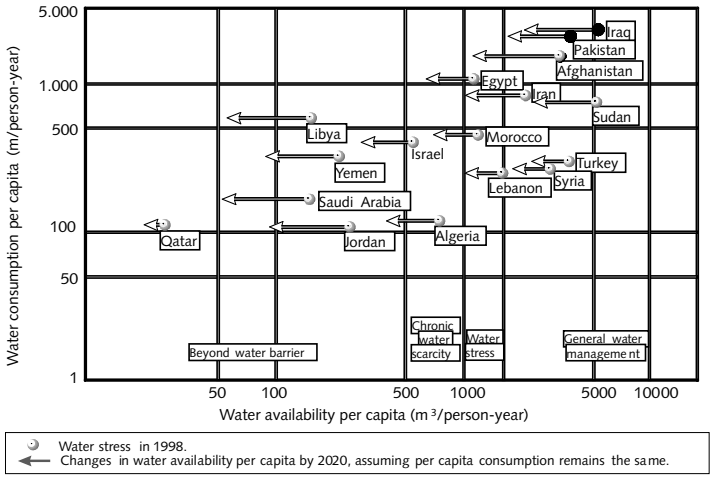
The World Resources Institute (1999) has compiled important data on water resources in the dry areas of WANA. The average annual per capita renewable supplies of water in WANA countries is now below 1500 cubic metres (m^3), well below the world average of about 7000 m^3. This level has fallen from 3500 m^3 in 1960 and is expected to fall to less than 700 m^3 by the year 2025. In 1990 only 8 of the 23 WANA countries had per capita water availability of more than 1000 m^3, the threshold for water poverty level. In fact 1000 m^3 level looks ample for countries like Jordan, where the annual per capita share has dropped to less than 200 m^3 (Margat and Vallae 1999). Mining groundwater is now a common practice in the region, which puts at risk both water reserves and quality. In many countries securing basic human water needs for domestic use is a major issue, as well for agriculture, industry and environment.

Figure 1. Projection of water availability per capita (Shiklomanov 1998).



The water scarcity situation in WANA is getting worst every day (Figure 1). It is projected that the vast majority of the nineteen WANA countries will reach severe water poverty level by the year 2025; ten of them are already below that level. Over the coming years this situation will worsen with increasing demand, given the fact that the possibility of new supplies is limited (Figure 2). The increasing pressure on this resource will, unless seriously tackled, escalate conflicts and seriously damage the already fragile environment in the region. This is particularly obvious between countries with shared water resources.

Figure 2. Water stress codes for selected Middle Eastern countries (Lonergan & Brooks 1994).



In WANA about one-third of the renewable water supplies are provided by rivers flowing from outside the region. Two-thirds of the Arab people, forming the vast majority of the region, depend on water flowing from outside the Arab countries and about one-fourth live in countries with no perennial water supplies (Ahmad 1996). Under the prevailing conditions, the principle of integrated water resources management is widely accepted as the best way of managing shared water at the basin level. However, considering the importance given to national sovereignty, and the fact that international laws on shared water resources are still inadequate, potential conflicts between two or more countries is a reality.

Water is a vital element in the continued economic development of the dry areas, especially in the Middle East. The current water supplies will not be sufficient for economic growth in all of the countries of the region, with the exception of Turkey and Iran. Water scarcity in this region has already hampered the development in all countries of the Arabian Peninsula, Jordan, Palestinian territories, Egypt, Tunisia and Morocco. Other countries of the region such as Syria, Iraq, Algeria and Lebanon are increasingly affected as water scarcity grows every year. It is therefore essential that substantial changes be made in the way water is managed to help overcome potential conflicts.

It is estimated that nearly one billion people live in the dry areas. About half of the workforce earns its living from agriculture, and water scarcity adds to their misery. An estimated 690 million people presently have an income of less than 2 dollars per day; of

It is estimated that nearly one billion people live in the dry areas. About half of the workforce earns its living from agriculture, and water scarcity adds to their misery.

these, 142 million earn less than one dollar per day (Rodriguez and Thomas 1999). Rural women and children suffer the most from poverty and its social and physical deprivations, which include malnutrition and high rates of infant mortality

Water-Related Issues

Despite its scarcity, water continues to be misused. New technologies have provided tools that enable farmers to extract water at rates far in excess of the recharge. This is depleting aquifers to exhaustion. Desertification or land degradation is another challenge in the dry areas, closely related to water. It has come to the forefront of global concerns, as reflected in a number of international conferences and conventions, most recently the Convention to Combat Desertification. Climatic variation and change, mainly as a result of human activities, is leading to depletion of the vegetative cover, loss of biophysical and economic productivity through exposure of the soil surface to wind erosion and shifting sands, water erosion, salinisation of land and water logging. Although these are global problems, they are especially severe in the dry areas of WANA.

Compounding these problems is the expanding human population. Population growth rates in the dry areas (up to 3.6%) are among the highest in the world. The total population in West Asia and North Africa alone is expected to more than double, approaching 930 million by 2020. This will also affect the amount of food deficit, which depends on water supplies. For example, according to an ICARDA study, the grain gap is projected to increase from 51 million tonnes in 1995 to 109 million tonnes by 2020 in 23 countries of the region (Nordblom and Shomo 1995). This is a conservative estimate that assumes no growth in per capita consumption. Assuming grain would be priced at only 130 dollars per tonne, 109 million tonnes of grain would cost 14.2 billion dollars!

This is not to paint a gloomy picture of the future of the dry areas, but rather to point to the challenges that lie ahead for all of us, and to the amount of effort that is needed to face them successfully.

Water and Food Security

The key to alleviating conflicts on water resources is to secure adequate water supplies to meet basic human needs, which will enhance the wellbeing of all countries of the region. Equitable distribution of water and protection of the environment are very much linked to sustainability of the solutions. There are several options for overcoming the consequences of water scarcity:

New water supplies

There is great potential for benefiting from non-conventional water resources. Desalination is gaining more importance as advances in the appropriate technologies are made. Desalting technology, such as multi-stage flash distillation and reverse osmosis (RO), has been used in many areas of the world to produce freshwater by removing the salts and other impurities from marine and marginal-quality waters. The RO technology, the most promising and widely used one, has been documented in various publications and its use has been demonstrated in many locations worldwide (Lee 1990).

Desalination is an expensive process, and hence is currently mainly used in areas where an affordable energy source is available. In Saudi Arabia, for instance, there are some thirty water-processing stations of various sizes, scattered over the country, and using different processes. The total production of fresh water may reach up to 913 billion m^3 annually for some18 million inhabitants. In the United Arab Emirates, desalinated water is expected to increase from 318.8 million m^3 in 1995, which is 12.5% of the total desalinated water in the world for that year to 1,223 million m^3 by 2025. The situation is similar in other Gulf countries such as Kuwait, Bahrain, Qatar, and Oman. In these countries part of the desalinated water is actually used for irrigation. The cost ranges between US$1.00–1.80 per m^3 to desalinate seawater as compared to about US$0.16 per m^3 for water available from conventional sources (Karajeh 2000). Desalination can become an economically feasible method, particularly with the development of new technologies, which can possibly make use of natural gas as a source of energy. Reduction in the cost of desalination would open up great opportunities for several countries of the region. However, our aspirations for a breakthrough in the desalination technology are hampered by lack of funds to support research in this field.

Rainwater harvesting provides opportunities for decentralised community-based management of water resources (World Water Vision 2000). Hundreds of billions of cubic metres of rainwater in the drier environments are lost every year. This loss occurs mostly in the marginal lands, which occupy a major part of the dry areas, and occurs mainly through lack of proper management. The development of water harvesting systems in these areas can save substantial amounts of water that is otherwise lost. ICARDA has demonstrated that over 50% of this water can be captured and utilised for agricultural production if integrated on-farm water-use techniques are implemented properly (Oweis et al. 1999). However, issues of policies and socioeconomic aspects require special attention for achieving greater success.

Rainwater harvesting provides opportunities for decentralised community-based management of water resources. Hundreds of billions of cubic metres of rainwater in the drier environments are lost every year.

The development and use of non-conventional water resources offers great promise. Potential sources include natural brackish water, agricultural drainage water, and treated effluent.

Developing marginal-quality water resources

The development and use of non-conventional water resources offers great promise. Potential sources include natural brackish water, agricultural drainage water, and treated effluent. Research shows that substantial amounts of brackish water exists in dry areas that can either be utilised directly in agriculture or desalinated at low cost for human and industrial consumption. The treated effluent is an important source of water for agriculture in areas of extreme scarcity, such as Jordan and Tunisia (El-Beltagy et al. 1997). It is, however, a great environmental issue in other countries.

In Jordan, treated effluent annually available for agriculture use is expected to increase from currently 87 million m^3 to 140 million m^3 by the year 2010, which is15% of the current total water supply in the country (Garber and Salameh 1992). In Yemen, available quantities of treated wastewater are growing rapidly. It is estimated that approximately 55 million m^3 per annum could be available for beneficial use, forming about 3% of the current irrigation needs for the country. Egypt is currently adding about 1.2 billion m^3 per year of recycled water from the city of Cairo to the total available water resources in the country; and it is predicted to increase to 1.93 billion m^3 by 2010 from Cairo, and to 4.9 billion m^3 year in the country as whole, amounting to over 8% of the total current Nile water supply to Egypt (El-Beltagy et al. 1997).

Nowadays, the proper reuse of drainage water in agricultural production is becoming an appealing option to many countries. This is not only to protect natural resources from deterioration, but also to make a new non-conventional water resource available for agriculture to irrigate salt tolerant crops, euhalophytic trees and herbaceous species. In the last two decades, the reuse of drainage water in agriculture and its impacts on the environment have become the focus of research scientists in many parts of the world, particularly in dry areas, such as California, Egypt, Jordan, India and Pakistan. (El-Beltagy 1993).

In Egypt, for example, officially reported annual reuse of drainage water increased from 2.6 billion m^3 per year in the 1980s to about 4.2 billion m^3 per year in the early 1990s. Two new projects, the El Ummum Drain and the Salam Canal, when established, will bring the total reused drainage water in the Nile Delta to approximately 7.2 billion m^3 per year, which is 13.5% of the 55.5 billion m^3 total current Nile water supply to Egypt (Karajeh 2000).

Water transfers

Major water transfers between water basins and across national borders have been extensively discussed in the region over the last two decades (Kally 1994). Importation of water is being actively considered in the Middle East. The two options most relevant involve transportation by pipeline (Turkey's proposed peace pipeline) and by ship or barrage (big tanks or 'Medusa' bags). Both suggestions are subjected to economical, political, and environmental measures, which are yet to be examined within the context of a peace treaty (Lonergan and Brooks 1994). In the WANA region, attempts to transfer water by balloons and tankers have been made, but the cost is still too high for agricultural purposes. The project to transfer water by pipelines from Turkey to the Middle East countries was unsuccessful because of economical and political reasons. The potential for such projects can only be realised with good regional cooperation and trust between the various parties. As water scarcity in the region grows, the issues associated with cross-boundary water resources become urgent and require solutions. Internationally agreed laws and code of ethics need to be developed to ensure water rights and to open the way for innovative projects in the region.

Improving water management

The effective management of water could become a vehicle for collaboration as much as its absence could be a source of conflict. Improved water management involves all sectors, but since agriculture is the main user of water, any success in this sector will have the greatest impact on the total water situation. It is, however, a complex matter and involves social, economic, organisational and policy issues in as well as the technical ones. I will focus on this option as it has substantial potential for balancing the demand and supply of water and is less constrained by sociopolitical issues.

Effective Water Management

Agriculture is the major consumer of water in the WANA region. Currently over 75% of the total water resources are used to produce food but, with fast growing population and improvement in living standards, more water is diverted to high priority sectors such as domestic and industry, leaving less water for agriculture. Ironically, as water for agriculture is declining, more food is needed. This can only be achieved by increasing the water-use efficiency (mass of agriculture products per unit water used). Is this achievable? Research at ICARDA and other institutes has demonstrated that proper management can more than double the return from water (Oweis 1997). One cannot but mention the

impact achieved by the green revolution on water savings by developing cultivars, which doubled the yield using the same amount of water. Other examples are available about the benefits from the proper management of water and cropping systems (Drek 1994). The following measures are the major contributors to improved water management.

Water cost-recovery

There is little incentive to farmers to restrict their use of water or to spend money on new technologies to improve the use of available water.

Although water is extremely valuable and essential in this region, it is generally supplied free or at low and highly subsidised cost (Cosgrove and Rijsberman 2000). There is, therefore, little incentive to farmers to restrict their use of water or to spend money on new technologies to improve the use of available water. International agencies, donors and research institutes are launching a huge campaign to adopt a pricing scheme for water services based on total operational costs. Although it is widely accepted in the region that water pricing would improve efficiency and insure better investment levels in water projects, the concept is seriously challenged in many countries of the region.

The reasons are mostly sociopolitical. Traditionally, water is considered in many countries of the region as God's gift and hence should be free to everyone. Farmers' pressure for subsidised inputs for agriculture makes it difficult for decision-makers to implement water pricing. There is also a fear in many countries that once water is established as a market commodity, then prices will be determined by the market where the poor may not be able to buy water, even for domestic needs. Downstream riparian fear that upstream riparian may use international waters as a market commodity in the negotiations on water rights.

One cannot ignore these concerns, as they are real and derived from the societies concerned. With difficulties in pricing water in this region, innovative solutions are very much needed to put a real value on water for improving efficiency. At the same time it is necessary to find ways from within the local culture to protect the right of people to access water for their basic needs. Subsidies to support the poor farmers may be better provided in areas other than water where they do not adversely influence efficiency. On the other hand it can be seen that in countries with increasing water scarcity there is a tendency to recover the running costs of operation and maintenance of the irrigation supply systems.

Also, the need to shift the approach, from supply to demand and to deal with water-resource problems is not just a Middle Eastern issue, it is a worldwide problem. The traditional strategy of responding to water shortages by increasing water supplies through capital-intensive water transfer or diversion projects has clearly reached its financial, legal and environmental limits.

Attention must now shift from development to management (El-Ashry 1991).

Improved technologies

It has been claimed that existing technologies may at least double the amount of food produced from present levels of water use, if applied in the field (Drek 1994). Implementing precision irrigation, such as trickle and sprinkler systems, laser levelling and other techniques contribute to substantial water savings and improve water productivity. Along with the development of technologies to capture new water such as water harvesting techniques or to improve the water productivity of the available resources, policies to implement and transfer these technologies are vital. There is a need to provide farmers with economic alternatives to the practices that lead to wastage of water, and with incentives that can bring about the needed change.

Improved water productivity

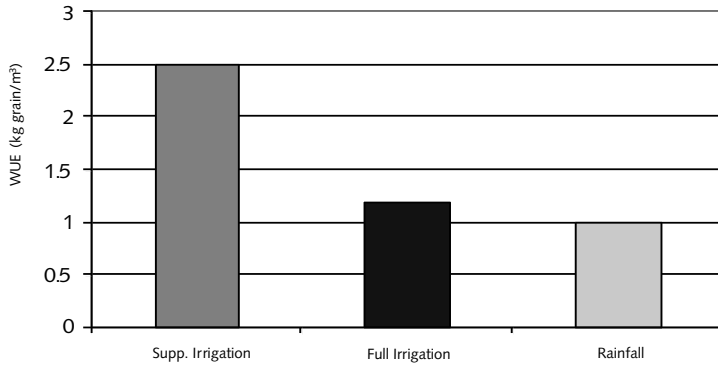
Research at ICARDA has shown that a cubic meter of water can produce several times the current levels of agricultural produce by adopting efficient water management techniques. In supplemental irrigation limited amount of water is applied to rain-fed crops during critical stages resulting in substantial improvement in yield and water-use efficiency (Figure 3). Water application based on deficit irrigation can maximise the return per unit of water rather than per unit of land (Oweis 1997). Application of water to satisfy less than full water requirement of crops was found to increase water productivity and spare water for irrigating new lands. Such strategies are important in the dry areas because water, not land, is the most limiting factor in agricultural production. This situation requires, as scarcity grows, an immediate adjustment to the conventional guidelines of irrigation in this region.

Application of water to satisfy less than full water requirement of crops was found to increase water productivity and spare water for irrigating new lands.

Optimising agribusiness practices and inputs such as selection of appropriate cropping patterns and fertility can also increase the water-use efficiency. Selection of crops should ensure that water used in its production is cost-effective in terms of social and economic considerations. It is, however, a dynamic process since the land-use in this area will be affected by globalisation and the new world trade agreements.

Using both Mendelian breeding techniques and modern genetic engineering, new crop varieties can be developed that can increase the water-use efficiency while maintaining or even increasing the yield levels (Singh and Saxena 1996). For example, through breeding, we have developed winter chickpea and drought-resistant barley varieties that use substantially less water to produce normal or higher yields (Figure 4). More work is needed to integrate all the above-mentioned approaches in

Figure 3. Water use efficiency of supplemental irrigation compared to full irrigation and rainfall in producing wheat grain in Syria (Oweis 1997).

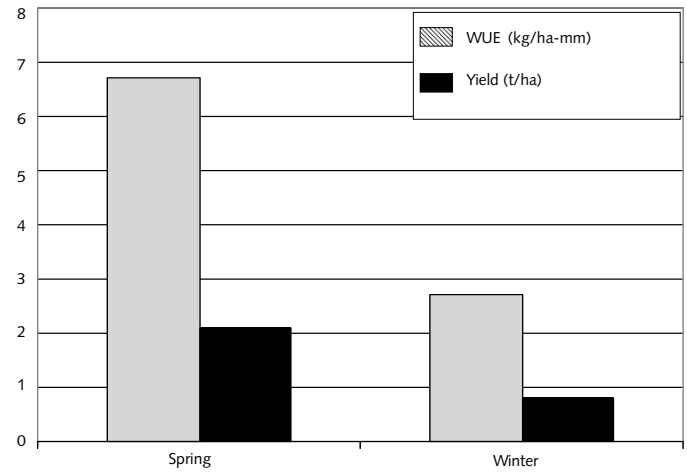


practical packages to achieve the largest return from the limited water available.

Participation of all concerned in the management of scarce water resources is the key to successfully implementing more effective measures of water management.

Participation of all concerned in the management of scarce water resources is the key to successfully implementing more effective measures of water management. Players include public and private sectors but, most importantly, the representatives of

Figure 4. Water use efficiency and grain yield of spring and winter-planted chickpea in Syria (Singh & Saxena 1996).



the users of water, particularly farmers and pastoralists, who should be involved in the decision-making on water management issues. Users cannot, without appropriate policies, achieve the objectives of effective water management. It is widely agreed that lack of proper policies in this region is the main constraint to improved water use.

The Challenge of Change

The world is passing through an exciting time, a time in which social, political, economic and scientific realities are changing, in which a growing recognition of collective responsibility, facilitated by modern information technology, is driving the struggle for change. Our success in the dry areas lies in integrating natural resource management, including water management, with crop improvement, and in developing agricultural systems that will contribute to food security in the dry areas of the developing world.

Fortunately, we now have new science available to us to improve the pace and efficiency of our work on dealing with water scarcity and bridging the knowledge gap. The application of biotechnology/genetic engineering has made it possible to develop crop varieties that produce more with less water. Advances in information technology have placed in our hands computer systems to use as important tools for technology dissemination and precision agro-management. Developments in the implementation of remotely sensed data, GIS, and simulation models are helping us to achieve improved water-use efficiency. We believe that these new tools will go a long way in meeting the objectives of our research to solve the problems associated with water scarcity.

Conclusion

In the 1997 World Water Forum meeting in Marrakesh, Morocco, Anthony Milburn of International Association of Water Quality called for a Blue Revolution in the productivity of fresh water sector to implement Chapter 18 of Agenda 21 (Aiat-Kadi et al. 1997). This vision can only be attained by huge changes in attitudes and behaviours. He stated that now mankind was challenged, through the Blue Revolution, to increase water productivity if humanity was to attain sustainable development and avoid water wars in the future.

The Word Water Council recently established a water vision (World Water Vision 2000): 'Our vision is a world in which all people have access to safe and sufficient water resources to meet their needs, including food, in ways that maintain the integrity of freshwater ecosystems. The vision exercise's ultimate purpose is to generate global awareness of the water crisis that women and men face and of the possible solutions for addressing it. This awareness will lead to the development of new policies and legislative and institutional frameworks. The world's freshwater resources will be managed in an integrated manner at all levels, from the individual to the international, to serve the interests of humankind and planet earth—effectively, efficiently, and equitably.'

'Our vision is a world in which all people have access to safe and sufficient water resources to meet their needs, including food, in ways that maintain the integrity of freshwater ecosystems

Water scarcity is a serious problem in the dry areas of WANA and is a cause for possible conflict, particularly among countries with shared water resources or water basins. The possibilities for an increase in renewable water resources are currently limited, either because the resources have been explored up to their safe-yield potential or because of economic considerations. Breakthroughs in desalination of seawater and brackish water may be achieved with substantial support to research. Major water transfers across basins and national boundaries are constrained by political and economic considerations and require substantial regional cooperation and active international efforts. Reducing water demand by changing the water delivery scheme from a supply- to a demand-driven basis; improving the efficiency of water use through advanced technologies; improved water management; appropriate cropping patterns; improved germplasm; and appropriate cultural practices can play a great role in alleviating conflicts in this region. Supporting research on the management of water under scarcity is vital to achieve this objective through developing new technologies, approaches and solutions to the growing problems.

'Cultivate your world as if you would live forever, and prepare for your hereafter as if you would die tomorrow.'

It is widely accepted that any agreement based on military balance is definitely temporary. The history of conflict over water in the Middle East teaches that water settlement must be a main part of a comprehensive peace agreement based on recognition of the basic rights of the people in the region.

Water, if properly managed, can be a vehicle for peace and regional cooperation and prosperity instead of a source of conflict and wars.

Ismail Serageldin, in his summation report of the 1997 World Water Forum in Marrakesh, Morocco, concluded, (Ait-Kadi et al. 1997) 'Above all, it is the values which we bring to the tasks that will make all the difference… They are values rooted in our common humanity, in the respect of all living things, in our determination to give voice to the voiceless, and to think of future generations and act as true stewards of Earth, which we did not inherit from our parents but borrowed from our children.'

So goes a saying of prophet Mohammed in the Hadith (Al-Azhar 1891): 'Cultivate your world as if you would live forever, and prepare for your hereafter as if you would die tomorrow.'

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FOOD, WATER AND WAR: SECURITY
IN A WORLD OF CONFLICT

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Fish Wars: Science is Shaping a New Peace Agenda

Dr Meryl J. Williams and Choo Poh Sze

Since the dawn of human endeavour, conflicts and wars related to the rights over the use of land and water have been important human issues. Although many of us are probably more aware of wars* fought over religious freedom, political ideologies and social issues, conflicts over fishing rights and resources are just as common, if less reported. A new peace agenda is sorely needed and science must help shape this. Indeed, science will increasingly act as the first port of call of those seeking knowledge to promote the agenda.

Conflicts arise within and between groups of fishers, and between fishers and other community groups. For example, when fishing methods shift from small-scale subsistence to highly efficient modern fleets, conflicts arise between the rights of traditional and commercial fishers. At the heart of most conflicts is the tension between the sustainability of fisheries resources and the rights to, and extent of, their exploitation by humans. Rights over fish are usually ill defined to start with and rarely recognised and assigned adequately as the fishery develops. Their definition and allocation is made more difficult by uncertainty over the size and the state of the resource. For example, most Australians will be familiar with the international conflict over the highly-migratory southern bluefin tuna stocks and the hot disputes over the total quota, scientific evidence on the status of the stock of this species, and national shares of the quota.

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Aquaculture, as an emerging aquatic resource industry, is also subject to conflicts over its impacts on the environment and on people displaced from land and coasts by its introduction. As

* The term 'war' is not used in this paper in the strict sense, accepted for quantitative purposes, by Soysa and Gleditsch 1999. Strictly, a 'war' is an armed conflict with over 1000 battle-deaths in a single year.

resources become scarce, land use conflicts between different stakeholders may become serious issues.

Ironically, wars external to the aquatic resources sectors can protect the fish because they prevent fishing. The fish stocks of the North Sea rebounded dramatically during the course of World Wars I and II because fishing ceased during the wars. Fish can also provide a subsistence food source for the refugees of war as they have done in Sarajevo and Cambodia, because, unlike terrestrial crops that need to be planted and tended, wild fish stocks continue to produce.

Aquatic resources make up 19% of total animal protein consumed and 4% of total protein consumed…

When resources dwindle, conflicts arise as to what constitutes wise use of resources, and stakeholders will often disagree on a common solution. Habitat and resource degradation often become important issues at about this time. The use of destructive gears, fishing over sensitive habitats and over-fishing often give rise to conflicts between different interest groups. For example, negative effects (which include direct mortality, reduction in diversity, biomass and of individual organism size) of the trawl gear on the bottom-dwelling organisms in both sandy and muddy grounds have been highlighted by some researchers (Bergman and Van Santbrink 2000; Ball et al. 2000). Such impacts have alerted environmental action groups and scientists to question fishing activities. The cessation of most whaling is partly a result of confrontation between the whaling industry and public interest groups.

Fish is a very important food source, especially in the developing countries. Unfortunately, despite being so, it is often excluded from projections of future food supply. Aquatic resources make up 19% of total animal protein consumed and 4% of total protein consumed (FAO 1992a). The International Center for Living Aquatic Resources Management (ICLARM) (1992) estimated that about 50 million people are involved in small-scale fisheries through catching, processing and marketing, and fish production provides about 150 million people with employment.

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Food security may be threatened when stocks are fished close to the level of collapse, coupled with problems of habitat degradation and destruction that may have negative effects on fish recruitment. Pauly and Christensen (1995) estimated that 8% of the world's aquatic primary production is required to sustain the fisheries compared to 35% to 40% required to sustain terrestrial systems. Scientists from the University of British Columbia, Canada and ICLARM have shown that humans are 'fishing down the food web' and the present exploitation patterns are unsustainable. Coral reef habitats rank amongst the most threatened aquatic habitats. ICLARM scientists working with others showed

that 58% of the world's reefs are potentially threatened by anthropogenic activities, with 80% of the coral reefs in the South-East Asian regions at highest risk (Bryant et al.1998).

The issues pertaining to the protection and conservation of the environment and resources were given wide coverage in the Rio Conference held in 1992. As we approach Rio+10 in 2002, we are facing even more serious conflicts and a poorer resource outlook for many fisheries. The outlooks, however, present real glimmers of hope promised by some recent insights from international scientific research.

This presentation attempts to highlight some of the conflicts arising from fish and fishers and their impacts especially on the poorer nations. It discusses how some of these problems can be overcome by innovative research partnerships, and the roles of fisheries research in shaping the new peace agenda necessary for assuring food security.

Conflicts and Solutions through Innovative Research Partnerships

Conflicts over the right to fish and to the fisheries resources are endemic in fishing industries all over the world, with some of these conflicts developing into open wars. In South-East Asian waters, fights between inshore (traditional small-scale) and offshore (larger commercialised) fishers are common. Trawling vessels encroach onto traditional fishing grounds and habitats such as mangroves and corals because these are the most productive areas. Negotiations by the Abu Sayyaf gunmen in the Jolo hostage crisis include demands for the return of fishing rights over their inshore waters, referred to as the 'municipal waters' under Philippine law. Within countries, fisheries conflicts often are compounded by ethnic differences between the fishers and the rest of the community and/or by migrations driven by many different positive and negative factors. Internationally, illegal fishing by foreign vessels in another country's territorial waters also causes strained relationships between countries (Dupont, these proceedings).

Conflicts over the right to fish and to the fisheries resources are endemic in fishing industries all over the world, with some of these conflicts developing into open wars.

Fish wars also wage amongst the industrialised countries. Cod wars were fought between the United Kingdom and Iceland in the 1970s. In the 1990s many conflicts amongst fishing fleets within the European Union were reported. British and French vessels fishing for tuna were attacked by the Spanish, and French fishers rioted over minimum European Union fish prices. The situation was no better in the high seas where countries fought for straddling and highly migratory fish stocks; countries such as Australia, New Zealand and Japan still do over southern bluefin tuna.

In 1982, the United Nations Convention on the Law of the Sea (UNCLOS) paved the way for nations to claim rights to the fisheries resources within 200 nautical miles of their coasts. This dramatically changed the map of responsibilities for fisheries and also spurred a major fisheries expansion as nations tried to capture the benefits of these resources by developing their own fleets. UNCLOS also established fishery management power in the hands of national governments, often inadvertently taking control away from the users and stakeholders. The latter are often deemed to be too ignorant and inexperienced to undertake the complexities of fisheries management, even though traditional and local management was often the only previous means of control over exploitation of the stock.

In tropical waters the complex situation with high biodiversity makes the estimation of sustainable yields even more difficult.

In the post-UNCLOS period, countries have attempted to build management decisions around technical rules and regulations derived from models such as the sustainable yield models. These may not always reflect the dynamics or the complexities of the fisheries resources in their biological systems (McGlade 1995). Estimating the abundance of fish stock is not easy and to sustain the resource is also a difficult task, especially when immediate social and economic pressures push for exploiting not just the surplus but also the resource base (Williams 1996). In tropical waters the complex situation with high biodiversity makes the estimation of sustainable yields even more difficult.

Despite millions of dollars spent on monitoring and enforcement, fisheries resources are known to have collapsed in countries from all over the world. An FAO study (FAO 1992b) showed that out of 200 fished stocks in all parts of the world, more than 25% were over-exploited, depleted, or recovering and would produce greater catches only if returned to a healthier state. Thirty-eight per cent were fully exploited and could not produce more catch without depleting the base stock. Only a little more than 33% could produce more.

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Many hypotheses have been proposed to explain the failures of fisheries management. These range from 'folly' to deficiencies in data and information and poor management institutions (Smith 1998). In many developing countries, the national fisheries departments do not have the capacity to conduct regular fisheries assessments, management and regulatory activities. Worse, governments usually exacerbate the problem through encouraging more intense fishing through subsidies and financial assistance to the commercial fishers.

Finding better ways to manage fisheries has become an imperative. In recent years, fisheries departments have focused more on their institutional options, and many national governments are

attempting to devolve management powers and implement co-management (power sharing between governments and stakeholders) or community-based management (self-involvement in management) to regulate fisheries resources. In a review of management of the fishing lots or concessions for inland fisheries of Cambodia, it was pointed out that any new management system must be developed in full cognisance of the pre-existing and historical institutions for the sector. Indeed, co-management systems are being found to work for the management of lagoon, near-shore marine resources and inland fisheries. Successful co-management models include the co-management of the inshore fisheries in Japan. There are many examples of effective community-based management systems, like those found in the Pacific Islands and several in the Philippines (Katon et al. 1997).

Where applicable, co-management and community-based management potentially are effective in managing resources because they take into consideration the needs of the stakeholders, and utilise their environmental and fisheries knowledge.

Hardin (1968) called the tendency to over-exploit fisheries and other common resources the 'tragedy of the commons'. However, recent thinking is that over-exploitation occurs not because of the ownership (common property or individual) but because access is open to all and unmanaged (Hardin 1998). In such a situation there is no interest in limiting fishing and everyone lands as many fish as possible, as not doing so will enable others to catch more. Thus fishers compete intensely with each other, leading to conflicts, over-exploitation and stock collapse. Some traditional systems show that access to commons resources can in fact be regulated. In the Solomon Islands, common property-type systems of marine tenure have been successfully practised for fisheries management of some reefs and lagoons (Hviding and Baines 1992). Fishers themselves manage the access and fishing of the resources according to traditional and customary laws. These systems provide for stock rotation, periodic reef closures, community involvement, group control, stock monitoring, ecological knowledge and understanding. In Ontong Java, in the Solomon Islands, although no government regulations exist for the management of sea cucumbers, the community itself took on the task of managing the fisheries by restricting harvesting to every other year (Richards et. al. 1994). How well these systems will survive the ravages of the present Solomon Islands inter-ethnic wars remains to be seen.

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Seeking better solutions for fisheries management in developing countries, ICLARM has been engaged in research on co-management and community-based fisheries management regimes since 1990. In keeping with the overall mission of the

Center, our target beneficiaries are poor men, women and children. Following an early start in Bangladesh, in 1994 we commenced a long-term collaborative project with researchers, community groups and fisheries managers in the Philippines, Vietnam, Thailand, Malaysia, Indonesia and Bangladesh in Asia; and Malawi, Zambia, Zimbabwe, Mozambique, South Africa, Benin, Cote d'Ivoire and Senegal in Africa; and the Institute for Fisheries Management (IFM), Denmark. The objectives of the project are:

- to gain practical experience in research in fisheries co-management;
- to demonstrate under what conditions it may be applicable as a sustainable, equitable and efficient management strategy; and
- to develop models for use and adoption by governments, fisheries communities, NGOs and others.

In its first phase, the project analysed 14 case studies from Asia, carried out in a variety of fisheries situations (Kuperan 1999). In all cases, the access and withdrawal rights were held by the fishers but management rights rested with communities and the state. Outcomes were measured in terms of equity, efficiency and sustainability, although not all indicators were measured in every case. Nine out of 10 case studies indicated improvements in the equity situation; 11 out of 14 showed improvements in efficiency outcomes; and, most promisingly for the sustainability of the resource and livelihoods, 9 out of 14 cases showed improvements in the resource situation.

Mixed results were obtained from 8 case studies undertaken in Africa (Kuperan 1999). In 3 cases, fisher representation in decision-making increased; in 4 cases, the ability to resolve conflicts improved; 4 out of 8 cases indicated improvements in control of destructive fishing and enforcement of regulations; and in only 2 out of the 8 cases did the village committees enjoy strong community support.

The fisheries co-management project of ICLARM is linked to the Consultative Group on International Agricultural Research (CGIAR) System-wide Initiative on Property Rights and Common Property Resources, covering fisheries, forests, rangelands, water and other commons resources. Some lessons, but by no means all, are transferred across different resource types.

In 1998 a three-year project entitled 'Sustainable management of coastal fish stocks in Asia', was initiated by ICLARM, together with eight developing member countries of the Asian Development Bank, namely Bangladesh, India, Indonesia, Malaysia, Philippines, Thailand, Sri Lanka and Vietnam. The main aim of

the project is to provide the countries with updated tools and help their institutions develop strategies to improve the management and sustainable utilisation of their coastal fisheries and related ecological systems. The project objectives are:

- to develop a fisheries resource information system that relates environmental and socioeconomic factors to the resource management needs of the selected countries;
- to develop appropriate strategies and action plans to assist the selected countries in managing their coastal fish stocks based on analyses of the completed information; and
- to strengthen the capabilities of institutions in these countries in the assessment and management of coastal fisheries.

Early results of the project are confirming, often from little utilised but existing data, that the overall status of the resources is dismal, and bottom-trawling practices especially should be reduced. The economic and biological wastage is large. The policy dilemma for governments is that, despite their equity and distributional goals, sectoral assistance is misplaced and goes primarily to the large-scale fishers. The project is helping government fisheries managers to recognise and develop prescriptions to tackle the problem.

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These two fisheries management research projects, which involve working closely with many partners, show both the challenges of fisheries resource management and offer insights into possible solutions. The peace agenda clearly includes evolving human institutions that recognise the stakeholders and involve them in suitable ways, and use data to develop new knowledge.

Aquaculture

Aquaculture first originated in China in 1100 BC. The first cultured fish is believed to be the common carp; later on during the Tang Dynasty (618—904 AD) polyculture and integrated freshwater fish farming systems were also developed. The Chinese and Indian carp constitute the greatest share of world aquaculture production today and accounted for 45.6% of the world's production in 1995 (Rana 1997). Carp are the most popular species of fish cultured in the world. They are amenable to polyculture, i.e. the culture of several different species in one water body, and integrated farming, i.e. the farming of fish and other agricultural crops through recycling of on-farm nutrients and organic wastes. Carp are either herbivores or omnivores, with feeding habits that are met with diets that are low in protein, and are therefore good candidates for sustainable practices.

Despite its apparent antiquity, aquaculture has only burgeoned

since the 1970s when rapid development of semi-intensive and intensive cultures occurred. The sustainability of the new developments has been hotly debated ever since. Conscious of the debate and drawing on its wide experience in aquaculture in freshwater and marine environments in developing countries, ICLARM has recently released a statement of its position, called 'Farming fish the right way' (ICLARM 2000).

Most of the controversies have centred on carnivorous species cultured in brackish or marine environments, especially penaeid prawn and salmon (Naylor et al. 1998). Naylor et al. (2000) calculated that feeding fish (as fishmeal) to grow fish actually reduced the total amount of fish available to humans. Conflicts arising from modern aquaculture mainly involve environmental issues, although some culture activities cause social problems. Adverse effects include habitat destruction, discharge of effluents containing high concentrations of organic matter and the tainting of the aquatic environment and organisms with chemicals. Common-user conflict, the introduction of exotics that may alter the diversity of the natural flora and fauna, and the escape of feral organisms from culture systems, are some of the associated issues. The siting of ponds can cause conflict among the various interest groups.

…feeding fish (as fishmeal) to grow fish actually reduced the total amount of fish available to humans.

In Indonesia and the Philippines, conflicts arose between the padi and fish farmers when productive rice fields were converted to fish ponds (Beveridge and Phillips 1993). In Malaysia, problems were encountered when padi farmers were directed to sell their land for conversion to shrimp farms. Rosenthal (1994) is of the opinion that aquaculture offers more benefits than negative effects and attributes the intense hostility against aquaculture, especially in industrialised nations, to lack of public involvement and understanding. Williams et al. (2000) noted the great economic benefits that low-income people could derive from aquaculture with appropriate development assistance interventions. Part of the basic public unease with modern aquaculture could be its novelty, that it is something new and man-made (ICLARM 2000).

…the great economic benefits that low-income people could derive from aquaculture with appropriate development assistance interventions.

In the tropics, the most controversial farmed species, the penaeid shrimps or prawns, have received worldwide attention. Environmentalists object to the use of mangrove land for farming, and self-pollution from farms crowding close to each other have caused disease problems and mass mortality. The conversion of mangrove land to shrimp farms has also transformed a common-user resource to a single-user resource. Social problems arise when coastal fishers are denied access to the mangroves and complain of the loss of earnings from reduced catches.

ICLARM's work in sustainable aquaculture is focused largely on the interdependence of people, aquaculture and the environment. ICLARM subscribes to the belief that increasing the access of the rural poor to productive resources is the key to sustained increases in food security (Ahmed et al. 1997). Poverty may deprive the poor of food, and hunger spawns conflict. Food and economic insecurity, and scarcity of natural resources are often major sources of conflict (Messer et al. 1998).

…increasing the access of the rural poor to productive resources is the key to sustained increases in food security

Although some semi-intensive and intensive culture of carnivorous species has damaged the environment and created social problems, overall, aquaculture can and is being carried out sustainably with a consequent increase in food production. Since the world's landings from capture fisheries have already reached their limits of about 89 million metric tonnes, the main growth sector in fisheries production is through aquaculture. It is therefore essential that aquaculture policies in all countries be appropriately planned and implemented without compromising the health of the aquatic environment. This may involve resolving conflicts among competing stakeholders, which may include those on the land who release effluents into aquatic systems.

How can aquatic research be used to help avoid conflicts in aquaculture development? An important starting point is the choice of species for culture, since this governs feeding, culture systems, inputs and markets. ICLARM works mainly with native species or species that have already been introduced, to avoid the negative effects associated with the additional introduction of exotics. Tilapia, although an anathema to most Australians, is a species of choice. Although it is a native to Africa, it has been farmed extensively in Asia and Africa and is increasingly important in the Americas. ICLARM's work on selective breeding for the genetic enhancement of the Nile tilapia for aquaculture in Asia has produced a strain (GIFT) that has a significantly higher growth than the strains already cultured, and can be produced at a lower cost, thus bringing it within the reach of more people.

ICLARM's research in the Pacific Islands on the culture of high value species, namely sea cucumbers, giant clams and the blacklip pearl oyster, is also highly environmentally friendly and requires surprisingly few inputs. The Australian Centre for International Agricultural Research (ACIAR) is the key supporter of this research. The species cultured are benign both in their demand for food and their effects on water quality. The sea cucumbers are detritus feeders, the giant clams obtain their food from a symbiotic relationship with microalgae, and the pearl oysters are filter feeders. Since no extraneous feeding is required, these organisms actually cleanse the environment. The culture of

these organisms not only provides food and income to the islanders, but the hatchery-produced seeds are also used for restocking programs.

Another critical way that aquaculture development can help reduce conflict is by helping reduce inequalities. For this to occur, aquaculture must be accessible to the poor.

Before it was closed due to the current Solomon Islands civil war, the ICLARM Coastal Aquaculture Centre (CAC) in the Solomon Islands had successfully developed breeding and farming methods for five species of giant clams. Seeds were produced in the hatchery, raised on small-scale marine farms run by the local village people and sold to the aquarium trade. Restocking of natural habitats to replenish natural stocks has been linked to their farming operations, and restocking programs are being attempted in 16 countries. Educating farmers on the need to protect the dwindling resource is encouraging them to control the harvesting pressure. In the Solomon Islands, 30 village farmers retain 2% of the marketable clams for restocking reefs under their tenure. However, the present Solomon Islands unrest has halted a suite of downstream development projects that followed on from the research. ICLARM is also engaged in developing simple low-cost scientific methods for producing sea cucumber larvae en masse and raising them to a stage where they can be released and survive in the wild to restore depleted stocks.

Another critical way that aquaculture development can help reduce conflict is by helping reduce inequalities. For this to occur, aquaculture must be accessible to the poor. Deliberate and planned interventions are needed to involve low-income people in aquaculture production and/or, through improving the efficiency of aquaculture production, make fish more affordable for them.

One technology suitable for many rural poor is integrated aquaculture-agriculture (IAA), involving the culture of fish in small water bodies.

One technology suitable for many rural poor is integrated aquaculture-agriculture (IAA), involving the culture of fish in small water bodies. The objective of the IAA system is to optimise farm production and the use of the biological outputs from the farm through recycling, and integration of aquaculture into the system. ICLARM's work on IAA is focused on small farms and its target beneficiaries are small and subsistence farmers and other rural people, especially women, who do not have the knowledge or financial resources, or often even the land, for intensive, high-value, or commercial activities. Research on IAA systems has been carried out in Ghana and the Philippines, and continues in Bangladesh, Malawi and Cameroon.

Scientists, farmers, NGOs and government agencies have had to work closely together to understand and improve the technology and its adoption. Each country and site presents a set of different ecological, biological and sociological conditions, highlighting the need for developing site-specific systems.

For example, in Bangladesh, ICLARM has tapped into the

very effective NGOs to be research, dissemination and extension partners and reach the poorer people, especially women, that normal government extension services were missing (Gupta et al. 1999). The research focuses on maximising fish production from unused or under-used ponds with methods that are feasible, affordable and acceptable to resource-poor households in rural areas. The average production increased by 452%, and net cash benefits and household nutrition improved through the higher consumption of fish. Women constitute a significant proportion of the beneficiaries and were the most valuable participants.

…maximising fish production from unused or under-used ponds with methods that are feasible, affordable and acceptable to resource-poor households in rural areas.

In Ghana, Malawi and the Philippines, the work is more on an experimental basis involving a small number of farms over different ecological conditions. In Ghana research was focused on introducing aquaculture in ponds surrounded by vegetable gardens. Results showed that, following one fish growing cycle, net income improved by 180%, biomass output by 10%, the number of species used by 13% and the types of recycling by 220%. Farm households also increased their intake of protein from the fish and of vegetables. Experiments in Malawi showed that participating farms had a 50–80% higher production of fish than the best farms with ponds that were not integrated. IAA farms had greater food availability, better rice crops and a better supply of water for the farm, garden and household. In the Philippines, participating farms experienced an increase in income from US$350 to US$750, total biomass output from 7 to 8 t/ha, the number of species cultured from 6 to 11 (ICLARM 2000). This resulted in significant increases in income, production, food availability and sustainability of the farms.

Thus, research can help the aquatic sector resolve its conflicts through such means as advising on species selection, developing new environmentally-friendly and low input species, improving access to the technology and increasing the profitability of recycling systems for small and landless farmers. The peace agenda for aquaculture is heavily dependent on science for its directions.

The peace agenda for aquaculture is heavily dependent on science for its directions.

The Contribution of Fisheries Research to the Peace Agenda for Food Security

Some of the previous examples of scientists and others working together show how science is reducing the conflict in the fisheries and aquaculture sectors. This is good news for many scientists who have been soul searching over their role in fisheries management, and generally seeking to clarify their part in the peace process.

The 'fish wars' have generated many papers on the failures of fisheries management and the need for fisheries science to

consider itself within the full management context (de la Mare 1998). This involves considering the whole system of fisheries and their management institutions, not just its parts, such as the resource, monitoring and surveillance and fleet and market economics. Management objectives and procedures have traditionally been viewed as outside the purview of fisheries science. Smith (1998) recommended that fisheries science extend to cover the scientific study of management, warning that a lack of focus on the whole of fisheries would leave fisheries science ineffective in the future as in the past.

Until the last decade, aquatic resource management research had mainly focused on resource biology, stock assessment, gear development, aquaculture research and a small amount of economic and social research. These inputs were probably sufficient when resources were under-exploited, aquaculture small and of the non-intensive scale, and human populations lower. But the present trend in fisheries development in many parts of the world shows that current research is insufficient to cope with the present day problems, let alone to meet future challenges.

But the present trend in fisheries development in many parts of the world shows that current research is insufficient to cope with the present day problems, let alone to meet future challenges.

Williams (1996) reviewed the contribution fisheries research could make to food security. Since the resolution of major conflicts is a prerequisite for food security, these contributions are relevant to the peace process. Research now needs to be broad in its disciplinary base and must play a range of roles.

Firstly, research can provide basic information on which strategic and applied studies can draw. Basic research includes studies like fish taxonomy, fundamental knowledge on biodiversity, economic market theory, trophic dynamics of ponds and ethnographic studies. The main users of the results from such studies would be other researchers and the general public. Scientists are expected to provide ready access to the results of this fundamental research through the traditional scientific literature and through modern information technology such as the Internet.

Secondly, research can identify critical issues and their implications. These issues may become the source of conflicts, and science may find itself as the messenger bearing bad news. Scientific studies may assess the status of an exploited stock; social science studies may reveal problems in how the catch is shared; and marine biology studies may reveal an unwelcome shift in species composition, e.g. to lower value species. The findings from such studies could be made use of by policymakers, fisheries managers, fishers, fish farmers and other researchers. These results must be conveyed in a way that clearly explains their meaning and consequences and the researchers must be aware of the context within which they communicate their results.

Thirdly, research results can be used to resolve conflict. Studies can be planned to address management questions such as:

- What will be the benefits for the fisheries resource, the local economy and for the fishing communities if a protected area is established?
- How big should this protected area be and where should it be sited?
- Should this fishery be managed as a single stock or as separate substock?
- What is the risk of stock collapse if catches are increased?
- Which groups or parts of the community will benefit or be disadvantaged by the new management regulation?

Users of the research will be those involved with the conflict or their representatives in committees and negotiating parties. There are many excellent cases in developing countries where local universities and action-research based NGOs are closely involved with community groups and local government actors in the management of coastal and inland aquatic resources. This is a relatively recent phenomenon, dating only from the 1990s in most countries.

Fourthly, research may be able to produce innovations, new solutions and options. For example, present day aquaculture research utilises new technology, like using genetic engineering and biotechnology as tools to select new species strains, new feeds and the production of vaccines for disease control. Fisheries production may become more efficient with the introduction of new gear, improved vessels and post-harvest technology. This role is usually used when no immediate conflict exists, or after a conflict when the parties have entered a phase of seeking other options to the problem. The users of this type of research are usually fishers, farmers, fisheries managers and other policy-makers.

All these four roles are critical components, directly and indirectly, of establishing the way forward for the aquatic resources sectors. If all are used, scientific research should have a major role in shaping the agenda for peace and sustaining fisheries and aquaculture development.

Conclusion

Fisheries and aquaculture often operate in an environment of strife, buffeted by internal conflicts and deeply affected by external events (Williams and Perez-Corral 1999), including wars and armed conflicts other than 'fish wars'. A stable political environment is a primary requirement for the development of people and the eradication of poverty. The same is also true for the

development of a sector. Knowledge gained through well-targeted and delivered research involving, or at least recognising, the views and aims of stakeholders, is essential in moulding the peace process and developing the sector. International aquatic resources research has a leading role in shaping the peace agenda for fish.

International aquatic resources research has a leading role in shaping the peace agenda for fish.

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FOOD, WATER AND WAR: SECURITY
IN A WORLD OF CONFLICT

DR DON J. BLACKMORE has been Chief Executive of the Murray-Darling Basin Commission since 1990. Prior to that he was Deputy Chief Executive for six years and worked for 15 years as a Civil Engineer with the Rural Water Commission in Victoria. He was also Deputy Chair of the Land and Water Resources Research and Development Corporation, a position that he held from 1990 to June 1999. Recently he has been appointed as a Commissioner to the World Commission on Dams who has a mandate to review the development effectiveness of large dams and criteria for the future investment in dams. He became a Fellow of the Institute of Engineers Australia in 1995 and a Fellow of the Academy of Technological Sciences and Engineering in November 1998. In May 2000 he was awarded the degree of Doctor of Science (honoris causa) by La Trobe University.

Dams: The Dilemma

Dr Don J. Blackmore

Water is fundamental to human wellbeing in ways that are integral to the survival of life and protection of health on the planet, as well as to every single form of economic production—starting with food and drinking water. One of the many ways we control water is by building dams. Dams are unique. They epitomise developmental policy dilemmas concerning large infrastructures, and at the same time have consequences more profound than for any other kind of mega-installation. The intervention of a large dam in the riverine environment—not only at the site, but also upstream and downstream—has impacts on the ecosystems, politics, sub-economies and sociocultural patterns in the entire river basin.

The purpose of this paper is to reflect on the current situation with regard to large dams and to discuss what the future may hold as we continue to strive to support basic human needs and development. In the myriad of issues associated with water and dams it is proposed to focus on the trans-boundary water sharing issues and the question of whether we are heading for water wars or whether water will be the catalyst for 'peace'. I also develop a frame of reference to test whether trans-boundary water sharing arrangements are robust and will stand the test of time, improved knowledge, changing community values and in many cases substantial increases in population.

The framework against which I test robust river basin management arrangements includes:

- does a stable institutional organisation exist supported by an agreement or treaty?
- are decisions based on a sound knowledge base?
- are processes in place to enable integration across natural resource issues?

- are governance arrangements transparent and do they include strong community participation?

The relative power relationship in river valleys have to date largely determined the water sharing arrangements.

While the framework is objective, the position of riparian countries is usually anything but objective. The relative power relationship in river valleys have to date largely determined the water sharing arrangements.

Turkey and India have been in such a position to use their political power on the Euphrates and the Ganges, respectively. In contrast, the development plans of an upstream riparian state may be held in check by a downstream power as have, for example, Ethiopia's plans for Nile development by Egypt.

The question is how do we create an environment of 'enlightened self-interest' that will promote an integrated and balanced approach to the sharing of water in a River Basin?

Before discussing the broader agendas involved in trans-boundary water sharing or more correctly wealth sharing, let us review the state of the dams debate.

I am a Commissioner of the World Commission on Dams, which was established two years ago to examine the development effectiveness of large dams and to advise on criteria and guidelines for future investment. The work of the Commission has produced the most comprehensive knowledge base yet created associated with dams, their contribution to society and their costs and impacts. The examination of this knowledge base, together with over 800 public submissions from 79 countries, has provided a unique perspective on the role of dams in society and the sharing of natural resources, both within countries and between countries.

The World Commission on Dams was borne out of an IUCN-World Bank sponsored workshop held in Gland in Switzerland in 1997. At Gland, the moment came at which key protagonists in the long-running and bitter dams debate agreed that the turmoil of controversy surrounding large dam projects needed resolution. The parties to the 'war of words' had reached the point where, however warily, they wanted to embark on 'peace negotiations' in a spirit of reconciliation.

That spirit has been carried forward into the work of the Commission. The Commission and an independent international team, within whose ranks all sides of the debate are represented, have conducted their business rather like peace negotiations. Its role is to propose an accord which all parties will be able to agree to. The ending of hostilities and the protection and support of the 'innocent affected' are our primary point of departure.

On the World Commission we have listened to each other's different viewpoints in a genuine spirit of openness and desire to find a common path through the shoals of our diversity. For all of

us, it has been a learning process, and an enriching if sometimes uncomfortable experience.

We have guided the work program in such a way as to add an independent body of extra knowledge to existing databases and large dam analysis. We have also looked at alternative ways of meeting water supply, energy and flood control requirements. Along the way we have had discussions with affected people, environmental activists, the dam construction industry, the external credit agencies and private investors, and the international development community.

As a result the World Commission on Dams has produced a 'knowledge base' which provides an authoritative resource for analysis of policy and practice concerning large dams in general.

The Commission has pioneered a new path for independent international commissions on issues relating to sustainable development and rights fulfilment in today's rapidly globalising world. For we are more than aware that the Commission is delivering its product in a rapidly changing international environment, in which debates proliferate. We have to conserve the world's precious resource base while meeting the needs of expanding populations ever more hungry for economic progress and a better quality of life not just for some, but for all humanity. Terms of investment, terms of trade, democratisation, the role of the state, the role of civil society, the obligation to preserve planet earth for future generations, the need to counteract the forces of marginalisation which leave some people languishing while others forge ahead—all these factors are part of the wider context in which any policy regarding large infrastructural projects has to be developed, whether for dams, or for highways, power stations, or other mega-installations. Enough of the World Commission on Dams—what are the lessons learnt?

If you define a dam as a structure at least two metres high, in the past century humans have built 800 000, at the unprecedented rate of nearly one dam per hour since 1900. Since 1950 that includes 40 000 large dams fifteen metres high, more than two per day. We have built, and are building dams for excellent reasons. Dams use and divert water for consumption, for irrigation, for cooling, for evaporation, for construction, for mills, for power and for recreation. However, even though we have constructed 40 000 large dams since 1950 we still cannot satisfy basic human requirements.

Despite all our dams, pipes, canals and levees, 1.2 billion people, or one in five world-wide, currently lack access to safe drinking water. Three billion, or half the world, live without basic sanitation. Each year five million children die of waterborne

If you define a dam as a structure at least two metres high, in the past century humans have built 800 000, at the unprecedented rate of nearly one dam per hour since 1900.

Despite all our dams, pipes, canals and levees, 1.2 billion people, or one in five world-wide, currently lack access to safe drinking water.

diseases. Farmers face new competition for water due to increasing urban demands. We mine fossil aquifers at an unprecedented rate. Saltwater intrudes on coastal groundwater. From China to Mexico to India, water tables are falling a metre a year.

Worse, in 25 years we must find 20 per cent more water for 3 billion new people. We are shoved hard up against a concrete wall of finite freshwater supplies. By 2025 one in three people will battle just to find water to drink and bathe, much less grow food. In short, water supply in the areas where it is critically needed is miniscule and finite; water demand is massive and unlimited. Scarcity locks both developed and developing nations into a desperate struggle, in which governments must satisfy the thirst, hunger and hygiene of restless populations confined within political borders.

Trans-National Waters

In 1978 there were 214 international river basins. With the break-up of the Soviet Union and Balkan states, there are now 261. These rivers cover 45.3 per cent of the land surface of the earth, and carry 80 per cent of its available fresh water. They include parts of 145 nations. Twenty-one nations, such as Bangladesh, lie entirely within a shared basin. Tensions and disputes are inevitable, with national interest so hard to define. Water, or even sediment, used or diverted in your country, upstream, is not available for me, struggling downstream, and I am likely to get rather tight jawed over your plans to develop it.

The negative vision for catchment management that we often see is communities looking towards the mountains but rarely towards the sea. They look upstream at what affects them and rarely consider people downstream affected by their own actions.

The negative vision for catchment management that we often see is communities looking towards the mountains but rarely towards the sea. They look upstream at what affects them and rarely consider people downstream affected by their own actions. Their primary interest is in what drives them rather than a broad River Basin perspective.

There are a number of 'hot spots' and 'flashpoints' around the globe—the Middle East, Southern Africa, South Asia, Central Asia and the Nile—all with water sharing issues unresolved.

In 1991, a senior international figure predicted that 'the political tensions between certain neighbouring countries over the use of international rivers, lakes and aquifers may escalate to the point of war, even before we move into the 21st Century.'

'My fear is that we're headed for a period of water wars between nations,' Klaus Toepfer, head of the United Nations Environment Programme, was quoted as saying in Newsweek. 'Can we afford that in a world of globalisation and tribalisation, where conflicts over natural resources and the numbers of environmental refugees are already growing?'

'Environmental scarcities are already contributing to violent conflicts in many parts of the developing world,' writes Thomas Homer Dixon. 'Moreover, these conflicts may be the early signs of an upsurge in violence in the coming decades—especially in poor countries—that is caused or aggravated by environmental change.'

'The wars of the next century will be fought not over ideology, but over natural resources…like water,' argued Robert Kaplan in a famous and widely influential essay in Atlantic Monthly.

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'We view water scarcity as one of the most serious threats to peace and prosperity' said Ismail Serageldin, who convened World Water Forum.

Michael Gorbachev maintains 'The potential for a conflict over water is perhaps at its most serious in the Middle East where water supplies are extremely limited, political tensions traditionally run high, and water is just one of the issues that may divide countries and make cooperation difficult.'

There is certainly a strong body of opinion that if we continue with 'business as usual' then this will inevitably lead to armed conflict. On the other hand, the fear of water wars, like the prospect of nuclear war, can force nations to cooperate.

Water, by its very nature, tends to induce even hostile co-riparian countries to cooperate, even as disputes rage over other issues. The weight of historical evidence demonstrates that organised political bodies have signed 3600 water-related treaties since AD 805. Against this there have been seven minor water-related skirmishes, all of which began over non-water issues. Most of these 3600 treaties dealt with navigation, but since 1814 states have negotiated a number of treaties deals with flood control, water management, hydropower projects and allocation for consumptive and non-consumptive use.

Without dismissing the concerns of others about water wars, I'd rather explore what is needed if we are to help communities and countries determine what is a fair and equitable outcome for them. After that we need to work out how to promote cooperative solutions. The question is how can we create an environment of 'enlightened self-interest' between riparian states and the river basin state?

My own observations are that there is a number of trans-boundary water sharing arrangements which fit within the framework mentioned earlier. Examples include the Rhine River Commission and the Boundary Waters Treaty between the US and Canada. The treaty between Brazil and Paraguay for the world's largest hydro-electric dam on the Parana River has also successfully survived its first 25 years.

However, if we look at those parts of the world with extreme development pressures the record is not nearly so encouraging. The current arrangements for the Jordan, Nile, Euphrates, Mekong and the two main central Asian rivers do not come close to meeting my criteria for stable river basin management. For many basins the knowledge base on which decisions are made is both narrow and thin and generally only focussed on water quantity with little consideration of water quality or environmental issues. Some do have institutional frameworks in place but generally they are poorly resourced, narrowly focussed and only fully activated when the matter is in the interest of all parties—a rare event.

An example is the Aral Sea Basin. Under the former Soviet Union rapid expansion of irrigation occurred from the early 1960s. This has resulted in approximately 7 million ha of irrigation and a massive reduction in the size of the Aral Sea. With the break-up of the former Soviet Union five independent countries manage the area. Water sharing arrangements were in place, however these have not proved to be robust. For example, major dams, on which one country depends for its irrigation, are now entirely within the borders of a neighbouring country. Perhaps the most concerning aspect in this case relates to salinity. The irrigation development of the region has now resulted in over 100 million tonnes of salt being mobilised into surface water systems each year. Despite this, no pollution sharing treaty exists, even though salinity problems are likely to threaten the very existence of these nations.

The Way Forward

Given that we have very few trans-boundary agreements that by any objective test could be seen to be robust, what contribution can we collectively make to improve the situation?

First—we must recognise that there are no repeatable, objective rules for sharing water between countries. Sharing arrangements are a negotiated outcome. There needs to be an international body that can provide consistent, objective, dispassionate support to the negotiation process.

Second—the process must be empowered with knowledge. It has never been cheaper to collect data. The problem is to convert it into knowledge, which is relevant to the range of issues to be addressed. Too much emphasis is still being placed on dealing only with water quantity.

Third—communications must be kept open and transparent.

Fourth—the international community must be consistent in the sanctions they place on non-performing countries. It is inter-

esting to note the behaviour of export credit agencies that fill the gap left when the World Bank or Asian Development Bank withdraws from a project because it does not meet their guidelines on operation between countries.

Fifth—realistic milestones need to be set for the development of the 'stepping stones' of trans-boundary water sharing, such as institutional arrangements, water sharing principles, water sharing details (the heart of any agreement), environmental protection etc. This is needed to assist in the management of the four points above by both the countries involved and by the international community via aid or other means.

The jury is still out on whether there will be water wars, but there is no doubt there will be every increasing demand for scarce water resources and that the current trans-boundary agreements are consistently weak.

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There are few examples of trans-boundary water sharing frameworks that meet my criteria for sustainable management arrangements. But a disciplined and coordinated international approach holds out the best hope for supporting riparian countries as they strive to establish robust trans-boundary arrangements.

In summary, there are currently no examples of countries that are at war over water. War is expensive and very destructive of infrastructure. Negotiated outcomes, no matter how protracted the process, have to date been seen as preferable. However, if the needs of current and future generations are to be fully met, then further large dam infrastructure is inevitable, as is further pressure on trans-boundary water resources.

Water for peace has the right ring—let's hope the bell tolls.

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Make Food Not War Pro-Security Options for the Asia Pacific Region

Beris Gwynne

Notwithstanding the diverse backgrounds and interests of speakers and participants, there is clearly a significant measure of agreement on the fundamental importance of secure access to adequate quantities of acceptable quality food and water to sustain life and to support economic growth and sustainable development. There is also broad agreement that, with population growth and increasing usage rates, competition between urban and rural consumers and between industry, agriculture and the environment for available and, in some respects, diminishing resources is likely to contribute to tensions within and between nation states in the 21st century.

The consensus is less clear with regard to the likelihood of wars being fought over food and water, with recognition readily given to the importance of other factors, the impact of globalisation, unequal distribution of wealth, population growth rates, the arms race (in particular the proliferation of small arms) and the ravages of HIV-AIDS. But there is little doubt that food and water insecurity is an important element in creating the conditions in which conflict is an acceptable option, increasing the intensity of the engagement, and resulting in high 'real' costs in fragile environments and opportunity costs in resource transfers. The vicious circle of poverty, violence and environmental degradation is maintained.

On this basis, the discussion about whether wars will be fought over food or water is somewhat academic as food and water security or its absence will impact on all other areas of human endeavour, making strange bedfellows of humanitarian and environmental activists, advocates for social and economic justice, proponents of sustainable development, investors, scientists and researchers, and military men.

There are also divergences in opinion with regard to the degree of urgency which should be attached to the search for solutions, reflecting in the main, the experience of the individuals concerned. The relative abundance of resources (including food and water) in developed economies like Australia creates the impression that our problems are relatively minor compared to those elsewhere which are someone else's responsibility. Further more, our confidence regarding the inevitability of science and technology delivering the required miracles leads us to assume that solutions will be found—the 'blue' revolution is just around the corner—and doomsday scenarios will be averted. For those whose recent experiences include chronic shortages of resources and a succession of natural and man-made disasters, the vulnerability of our planet is all too apparent and the distribution of the benefits of recent progress gives little cause for comfort.

Against this background, while previous presenters argued the case for a fully integrated, holistic approach, the contributions of Professor El-Beltagy, Dr Williams and Mr Blackmore provide substantial and in some ways, surprising, consistency in their identification of common themes and priorities for action.

Knowledge

If improved food and water security would significantly reduce the incidence and intensity of conflict on an already damaged planet and accelerate sustainable development for the billions still living in poverty, heightened awareness and greater understanding of the issues will be required to translate concern into action. Awareness raising and advocacy has to be informed by research to ensure that the information on food and water security situations is current, accurate, and reliable, particularly if there is room for debate among the different stakeholders with regard to availability, quality, usage, cost structures and the distribution of benefits. Analysis is required to transform information into knowledge, and communication systems need to be in place to ensure that all stakeholders have access to the knowledge available.

…the need for further work to improve usage of current water and food (including fisheries) resources, to increase the supply of water available from non-conventional sources, and to reverse or repair previous environmental damage.

Research, analysis and communication are critically important in the development of policy and regulatory frameworks appropriate to each situation, and to support and promote innovation. In the latter regard, Professor El-Beltagy and Dr Williams emphasised the need for further work to improve usage of current water and food (including fisheries) resources, to increase the supply of water available from non-conventional sources, and to reverse or repair previous environmental damage. In all of these respects, there is room for more determined pursuit of the transfer of new technologies to bridge the technology and digital divides, to

gather, analyse, manage and disseminate information and knowledge as the precursors for action.

Engagement

Despite the variation in subject matter, the presentations of Professor El-Beltagy, Dr Williams and Mr Blackmore attached priority to the same issues in regards to engagement.

Each called for improvement in relation to the overarching policy and regulatory frameworks, pointing to the need for more and perhaps better targeted research and analysis to assist policy formulation and decision making. The importance of institutional strengthening and capacity building activities to support stable, effective and efficient governance and management systems was stressed, as was the need for better coordination between the various international, national and community organisations to improve capacity to ensure compliance.

In line with earlier presentations, Professor El-Beltagy, Dr Williams and Mr Blackmore emphasised the importance of a fully integrated, holistic approach, given high levels of inter-connectedness in 'living' systems and the high probability that adjustments in one area can have significant impact in other, sometimes less obvious ways. Food and water security issues defy simplistic definitions and demand multi-sector, multi-disciplinary, and multi-dimensional solutions:

- multi-sector in terms of the necessary involvement of government (politicians, civil servants and the military), business and the private sector, the academic and scientific communities, and civil society, including non-government and grassroots or community-based organisations;
- multi-disciplinary in terms of the connections with economics and employment, health and education, agriculture, political and environmental sciences, management, international development cooperation and community development;
- multi-dimensional in terms of the intersection of global, international, regional, national and intra-national discussions relating to the oceans and seas and river basins and catchment areas.

In this context, all three presenters underlined the importance of wide consultation among stakeholders and high levels of participation on the part of landowners, farm-workers and fishermen and community and women's groups. The brokering of meaningful conversations between stakeholders representing vastly different interests and with very different backgrounds in what are frequently highly conflictive situations—what Dr

Williams described as 'consensual management'—is clearly a challenge in itself. Open communication is difficult to achieve in the absence of common understandings of issues and shared objectives, but, in addition to the achievement of food and water security objectives, the 'process' provides exposure to negotiation and conflict-resolution techniques among stakeholders and promotes networking and alliance-making to achieve a common goal.

In this sense, conflict resolution is not just a by-product. Building local capacities can and should be an objective of scientific and technological interventions in support of food and water security, to assist conflict prevention and peace building and to strengthen the communities' ability to deal with other issues.

The Challenges

Professor El-Beltagy, Dr Williams and Mr Blackmore cited case studies to support their conclusions with regard to the need for improved governance and management systems, and an integrated, holistic, and participatory approach. At the same time, however, they flagged significant challenges facing the international community which will undermine our efforts if not quickly and comprehensively addressed.

Firstly, to transform concern into commitment and commitment into action, the information, knowledge and communications elements referred to previously are not sufficient if there is no shared world view—the 'enlightened self-interest' referred to by Mr Blackmore—or some other clarification of the 'values framework' or 'social contract' which shapes our own stewardship of the planet's resources and our responses to the needs of others. At what point is there need for more scientific examination of the economics of food and water security, the principles of interdependency, and inter-generational equity issues?

If we are to assume that globalisation is here to stay, at what point is it in our interests to ensure that there is an equitable sharing of benefits, perhaps even some constraints on the 'lifestyle' consumption levels of the minority, in favour of a reasonable livelihood for the majority?

If we are to assume that globalisation is here to stay, at what point is it in our interests to ensure that there is an equitable sharing of benefits, perhaps even some constraints on the 'lifestyle' consumption levels of the minority, in favour of a reasonable livelihood for the majority?

As mentioned previously, the occupants of the 'lucky country' in their island fortress have special barriers to overcome if we are to play our part in global efforts in support of food and water security and influence those who may be in a position to have even greater influence on 'global futures'.

Secondly, the international relations framework established during the first half of the 20th century is seriously frayed as a result of the enormous and very rapid changes which have

occurred, particularly under the 'globalisation' banner. The primacy of the nation state is no longer secure, with significant political and economic activity now occurring in non-state (including a range of illegal) contexts. Smaller government is 'in'—with the prevailing market forces, privatisation and de-regulation impacting on a range of services previously deemed to be the responsibility of governments, in what Dr Williams referred to as 'sometimes misplaced assistance'.

The democratisation of 'multilateralism' through the United Nations and its specialised agencies is being challenged as developed countries withhold contributions and pursue their own and their corporations' interests through 'economic' organisations which they are more readily able to control. Developing countries see their unequal participation in the old economy replaced by even less equitable access to the much faster-moving 'new' economy.

In this context, it is reasonable to ask who decides what constitutes the 'common good' for the planet and its people when the interests of 'the people' and 'people' in different parts of the world are not necessarily the same as the interests of the state or a global investor? How is it possible to legislate among non-state actors? And who will hold whom accountable to ensure that an international sustainable development code of ethics or 'triple bottom line' approach is maintained?

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Thirdly, with increased emphasis on processes of integration, consultation and negotiation, new skills are needed for the range of participants, from scientists to community development workers, political leaders, civil servants and businessmen. Integration cannot be at the expense of action, where attempts to cover every sector, discipline or dimension paralyses effort, or where in the absence of good governance and contemporary management systems, no work proceeds. Multi-skilling should not be pursued if better outcomes can be secured by appropriate alliances with expertise in relevant areas. And the higher costs of integrated, participatory approaches to development and conflict prevention—when there are no 'templates' or 'blue-prints' to suit every occasion—cannot be absorbed within existing budgetary arrangements.

Finally, the call for the creation of a learning environment in which critical success factors such as sustainable outcomes, an equitable distribution of benefits, the longevity of solutions, the reversal of earlier environmental degradation, and prevention of further damage are identified, criteria for objective evaluation are established and 'learned lessons' are acknowledged and applied.

Conclusion

Relatively speaking, Australia is blessed with an abundance of food and water, and, as was demonstrated by Mr Blackmore's video illustration, the freedom to engage in vociferous debate on river system management. It may be that we can afford to take the long view. Global economic interdependency and the complex relationships between poverty and conflict, industrial development and the environment, and the speed of change would urge against complacency.

Either way, we are uniquely placed to understand and identify with the extraordinary challenges facing developing countries—many of them in the Asia Pacific region—and to galvanise increased effort and additional resources in support of scientific and technological research to promote global food and water security. There is mounting evidence that defensive positions are not sufficient, and there is ample opportunity in preparation for the re-convening of the Earth Summit (Rio + 10) for us to start to put our house in order. Future generations will not regard us well if we fail to pick up the baton as the millennium commences.