

Proceedings
Regional Asia Pacific Defence Environmental Workshop

Catherine A. J. Phinney
Kent Hughes Butts

Environmental Security Series
Number 5

Darwin, Australia

11-14 May 1998

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE MAY 1998		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Regional Asia Pacific Defence Environmental Workshop				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Catherine A. J. Phinney and Dr. Kent H. Butts				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army War College 122 Forbes Avenue Carlisle, PA 17013-5234				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT This workshop explored the how defense assets and expertise can be applied toward a number environmental resources, strategies, practices and operations. The workshop findings concentrated on the resources and options available in the Asia-Pacific region, primarily in climate change, energy, fisheries and disaster response.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 331	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Editors
Catherine Phinney
Kent Hughes Butts

Composition
Mrs. Mary Jane Semple

Cover Artist
Arthur L. Bradshaw, Jr.

The editors wish to thank Commander Richard Hobbs, Dr. Lorraine Elliott, LTC. Ian Wing, Ms. Jackie Hux and Mr. Martin Walker, for their timeless work in support of this workshop. Their insights and cooperative spirit in eliciting creative ideas from all participants enabled the workshop to accomplish its objectives. Thanks also to COL. (R) Art Bradshaw, CPT. Tony Hassler and MAJ. Heather Meeds for their efforts in getting this publication completed in a timely manner.

The views expressed in this report are those of the participants and do not necessarily reflect official policy or position of the United States Army War College, the Department of the Army, the Department of Defense, or any other Department or Agency within the U.S. Government. Further, these views do not reflect uniform agreement among the exercise participants. This report is cleared for public release; distribution is unlimited.

Comments pertaining to this report or requests for additional copies are invited and should be forwarded to: Center for Strategic Leadership, U.S. Army War College, Carlisle Barracks, PA 17013-5049. Comments may also be conveyed by electronic mail to perryj@csl-emh1.army.mil or by calling (717) 245-3226 or DSN 242-3226.

TABLE OF CONTENTS

FOREWORD

Professor Doug Campbell	vii

EXECUTIVE SUMMARY	ix

CHAPTER I

WELCOMING REMARKS & OPENING ADDRESS

Welcoming Remarks by Mr. Rod Corey.	1
Opening Address by Major-General J.M. Connolly, AO	3

CHAPTER II

KEYNOTE ADDRESS

Keynote Address by Dr. Lorraine Elliott	9

CHAPTER III

PLENARY SESSION I - ENVIRONMENT AND SECURITY: CONCEPTS AND DEFINITIONS

Lt. Colonel Ian Wing	27
Mr. Michael Rae	39
Dr. Richard Matthew	45

CHAPTER IV

PLENARY SESSION II - ENERGY, ENVIRONMENT & GLOBAL CLIMATE CHANGE

<i>Concept Paper (Energy and Environment)</i>	59
Mr. Kar Sukardi	61
Mr. K.A.S. Gunasekera	77
Mr. L. Dorjtseden and Mr. S. Jargalsaikhan	81
Discussion	112

<i>Concept Paper (Global Climate Change)</i>	118
Ms. Ruby Saha	121
Ms. Kathleen McCarron.	141
Speech by the Chinese PLA Delegate.	
Discussion	

CHAPTER V

PLENARY SESSION III - FISHERIES AND MARINE PROTECTION

Concept Paper	
<i>Introductory Remarks</i> - Mr. A.T. Downs	

Mr. Gerald Miles	
Lt. Commander John Shevlin	
Discussion	

CHAPTER VI

PLENARY SESSION IV - INFORMATION AND TECHNOLOGY EXCHANGE

<i>Concept Paper</i>	
<i>Introductory Remarks</i> – Mr. Warren Meekins	
Ms. Jackie Hux	
Discussion	

CHAPTER VII

PLENARY SESSION V - NON-INDIGENOUS INVASIVE SPECIES MANAGEMENT

<i>Concept Paper</i>	
<i>Introductory Remarks</i> – Colonel Don Driggers.	
Mr. Gary Oldenberg.	
Dr. Mike Pitzler	
Mr. James Murphy	
Mr. Craig Walton	
Mr. Bob Woods	
Ms. Katherine Colgan.	
Major David Jones	
Ms. Pam Frost	
Discussion	

CHAPTER VIII

PLENARY SESSION VI - ENVIRONMENTAL DISASTER RESPONSE

<i>Concept Paper</i>	
<i>Introductory Remarks</i> – Mr. Rod McKinnon	
Captain (N) B.R. ‘Bear’ Brown	
Colonel Imsuk Yang	
Major John Henshaw	
Discussion	

APPENDICES

Attendee List	
Biography for Catherine A.J. Phinney, BA (Hons), MA	
Biography for Kent Hughes Butts, PhD.	
Agenda	

FIGURES

1. World Population-Recent and Projected Trends	62
2. Government Structure for Environmental Management	69
3. Implications of Changes in Agricultural Productions	72
4. Population and Economic Growth from 1990-2100 Under Different Development Scenarios.	73
5. Fuel Structure of Mongolia	83
6. The Transformation Structure in Mongolia.	84
7. Energy Demand Tree	85
8. Energy Consumption in 1990-1995.	86
9. Per Capita Energy Consumption	87
10. Heat and Electricity Consumption in 1990-1995	88
11. Energy Intensity Trend (KJTOE/Mtugr)	88
12. Traditional Fuel Consumption in 1990-1995	89
13. Sectoral Energy Consumption Structure	90
14. Final Energy Demand (By Type of Energy).	95
15. Final Energy Demand by Sector.	97
16. Structure of the Final Energy Demand in 1993, 2010 and 2020	97
17. Fuel Evolution	99
18. Electricity Generation Structure	100
19. Important Indicators (BAU)	101
20. Primary Energy.	109
21. TSP Reduction Impact	110
22. SO ₂ Emission Reduction Impact	110
23. NO _x Emission Reduction Impact.	111
24. CO ₂ Emission Reduction Impact.	111

TABLES

1. Perspectives on Environment and Security	49
2. Gross Domestic Product-Recent and Projected Trends.	62
3. Primary Energy Consumption-Recent and Projected Trends. . . .	63
4. National CO ₂ Emissions.	71
5. Heat Demand Structure	96
6. Energy Supply, 1993-2020	98
7. The Emission Sectoral Breakdown	101

**Sponsored by the Department of Defence,
Australia Department of National Defence, Canada
Department of Defense, United States**

FOREWORD

The Environmental Security Trilateral Partners of the Australian, Canadian, and United States Departments of Defence hosted a regional Asia-Pacific Defence Environmental Workshop in Darwin, Australia, from 11 to 14 May 1998. The theme of this workshop was “Defence Dimensions of Contemporary Environmental Issues” and was a follow-up to the September 1996 “Asia-Pacific Defence Environmental Conference” held in Honolulu, Hawaii, USA. The purpose of the workshop was to provide a forum where defence and environmental officials from Asia-Pacific Nations could examine the importance of defence related environmental issues to regional stability. Participants of the Hawaii Conference requested future regional workshops, suggested topics and asked to participate in panels and presentations. This workshop was structured in response to those requests.

The objectives of the workshop were to: promote cooperation in addressing environmental issues by providing a forum for regional views; create a database for information exchange and research; identify methods and policies to address environmental issues; and to promote regional cooperation and stability. The workshop covered six broad topic areas suggested by the Honolulu Conference participants: Energy and the Environment; Global Climate Change; Fisheries and Marine Protection (watershed and coastal zone protection); Environmental Disaster Response; Information and Technology Exchange; and Non-Indigenous Invasive Species Management.

The sponsors hoped that the workshop would allow the defence ministries of the region to develop effective strategies to address environmental issues in a proactive approach, thereby promoting regional stability while enhancing the military to military relationships of defence cooperation.

The Center for Strategic Leadership of the U.S. Army War College is pleased to have been asked to design the workshop program and web site, and conduct its six research games. This is the fifth in the CSL series of Environmental Security reports and follows on to our *Asia Pacific Environmental Change and Regional Security* conference work with the Asia Pacific Center for Security Studies. We hope this report will further the objectives of the sponsors and the spirit of defence environmental cooperation evidenced by the participants.

DOUGLAS B. CAMPBELL

Professor

Director, Center for Strategic Leadership

U.S. Army War College

EXECUTIVE SUMMARY

Following the success of the Asia-Pacific Defence Environmental Conference held in Honolulu, Hawaii in September 1996, the Environmental Security Trilateral Partners of the Australian, Canadian, and United States Departments of Defence hosted the Regional Asia-Pacific Defence Environmental Workshop in Darwin, Australia in May 1998.

The objectives of the workshop were drawn from the overall theme, *Defence Dimensions of Contemporary Environmental Issues*. The workshop forum provided an opportunity for stakeholders from a number of regional countries, including national officials, policy-makers, academics, representatives of non-governmental organizations and military officers to explore the impact of environmental issues on national and regional security.

Participants were encouraged to examine the security challenges presented by environmental concerns, and to then consider possible opportunities for cooperation toward mitigating these threats.

Several major themes emerged throughout the workshop, both in the formal presentations and during subsequent discussions and individual workgroups. It became possible to recommend cooperative strategies for confronting environmental challenges once common issues had been identified.

Defence assets and expertise can be applied toward a number of environmentally-related strategies, practices and operations

- Defence Forces are in a position to demonstrate leadership by developing policies and procedures that minimize any impact they have on the environment and to remediate existing problems
- Defence Forces should take a leading role in pursuing cooperation among military, civilian and non-governmental organizations toward managing regional environmental security threats, particularly in terms of information and technology exchange

- Defence personnel and equipment can be used to supplement civilian disaster relief capabilities

The Trilateral partner countries in general, and their Defence Forces in particular, should assume a leadership role in capacity building initiatives in the region. These initiatives aim to enhance the capabilities of regional states in assessing causes and impacts of environmental problems, developing response strategies to mitigate these problems and contingency planning for crisis response. Capacity building requires a number of measures which may be undertaken cooperatively by governments and their defence forces, non-governmental organizations, and civilian agencies, through:

- The transfer of knowledge and expertise, particularly in terms of environmentally sound technologies;
- Information sharing and exchange;
- Regional coordination in joint areas of concern;
- Sharing expertise and lessons learned through regional forums, multilateral exercises and personnel exchanges;
- Assisting in the development of disaster warning mechanisms;
- Assisting in contingency planning and disaster response strategies;
- Sponsoring training activities, exercises and operations in areas such as disaster relief, environmentally responsible operating procedures, and energy-management.

Cooperative arrangements should be advanced toward preventing the occurrence or escalation of environmental problems to the extent that they present a threat to national, regional or global security.

- Defence cooperation on environmental security issues can build confidence and goodwill between countries with other differences.

- Capitalize on existing treaties, arrangements and organizations rather than developing new arrangements.
- Information and technology exchange should be undertaken toward breaking down communication barriers.
- The responsibility of initiating these arrangements remains with national governments; Defence Forces can play a valuable role in areas such as facilitation, stewardship, information sharing and dissemination, logistical support, verification and enforcement.

Strategic environmental planning should be undertaken at both the levels of prevention and mitigation.

- The focus should be long-term rather than short-term.
- Traditional strategic planning must now incorporate such issues as alternative energy options, sustainable development, capacity building, information sharing and exchange.

Workgroup Findings

A scenario which encapsulated the environmental challenges and potential threats consistent with each of the six topics was provided to each workgroup participant. The aim was to promote debate and stimulate thinking about developing cooperative measures toward mitigating these challenges.

The conference concluded with each workgroup leader briefing the plenary on the workgroup findings.

The **Energy and Environment** workgroup addressed issues related to the environmental impact of energy consumption, including the threat of pollution through accidental spills during the transportation of energy resources. In consideration of the possible long-term risks to the environment, including the socio-economic context in which these impacts are felt, long-term strategic planning should be prioritized. This includes improving current energy efficiencies and developing alternative energy options. The objective of strategic energy planning is to minimize the negative impact that energy use has on the environment.

- Defence assets and resources may be applied to energy-related management strategies such as energy reduction, alternative energy resources and environmental protection.
- Regional arrangements should be developed toward protecting the movement of energy resources; a possible role for the military includes monitoring, reporting and where applicable, enforcement.
- Defence Forces should continue to provide leadership in energy efficiency.

The **Global Climate Change** workgroup identified global warming as a major long-term environmental threat to regional security. Measures attempting to eradicate, or to confront these challenges must be both proactive (prevention) and reactive (mitigation and remediation).

The impact is likely to be felt most strongly on socio-economic factors. Islands and coastal regions are threatened in areas such as tourism, agriculture, and fisheries. The subsequent social and economic impact may leave these areas more vulnerable to third party exploitation or intervention. These regions are also threatened by other global climate change-related events such as cyclones, and typhoons. Population movements brought on by natural disasters or poor economic conditions may increase instability in the regions to which they migrate or indeed, exacerbate the socio-economic conditions in their own regions.

The workgroup participants identified several opportunities to address these concerns.

- Small islands could benefit from developed countries' experiences through information sharing and capacity building; emphasis is on an enhanced leadership role for Defence Forces.
- Contingency planning for disaster response should be undertaken with the support of experienced Defence Forces.
- Flashpoints should be identified through enhanced Early Warning techniques.

- Defence Departments should participate in multilateral fora where environmental abatement issues are addressed (eg.: *the Intergovernmental Panel on Climate Change*).
- Capacity building toward reinforcing indigenous capabilities should be undertaken through information exchange, technical assistance, and improving disaster response strategies.

Participants in the **Fisheries and Marine Protection** workgroup agreed that the fisheries of the Asia-Pacific region are vitally important to each of the nations' economies. Overfishing threatens the sustainability of these resources and the region's economies. Illegal fishing is a challenge to regional stability and security. Coastal and marine pollution threaten the sustainability of the fisheries and other industries in the region.

Opportunities for cooperation toward abating these concerns suggest specific defence contributions that might reduce or contain a larger problem. These contributions should be considered in the context of overall national and regional solutions.

- Provide an increased capability in maritime and aerial surveillance, including satellite surveillance.
- Assist in monitoring vessels and fishing activity.
- Identify incursions on Exclusive Economic Zones (EEZ) at the request of affected countries.
- Foster an indigenous surveillance and enforcement capability.
- Assist in establishing communication systems that facilitate the flow of information and intelligence regarding possible illegal fishing activities.
- Promote awareness of the problems and dangers of illegal fishing, such as the financial costs and long-term impact and related penalties.
- Increase the defence presence through the peak fishing period.

- Train local defence and law enforcement services in the techniques of boarding and apprehension, surveillance, monitoring and communications systems.
- Provide free access to scientific data to facilitate the measuring and monitoring of changes in the marine environment.
- Provide practical pollution control assistance.

The conclusions reached by the participants to the **Information and Technology Exchange** workgroup suggested that information sharing is one mechanism that can foster capacity building. In addition, information exchange may be employed as a tool for enhancing cooperation and developing communication links among states, organizations and agencies.

Important considerations in the area of information and technology exchange include on the one hand, how information will be disseminated and exchanged and on the other, how information exchange might encourage regional cooperation.

- There must be a degree of interoperability of systems between sender and receiver including standardised formats and infrastructure; this could be achieved through the establishment of a central information and coordination centre.
- Defence involvement at interest-focussed conferences and workshops would allow defence expertise and capability to be publicized and employed; the focus should be on specific areas such as disaster response, meteorology, quarantine, land management and humanitarian assistance.
- Information technology could be used to hold discussions, plan meetings and share information, allowing multimedia access to a broad range of defence issues across an unlimited geographical area.

The conclusions reached during the workgroup on **Non-Indigenous Invasive Species (NIIS)** suggest that NIIS is most threatening economically. Non-indigenous species can affect the

economy in every sector by disrupting a nation's ecology and impacting on areas such as tourism, agriculture, fisheries, public health, fertility of lands and water.

The affected state may also face the degradation of national security resulting from international isolation and the diminished capability and readiness of its armed forces. This may result from the degradation of training areas and the diversion of resources into remediation activities at military expense. The opportunities for defence cooperation in response to this problem are not extensive, although emergency response operations likely involve defence forces. The goal of the operation should be the immediate control of the NIIS.

Nevertheless, Defence Forces should assume responsibility for protecting the environment in their own operations.

- Defence forces have a “duty of care” in maintaining the local, regional and global environment.
- The environment must be taken into consideration in the scope of every mission.
- Information regarding the control of NIIS and other relevant issues should be exchanged among military and civilian agencies and NGOs through the Internet, councils and fora.
- Emergency response often includes Defence capabilities, including logistics, transportation and health support.
- Defence Forces can assist in detailed contingency planning prior to crisis.

The recommendations concluded by the **Environmental Disaster Response** workgroup are applicable to each of the other categories of challenges discussed throughout the workshop.

In focussing on opportunities for defence cooperation, three themes emerged.

- the need for detailed contingency planning prior to a crisis.

- the need to strengthen indigenous capacities, including reinforcing and fortifying infrastructure and increasing the efficiency and effectiveness of response.
- the need to coordinate emergency response capabilities with civilian and non-governmental partners.

Defence Forces from the region may assist states that are likely to be stricken by a disaster in several ways. The majority of the suggestions are long-term, preventive measures, although they do account for short-term requirements such as the provision of basic needs immediately following a disaster.

Defence Forces may assume a critical role in providing assistance toward improving the local response capacity, and preventing or minimizing the damage and loss of life caused by disasters once they occur; through:

- Practical assistance in reinforcing and fortifying infrastructure;
- Support to local policing and security capacities toward preventing crime and instability in the post-disaster period;
- Improved communications and mechanisms for information dissemination, sharing and exchange;
- The development of personnel exchanges and training programs for disaster preparedness planning;
- The development of disaster warning mechanisms;
- Assistance in the development of contingency plans.

The opportunities for defence cooperation are aimed at increasing the efficiency and effectiveness of disaster response operations.

- There is a requirement for coordination and education across governments, agencies and organizations including defence forces, non-governmental organizations, donor and recipient nations and international organizations.

- There must be a clear mandate for action which includes a clear extraction plan.
- The military must have clear rules of engagement; NGOs and international organizations must have an express understanding of their respective roles in the overall framework.
- Improve information and technology exchange and develop standard operating procedures, particularly when there is a requirement for cooperation and coordination between military and civilian agencies and groups.
- An efficient coordination and liaison mechanism should be established to facilitate civilian-military interaction at the disaster site; each actor should be performing the function they do best so as to effectively undertake the relief effort.
- Exercises, personnel exchanges and training programs should be undertaken to jointly engage military and civilian personnel prior to a crisis.

CHAPTER I

WELCOMING REMARKS AND OPENING ADDRESS

WELCOMING REMARKS

Mr. Rod Corey, Head Defence Estate, Australia, welcomed the participants on behalf of Mr. Gary Vest from the U.S. Department of Defense and Mr. Tony Downs, Department of National Defence, Canada, to the second Regional Asia Pacific Defence Environmental Workshop.

Mr. Corey provided a brief history of the Environmental Trilateral Forum which has been in effect for almost four years. The arrangement has engaged Australia, Canada, and the United States in a series of activities; in particular, the Trilateral has provided for a joint examination of common issues under the leadership of one of the partner states: information-sharing on a range of environmental topics such as the management of military training areas; unexploded ordnance and other remediation; Navy clean ships programs; and technology exchange.

The Trilateral provides a forum where each member can benefit from the experience of each of the other partners, while avoiding the duplication of efforts.

Mr. Corey pointed out that from an Australian perspective, the arrangement has been very rewarding and of great benefit as the defence sector progressively develops its approach to the responsible environmental management of defence activities. He further indicated that the Environmental Trilateral Forum is only one of a number of similar management initiatives which the United States and Canada are involved in throughout the world.

In a serious attempt to build awareness in the Asia-Pacific Region of both the activities of the Trilateral and the potential benefits from becoming involved in some form of bilateral or multilateral arrangement, the Trilateral partners decided to sponsor the first *Asia-Pacific Defence Environmental Conference* in Hawaii in June of 1996.

The primary purpose of the Conference was to expose delegates to the types of issues that the Trilateral partners were themselves confronting, the actions being undertaken to combat these issues, and the mutual benefits obtained through the partnership arrangement.

The Conference was also attended by a number of industry representatives who were invited to address the conference on the technologies and methodologies they were adopting or developing to identify potential environmental concerns and, where necessary, to remediate the existing problems and prevent future problems.

Mr. Corey explained that participants were invited to express their views on the issues that had been raised throughout the Conference and, specifically, the potential benefit they could gain from participating in a bilateral or multilateral forum on environmental management issues.

The general response favored some method of involving participating nations in the work of the Trilateral and included a number of suggestions as to how this might be achieved.

One suggestion that was strongly recommended was the creation of regional workshops to allow liaisons from the neighboring countries to discuss common issues and identify potential mutual benefits.

Mr. Corey noted that irrespective of distance or location, in a global environmental context there is a common interest in identifying, and where possible, addressing strategies to overcome similar problems that exist whether to a lesser or greater extent in each of the participating countries.

The workshop was organised in order to provide those attending with the opportunity to communicate fully with environmental policy makers and military personnel from a variety of backgrounds on issues of individual, national or common concern.

Mr. Corey emphasised that the forum and format were designed in direct response to comments from those nations which participated in the 1996 Hawaii Conference. Participants were encouraged to make full use of the opportunity to discuss and develop themes which are of particular interest to them in each of the workshops. While pointing out that many of the attendees' concerns are likely to be

country-specific, Mr. Corey noted that the issues to be discussed throughout the workshop were expected to be largely global in nature.

Mr. Corey acknowledged the effort that each participant made in order to participate at the workshop and asserted his belief that the format of the workshop would ensure a commensurate outcome. Mr. Corey concluded by expressing the Trilateral members' shared interest that each participant would find the event both rewarding and beneficial in addressing individual and common environmental concerns.

Mr. Corey then introduced Major-General J.M. Connolly, AO, Commander Australian Theatre, who was invited to present the workshop's opening address.

OPENING ADDRESS

In the Opening Address, Major-General Connolly addressed the increasing importance of defence-oriented environmental issues as they relate to regional stability, and some of the initiatives undertaken by the Australian defence sector in an effort to remediate these problems.

Major-General Connolly expressed his pleasure in welcoming participants from throughout the Asia-Pacific region and beyond to the workshop, which he referred to as an "important gathering of defence and environmental practitioners."

Major-General Connolly began by asserting that the environment is of increasing importance in all sectors. As the new millennium approaches, the world is faced with many crucial environmental challenges.

There is potential for environmental problems to greatly influence economic, social and political security, and consequently, regional stability.

The earth has this century undergone the fastest warming since the end of the last Ice Age, where human impact on the atmosphere, through the burning of fossil fuels, has created the so-called

‘greenhouse effect’ and appears to be bringing about significant climate change.¹

The world is losing seven million hectares of fertile land each year due to soil degradation resulting from overgrazing and deforestation.² Ten million hectares of forestland is lost annually through stripping and burning, over two million hectares, an area about the size of South Korea, in the Asia/Pacific region alone.³

The world population continues to grow by approximately 87 million people per year.⁴ The baby that breaks the six billion barrier will be born in 1999. By 2025 the world’s population will have reached an estimated 8.2 billion.

Currently, about a third of the world’s population does not have access to safe, clean water.⁵

Although significant reductions have been made in the production of chlorofluorocarbons (CFCs) and the manufacture and use of renewable, non-polluting energy sources continues to rise, there remains much work to be done.

Major-General Connolly pointed out that the theme of the Regional Asia-Pacific Defence Environmental Workshop, Defence Dimensions of Contemporary Environmental Issues, provides the opportunity to firstly, examine defence-oriented environmental issues as they relate to regional stability while identifying opportunities for defence cooperation, and secondly, promotes cooperation by providing a forum for the exchange of regional views.

Major-General Connolly went on to describe a number of initiatives undertaken by the Australian Defence Force which have contributed to the responsible environmental management of the force’s activities. One such initiative was the establishment in 1997 of the Defence Environmental Panel (DEP). The DEP is a panel of

1. Goddard Institute for Space Studies, New York, Cited in Vital Signs 1996/1997, World Watch Institute

2. World Resources 1992-93, cited in Joni Seager, The State of the Environment Atlas, Penguin 1995

3. Forest Resources Assessment 1990: Global Synthesis, UN Food & Agricultural Organisation 1995

4. World Population Prospects: The 1994 Revision, United Nations 1995

5. Human Development Report 1996, UNDP

environmental consultants who offer such services as strategic level advice on the planning, development, and management of environmental initiatives and contamination assessment, survey, and remediation. Other services offered by the panel include environmental impact statements, preparation of Environmental Management and Conservation Management Plans, and environmental project management.

The need for the DEP arose from the requirement to ensure that environmental services offered to Defence across Australia were of a consistent standard and to pool and share environmental expertise across the wider Defence organisation.

Similarly, the Defence Estate Organisation (DEO) was established in July 1997 and is responsible, on a national basis, for the management of Defence infrastructure and property.⁶ Considerable effort has been made to ensure that the proper management of defence force training areas includes the integration of military maneuvers with environmental concerns. Major-General Connolly offered Puckapunyal Training Area in Victoria and Shoalwater Bay Training Area (SWBTA) in North Queensland as examples where much has been done by the Australian Defence Force to enhance and protect the environment.

In addition, the environmental management of Australian Defence Force exercise areas includes a range of measures designed to reduce the effects of aircraft noise emissions, soil erosion, and damage to flora as well as the protection of indigenous fauna.

Exercise *Tandem Thrust*, a major joint crisis planning and field training exercise with United States Commander-in-Chief, Pacific Command (USCINCPAC), was held in the Shoalwater Bay Training Area last year and involved large numbers of ships, armoured vehicles, aircraft, and personnel. A noteworthy aspect of this ambitious and extensive exercise was the proactive measures taken in environmental management. Considerable planning was carried out in terms of general environmental protection, particularly with respect to safeguarding one of Australia's most significant natural assets, the Great Barrier Reef.

6. Defence owns some 2.7 million hectares of land and controls approximately 300 leased properties. DI(G) ADMIN 57-1 (Comments by Mgen J. M. Connolly during Opening Address)

Major-General Connolly asserted that measures to enhance environmental protection must be given priority in all defence exercises and training activities. Given the inherent organization, command, control and communications capabilities, diverse skills, and ability to respond and deploy quickly, the Defence Force has the capacity to assist in disaster relief operations. Indeed, the provision of Defence resources for such operations is regarded as a normal Defence function.

Regional defence cooperation on environmental issues is already underway. As the result of a suggestion made by the Philippines, the Australian Defence Force is currently involved in the planning of a trilateral humanitarian assistance/disaster relief simulation. To be known as exercise SAGIP (to 'save' or 'rescue'), the exercise will be conducted in Manila in the first quarter of 1999 and will involve military and civilian representatives from Australia, the Philippines, and the United States. The intent is to conduct a series of exercises, possibly on an annual basis, that will progress in both focus and substance.

The aim of the exercise SAGIP series is:

"To develop common understanding and procedures for cooperative multilateral relief operations in the event of a major disaster as a means to enhance regional defence relationships"

SAGIP '99 is perceived as a significant confidence-building activity that will at once enhance engagement and interaction, and lead to the development of operating procedures for trilateral disaster response.

Major-General Connolly then expressed his wishes to the participants for a successful workshop. In particular, he noted that dialogue during the workshop had the potential to provide a basis for developing cooperative and coordinated responses to a range of environmental issues. Such interaction is essential in promoting regional stability, protecting strategic interests and creating sustainable economic growth and trade. Most significantly, the workshop results would indicate a measure of progress, serving to indicate a direction for the future.

Major-General Connolly thanked the sponsors on behalf of the workshop participants, specifically the Environmental Security

Trilateral Partners of the Australian, Canadian and United States Departments of Defence and organisers for their work in arranging the agenda, accommodations and facilities.

Inclosing, Major-General Connolly echoed the desire of the sponsors that the conference discover ways for the defence ministries of the region to cooperate in addressing the many environmental challenges that exist, thereby promoting regional stability and enhancing valuable military-to-military relationships.

CHAPTER II

KEYNOTE ADDRESS

Dr. Lorraine Elliott
Political Science Department,
Australian National University

It is clear at the end of the twentieth century that human activity is changing the environment in a way unlike that of any other era, and not for the better. Despite the many international conferences convened and treaties adopted over the past twenty-five years, the state of the world's environment continues to deteriorate as the United Nations Environment Program's (UNEP) *Global Environmental Outlook* attests in preparing for last year's Special Session of the General Assembly.

The agenda of contemporary environmental concerns and their social, economic and ecological impacts is long. It includes atmospheric pollution and ozone depletion; deforestation, desertification and land degradation; loss of species and habitat biodiversity; air and water pollution; depletion of renewable and non-renewable resources; waste management, including toxic and hazardous waste; vector-borne diseases; and continuous and increasing urbanisation. It also includes the issues that provide the specific focus for discussions over the next four days: energy, global climate change, fisheries and marine protection and invasive species management.

Protection of the environment locally, nationally, regionally and globally is crucial to security. It is a decisive factor in economic vitality. A secure environment is fundamental to individual and community health and well being and in some cases, survival. The fact that the environment should be protected and sustained rather than abused and degraded is a fundamental ethical principle.

The phrase that has most often been used to provide a framework for examining the defence dimensions of this agenda is

“environmental security”. Yet the meaning of the concept and the policy prescriptions that arise from it are contested. It has been used to focus on the deliberate and unintended destruction of the environment and environmental services during wartime. It has been used to draw attention to the direct and indirect environmental impact of defence and defence-related activities during peacetime. It has perhaps most often been used as a vehicle for examining the potential for conflict to arise from environmental degradation and resource depletion. It has also been used to direct attention to the importance of securing or protecting the environment not simply as a goal in itself; as Gareth Porter explains, “increasing stresses on the earth's life support systems and renewable natural resources have profound implications for human health and welfare that are at least as serious as traditional military threats” (1995, p.218).

As a normative concept, environmental security illustrates the debate about what security means as we approach the 21st Century, and about the kinds of strategies and policies that must be adopted in order to ensure that security. In other words, what will “buy more security - real, enduring and all-round security” (Myers; 1996, p.218). In this context, the defence component of environmental concerns is not simply another policy issue for the military sector, although an important factor, it is only part of a complex set of issues regarding the nature of the military's mission in a post-Cold War world and how that mission can best be pursued and achieved. It raises questions about the roles and responsibilities of the military sector, set against disagreements over the revolution in military affairs and the nature of what some have called the post-modern military or the military after next. The defence dimensions of contemporary environmental issues are neither straightforward, nor are they easily made amenable to strategic guidelines or operational directives.

A discussion of the defence dimensions of contemporary environmental concerns and their implications for regional stability poses at least three major questions. First, what is the relationship between environmental degradation and regional instability or insecurity? Second, in terms of a role for the defence sector it is necessary to consider the nature of a military response to environmental security issues. As such, what kind of involvement should the military have in addressing regional environmental

concerns and what should the purpose and nature of defence environmental cooperation be? Third, is this role compatible with the traditional understanding and pursuit of the defence mission?

The revisiting of the security agenda within the scholarly and policy community has been motivated by an interest in understanding the new configurations of power after the collapse of the familiar bipolarity of the superpower era, and to anticipate “new” and non-conventional threats to national and international peace and security. Environmental degradation is now labelled as one such non-military threat with the potential to undermine economic vitality and, whether directly or indirectly, constitutes a possible source of intra- and inter-state tension and conflict. The Final Declaration of the historic summit of the Heads of State and Government of the UN Security Council, held in 1992, concluded that the “non-military sources of instability in the economic, social, humanitarian and ecological fields have become threats to peace and security”. “The United Nations membership as a whole”, the declaration continued, “needs to give the highest priority to the solution of these matters” (cited in Tinker 1992, p.787). The North Atlantic Treaty Organization’s (NATO) Strategic Concept similarly observes that “risks to allied security are less likely to result from calculated aggression [than from] the adverse consequences of instabilities [and that] security and stability have...environmental elements as well as the indispensable defence dimension”(see NATO 1996).

Much attention has therefore been paid to the “potential [for] major environmental changes to generate and intensify conflict between and within states” (Soroos 1994, p.318). This version of the environmental security project seeks an improved understanding of the dynamics of this relationship and to characterize the kinds of environmental degradation which might disrupt national, regional or even global security and political or economic stability.

The web of causality which links environmental degradation with conflict is highly complex. The most direct causal link is expected to arise from resource scarcity. The new strategic resources are often those which have in the past been regarded as plentiful, either because they were renewable or non-depletable. Studies have thus examined the potential for internal instability and cross-border tensions to arise over access to water and arable land including

environmental services, such as food and agriculture, which those resources support and supply.

The relationship is further complicated by what the World Commission on Environment and Development called “differences in environmental endowment” (1987, p.292), that is, inequities in the distribution and use of resources (such as energy); inequities in the causes of environmental degradation and resource depletion; in disproportionate impacts and relative vulnerabilities (a key example being climate change); and differences in response capacities. As such, environmental decline may become a contributory factor in what Thomas Homer-Dixon calls “relative deprivation conflicts” (1991, p.109). The most immediate and disproportionate impact of environmental degradation will be felt by those who are already marginalised in society and who have contributed disproportionately less to the environmental decline, including, for example: the poor, women, and indigenous peoples. The social and economic consequences of environmental degradation and resource depletion will exacerbate the prevailing misery and despair in the poorer parts of the world. When compounded by internal migration, additional environmental pressures on land that is already marginal, or competition for scarce urban infrastructure, it may contribute to the disruption of “legitimised and authoritative social relations” (Homer-Dixon 1991, p.91).

A review of Asian-Pacific literature reveals that many environment and resource-related concerns have been identified as possible factors in intra- and inter-state tensions, instabilities and conflict. The availability of fresh water, important for individual well being, health and agriculture, is declining on a per capita basis as population increases and as a result of other factors such as pollution and the demands of urbanisation. Fish stocks, a major source of protein in the region and a major economic resource for local communities in terms of export commodities, are in decline as a result of marine and coastal pollution, over-fishing and illegal-fishing. Of major concern to many low-lying Pacific Island countries as well as many other countries in the region are the potential impacts of climate change particularly sea level rises. Other likely impacts include flooding, salt-water intrusion of inland waterways, damage to coastal ecosystems, loss of land and

agricultural productivity, and displacement of coastal, rural and urban populations.

Air pollution, including increases in sulphur dioxide and nitrogen oxide and loss of ambient air quality, is on the rise as a result of continued urbanisation and increased energy demands, which in turn, contribute to climate change. Deforestation, which has many causes including illegal logging (often in border areas), is a major regional environmental problem, as is soil degradation, loss of biodiversity and increased flooding in watersheds. Other potential problems include hazardous waste management, concerns over marine pollution (about 70 percent of which arises from land-based activities), and the possibilities of environmental disasters, such as oil spills (of major concern is shipping traffic in the Malacca Strait) and increased frequency and intensity of natural disasters such as flooding, drought, and cyclonic activity.

The potential for regional instability in each or any of these cases is speculative, although inter-state tensions are already in evidence in some cases, such as the decline of fish stocks. If environmental degradation is a factor in exacerbating poverty and ill health, increasing competition for resources, or the enforced movement of peoples, it may be a factor in internal tensions and instabilities which nevertheless have other proximate causes. To the extent that environmental decline and resource depletion is transboundary, in both cause and impact, there is potential for inter-state tension.

It is thus necessary to consider the defence dimensions of this agenda. In a 1994 study, strategic analysts James Winnefeld and Mary Morris listed a number of questions relating to the likely intervention points in the relationship between environmental degradation and conflict (1994, p.19):

- what are the causes of environmental degradation;
- what can be done to reverse such degradation;
- what are the adverse environmental effects (and their causes) in the region;
- what can be done to reduce environmental problems that have important social effects;

- what are the adverse social effects that result from regional environmental problems;
- what can be done to reduce adverse social effects that might result in an acute conflict;
- what are the types of possible an acute conflict (and their likelihood) that might result from adverse social effects;
- what can be done to reduce the effects of acute conflict that will produce adverse environmental effects?

This list suggests that there are points of intervention other than simply responding to the conflict or instability that might arise. Nevertheless, perhaps the most conceptually familiar (though arguably the most policy inappropriate) is that which envisages “a traditional coercive task” (Oswald 1993, p.118) for the military sector in responding to the instabilities that result. Thus defence forces might engage in defensive or pre-emptive action to maintain internal security in the event of environment-related instabilities, to maintain control over resources, to secure borders against environmental refugees, or to respond to trans-border conflict driven by environmental or resource concerns. Others have suggested the possibility that “poor environmental behaviour from the nations of the world” could require a “direct active response” from military forces (Oswald 1993, p.129).

Understanding the defence-environment connection solely through the lens of conflict or instability limits the scope for analysis and action. The conditions under which environmental degradation might result in violence or conflict are not only the subjects of much study, as suggested above, but also of much disagreement. While the propositions about conflict over scarce resources and depleted environmental services seem persuasive, they are not universally accepted, nor should they be. Questions are asked about whether the images of scarcity, particularly of non-renewable resources, can be sustained in the face of technology and market forcing of substitutes. Questions are asked also about whether the arguments about causality are reduced to an easy inevitability which ignores other factors in internal and inter-state violence and instability and which overlooks other outcomes. Richard Moss, writing in the Yearbook of

the Stockholm International Peace Research Institute (SIPRI), suggests that “conflict is only one possible outcome” (1993, p.27) and that environmental decline and resource depletion may provide incentives for greater cooperation in the management of common problems.

Understanding the defence dimensions of contemporary environmental issues simply in terms of conflict or instability also runs the risk of narrowing policy options by focusing on symptoms rather than causes. As Jessica Mathews has suggested, the “underlying cause [of environmental degradation] is often ignored [as] governments address the...instability that results” (1989, p.166). Similarly, as Admiral Sir Julian Oswald argued as First Sea Lord of the United Kingdom, it is failure to take action on environmental degradation that is “likely to lead to escalating insecurity and instabilities in which the forces of traditional security will be heavily engaged” (1993, p.113).

The traditional idea of an enemy is also increasingly inappropriate for defining contemporary insecurities and determining policy responses. The geopolitical metaphors of borders and boundaries, and power acquired through dominance and deterrence, are increasingly inappropriate for the ecological imperatives of addressing environmental degradation. These are threats without enemies. Certainly the environment is not the enemy. Rather, the ‘threat’ lies in the everyday activities of humans and corporations; the former primarily in the pursuit of quality of life (notwithstanding inequitable consumption and waste production patterns between the North and the South) and the latter in pursuit of profit. As Michael Renner has argued, traditional military responses “cannot reverse resource depletion or restore lost ecological balance” (1989, p.38). As the World Commission on Environment and Development observed, there are “no military solutions to environmental insecurity” (1987, p.301).

If this is the case, how can we then understand the defence dimensions of the contemporary environmental agenda? In elaborating his concept of preventive defence, then US Defence Secretary Perry argued that “security depends equally as much on preventing the conditions that lead to conflict and on helping to create the conditions for peace” (cited in Goodman 1996). At the heart of preventive defence, he argued, is not only understanding the causes

of conflict and instability, but also in providing adequate warning of potential crises, and acting well before a crisis to avoid costly military interventions (cited in Goodman 1996).

The defence dimension of contemporary environmental problems is therefore directed away from reacting to conflict to the theatre of “operations other than war”. The military-to-military dimension of defence environmental cooperation has been the subject of considerable discussion and there are now a number of examples of successful implementation. The imperatives of maintaining and extending such cooperation in order to minimise the environmental impact of defence activities cannot be overlooked. The benefit to the environment arises from more efficient resource use, a reduction in pollution and waste production and the clean-up, protection and conservation of the military and military-related sites, range management, remediation of landmine-contaminated areas and the development of more environmentally benign weapons acquisition and disposal strategies. The political and strategic benefits arise from confidence-building and closer relationships among regional military and defence establishments.

A proactive approach to security suggests that there is a role for military resources and expertise in environmental early-warning, working not only with other militaries but with the scientific and non-governmental community, as well as with other government and inter-governmental agencies. In 1990, US Senator Sam Nunn spoke of the need to “harness some of the resources of the defense establishment...to confront the massive environmental problems...facing the world today”(cited in Goodman 1996).

The questions about how this could or should be done are operational, institutional and normative. How can defence assets and resources be used to mitigate environmental problems, including those that might lead to conflict, before that conflict arises? In response to past environmentally- damaging and resource-profligate practices, the military sectors in many countries now have some expertise in waste management and clean-up technologies; land and habitat conservation and restoration practices; and energy management. Defence forces in many countries are already well experienced in disaster response and relief activities. Defence assets and resources, which may contribute to environmental early warning, include the use of satellite, aircraft, seaborne and terrestrial

observation platforms for monitoring and mapping; imaging systems to monitor deforestation, land clearance and desertification; missile launch detection systems to spot volcanic eruptions that might threaten arable land; the use of naval sound arrays and submarine tracking systems to track marine resources (see, for example, McDonald 1995; Butts 1994b; Crabb et.al 1996). Defence support may also contribute to the development of civilian capabilities in areas such as anti-poaching and interdiction of illegal smuggling activities, which are important for both maritime and terrestrial ecosystem management.

The institutional challenges for such cooperative efforts - military-to-military but perhaps more particularly military-civilian includes the management of information exchange (perhaps through some form of regional clearinghouse mechanism) and how best to coordinate military efforts in support of scientific and environmental program initiatives (in effect, making the rules of engagement compatible). It includes the difficult issue of how to make information derived from military intelligence available to civilian actors without compromising intelligence needs but also without undermining the environmental purposes for which such intelligence is being made available.

In examining these issues, it is helpful to identify other organisations in which similar debates and concerns are being pursued. The CSCAP Working Group on comprehensive security is one such location, and the Australian-CSCAP Committee has displayed some interest in continued discussion on environmental security concerns in the region. The Australian National Committee of the International Human Dimensions Program, along with GECHS (the Global Environmental Change-Human Security program theme of the IHDP) is convening a water security workshop in Canberra later this year. Discussions there are likely to include a range of security aspects of regional water concerns.

Defence environmental cooperation, particularly when it engages systematically with the civilian sector, also has a normative dimension. As US Deputy Under Secretary of Defence for Environmental Security, Sherri Goodman, suggested at a Strategic Environmental Research and Development Program (SERDP) Symposium in December last year, it “challenges us to embrace change, to let go of old paradigms and preconceived notions of how to

do business” (Goodman 1997). Meeting the challenges of environmental protection requires cooperation rather than conflict; and openness and transparency rather than secrecy, in the interests of national security. As Winnefeld and Morris have argued, “dealing with the defence dimensions of environmental degradation provides a challenge to the customarily closed domain of national security and strategy planning” (1994, p.iii).

It is perhaps for these reasons that the extent of defence involvement, and the opportunities for defence cooperation that it might provide, are matters for some dispute, both within and outside the defence community. Depending on one's perspective, a closer engagement of the military sector in environmental debates is either to be welcomed or resisted; it has led to some strange coalitions in argument if not in practice.

The view is sometimes still expressed among defence and military officials that a concern with environmental degradation beyond limited operational stewardship takes the military too far away from its traditional role; that any such involvement runs the risk of “dulling the sword” and compromising the readiness doctrine. Still others are sceptical of this apparently newfound defence interest in environmental concerns, arguing as Ronnie Lipschutz and John Holdren have done, that it represents little more than “strategic analysts...busy combing the planet for new threats to be countered” by military forces (1990, p.126). Others argue that, in the final analysis, a ‘green military’ is an oxymoron and that letting the military get involved in debates about environmental degradation, let alone the practice of environmental protection, is rather akin to leaving the fox in charge of the chickens. Many environmentalists, while welcoming attempts to minimise the environmental impact of defence activities, would suggest that descriptions such as that offered of the US Navy’s new attack submarine, destined for fleet service in 2004, which draws attention to its environmentally-benign weapons systems and to “its future capabilities as a killing machine” (see Meadows 1997, p.28) demonstrate an intuitive militarism which is at odds with the ethical foundations of environmental protection.

Yet expanding the defence dimensions of contemporary environmental concerns (and the impact on regional stability) can be accommodated within the military mission, which should be about more than the “management of violence” (Wolpin 1992, p.93). As

Kent Butts has argued, the defence and military sector “has a larger role beyond the physical defence of the nation” (1994a, p.2).

The United Nations Development Program (1994) urges that environmental security should be part of a comprehensive approach to security that moves away from a narrow military and defensive conception of security to one which is integrative and which emphasises common human security. It may seem counter-intuitive to suggest that defence has a role to play here or that this role should go beyond responding to conflict or instability situations. Yet it is not.

The defence mission of Australia, for example, is to “promote the security of Australia and to protect its people and its interests” (Commonwealth of Australia 1998). Contributing to national and regional security through the mitigation of environmental decline does not contradict that mission. Indeed, it enhances this mission by contributing to confidence-building measures, the development of preventive diplomacy and of conflict resolution measures, all of which underpin the ASEAN Regional Forum's strategic dialogue (see Brooke 1996).

Environmental problems require cooperative solutions; cooperation between the defence and civilian sectors can contribute to that process. Limiting or reversing environmental degradation can help to minimise the likelihood of a range of negative social effects, including conflict and instability.

In 1989, Norman Myers, writing in the American journal *Foreign Policy*, suggested that the “difficulty of perceiving connections between the environment and instability may say less about the nature of the connections than about the limited capacity of policy-makers to think methodically about matters that have long lain outside their purview” (1989, p.39). Nearly ten years later, the agenda of a conference such as this demonstrates that environmental cooperation and the security imperatives of addressing environmental decline are no longer outside that purview. It demonstrates that defence and civilian policy-makers are paying attention to methodical thought and imaginative action in recognising and ensuring that there is a role for defence in creating an “alliance for a sustainable future” (Barnett 1996).

Bibliography

- Anon. (1993) "Germany faces expensive world war military waste clean up", *Canberra Times*. 29 July, p. 9
- Anon. (1994) "Defence push to cut energy use and greenhouse gases", *Defence Information Bulletin*, Winter, p. 15
- Anon. (1994) "Defence stands up for the environment", *Defence Information Bulletin*, Winter, p. 16
- Barnett, Jon (1996) "Linking defence with environment: an alliance for a sustainable future" in Peter Crabb, Julie Kesby and Laurie Olive (Eds) *Environmentally responsible defence* (Canberra: Australian Defence Studies Centre)
- Brooke, Micool (1996) "The Asia-Pacific Security Dialogue", *Asian Defence Journal*, 4/96. April, pp. 156-60
- Brundtland, Gro Harlem (1993) "The environment, security and development". *SIPRI Yearbook 1993* (Oxford: Oxford University Press)
- Butts, Kent Hughes (1994) *Environmental security: a partnership for peace*. Strategic Studies Institute Special Report (US Army War College)
- . (1994b) "Why the military is good for the environment" in Jyrki K@k`nen (ed.) *Green security or militarized environment* (Aldershot: Dartmouth Publishing)
- . (Ed.) (1997) *Environmental change and regional security: conference report* (Asia Pacific Center for Security Studies/Center for Strategic Leadership)
- Commonwealth of Australia (1998) Australian Defence: Department of Defence Home Page [<http://www.adfa.oz.au/DOD/dodhmpgn.html>]
- Crabb, Peter, Julie Kesby and Laurie Olive (Eds.) (1996) *Environmentally responsible defence* (Canberra: Australian Defence Studies Centre)
- Deudney, Daniel (1990) "The case against linking environmental degradation and national security", *Millennium*. 19(1), Winter, pp. 461-76
- Drucker, Merrit P. (1989) "The military commander's responsibility for the environment" *Environmental Ethics*, 11(2), Summer, pp. 135-52
- Dunk, Graeme (1994) "Security or defence? Force development in the absence of a direct military threat", *Journal of the Australian Naval Institute*, May/July, pp. 5-10

- Elliott, Lorraine (1996) "Environmental conflict: reviewing the arguments", *Journal of Environment and Development*, 5 (2), June, pp. 149-67
- Finger, Matthias (1991) *Unintended consequences of the Cold War: global environmental degradation and the military*, Occasional Paper No 10, Program on the Analysis and Resolution of Conflicts, Maxwell School of Citizenship and Public Affairs, Syracuse University. Syracuse, New York
- Funke, Odelia (1994) "National security and the environment" in Norman J. Vig and Michael E Kraft (Eds.) *Environmental policy in the 1990s*, 2nd edition (Washington, DC: CQ Press)
- Gleick, Peter (1991) "Environment and security: the clear connections", *The Bulletin of the Atomic Scientists*, April, pp. 17-21
- Goodman, Sherri Wasserman (1994) "Vision for environmental security", *Defense*, No. 3 pp. 25-39
- . (1996) "The environment and national security", Address to the National Defense University, 8 August [<http://www.loyola.edu/dept/politics/hula/goodman.html>]
- . (1997) "Supporting defense reform through technology innovation", Third Annual SERDP Symposium, 3 December [<http://ceq.cso.uiuc.edu/denix/Public/ES--Programs/Speeches/speech--38.html>]
- Holst, Johan Jrrgen (1989) "Security and the environment: a preliminary exploration", *Bulletin of Peace Proposals*, 20(2), June. pp. 123-8
- Homer-Dixon, Thomas (1991) "On the threshold: environmental change as causes of acute conflict", *International Security*. 16 (2), Fall. pp. 76-116
- Kakonen, Jyrki (ed.) (1994) *Green security or militarized environment* (Aldershot: Dartmouth Publishing)
- Lipschutz, Ronnie and John P. Holdren (1990) "Crossing borders: resource flows, the global environment and international security", *Bulletin of Peace Proposals*, 21(2), pp. 121-33
- MacDonald, Gordon (1995) "Environmental security", IGCC Policy Brief. February, No. 1
- McClement, T P (1992) "The environment, green issues and the military", *The Naval Review*. 80(3), July, pp. 201-8
- Mathews, Jessica Tuchman (1989) "Redefining security", *Foreign Affairs*, 68 (2), Spring, pp. 162-77

- Matthew, Richard A. (1996) "The greening of US foreign policy", *Issues in Science and Technology*, 13 (1), Fall, pp. 39-47
- Meadows, Sandra I. (1997) "Navy casts multimission sub for pollution-free dominance. *National Defense*, 81 (526), March, pp. 28-9
- Moss, Richard H. (1993) "Resource scarcity and environmental security", *SIPRI Yearbook 1993* (Oxford: Oxford University Press)
- Myers, Norman (1989) "Environment and security", *Foreign Policy*. No 74, Spring, pp. 23-41
- . (1996) *Ultimate security: the environmental basis of political stability* (Washington DC: Island Press)
- NATO (1996) *The NATO Handbook* (Brussels: NATO) [<http://www.nato.int/docu/handbook/index.htm#3>]
- Oswald, Julian (1993) "Defence and environmental security" in Gwyn Prins (ed.) *Threats without enemies* (London: Earthscan)
- Peace Research Institute, Oslo (1989) *Environmental security: a report contributing to the concept of comprehensive international security* (Oslo: PRIO/UNEP)
- Porter, Gareth (1995) "Environmental security as a national security issue". *Current History*. 94 (592), May, pp. 218-22
- Renner, Michael (1989) *National security: the economic and environmental dimensions*, Worldwatch Paper 89 (Washington DC: Worldwatch Institute)
- Schneider, Keith (1991) "US escalates war on waste", *Financial Review*, 20 September, p. 30
- Soroos, Marvin S. (1994) "Global change, environmental security and the Prisoner's Dilemma", *Journal of Peace Research*. 31(3), August, pp. 317-32
- Stern Eric K. (1995) "Bringing the environment in: the case for comprehensive security", *Cooperation and Conflict*, 30(3), September, pp. 211-37
- Tennberg, Monica (1995) "Risky business; defining the concept of environmental security". *Cooperation and Conflict*, 30(3), September, pp. 239-58
- Terry, COL James P. (1992) "The environment and the laws of war: the impact of Desert Storm", *US Naval War College Review*. Sequence 337, Winter, pp. 61-7

- Theorin, MAJ Britt (1992) "Military resources to the environment", *Bulletin of Peace Proposals*. 23(2), June, pp. 119-22
- Tinker, Catherine (1992) "'Environmental security' in the United Nations not a matter for the Security Council", *Tennessee Law Review*, 59(4), Summer, pp. 787-801
- Tpfer, Klaus (1994) "Environmental policy as a factor in a new security policy", *GeoJournal*, 33(4), August, pp. 349-54
- United Nations Development Programme (1994) *Human Development Report 1994* (New York: Oxford University Press)
- Winnefeld, James A. and Mary E. Morris (1994) *Where environmental concerns and security strategy meet: green conflict in Asia and the Middle East* (Santa Monica, Ca: RAND)
- Wolpin, Miles (1992) "Third World military roles and environmental security". *New Political Science*, number 23, Fall, pp. 91-120
- World Commission on Environment and Development (1987) *Our Common Future* (Oxford: Oxford University Press)

CHAPTER III

PLENARY SESSION I – ENVIRONMENT AND SECURITY

CONCEPTS & DEFINITIONS

The role of environmental issues in regional stability has grown significantly and is now recognized as an important variable in the economic, social, and political dimensions of security. As such, the environment is of increasing importance to governments, non-governmental organizations, and the private sector. Cooperation among these sectors in the solution of environmental problems is essential to promoting regional stability, protecting strategic interests, preventing disputes/conflict, and creating sustainable economic growth and trade.

In order for the workshop to permit communication between environmental policy makers and military professionals from different countries, and allow them to address the Defence dimensions of contemporary environmental issues in the context of regional security, it was first necessary to establish common concepts and definitions for environmental and security. This plenary session brought clarity to this process.

Based on these concepts and definitions during the course of this workshop attendees will be asked to participate in discussions and exchanges. Plenary session presentations and discussion enabled participants to put forward their own country's position. In the Game sessions all input was non-attributable in order to generate an open debate, which assisted in the derivation of solutions and recommendations. It is important that participants consider the direct and indirect consequences and potential responses of the military to these environmental concepts. Asking the customary questions of "when, what, who, how and why" helped prepare the participants for this workshop.

Questions

- What are the environmental challenges and issues that threaten regional stability?
- What is the military's role in responding to a particular environmental event or circumstance?
- When should the military respond to a particular event or situation?
- Why should the military respond? National Security implications? Direct/indirect threat? Direct/indirect impact? Unique capabilities?
- How should they respond - in planning, preparation, or the execution of a response?
- When should the response be unilateral or multilateral?
- What are the opportunities for Defense Cooperation?
- Who should respond?
- How can the military cooperate with governmental and non-governmental agencies?

DEFENCE AND THE ENVIRONMENT – DEFINITIONS AND CONCEPTS

LTCOL Ian Wing
1998 Chief of the Defence Force Scholarship Fellow,
Australian Defence Force Academy

Introduction

The aim of this paper is to propose working definitions of several key concepts involved in the defence/environment nexus. The definitions are intended to facilitate purposeful communication between policy makers, diplomats, non-governmental organisations and military professionals from the many countries which are represented at this Conference, and allow them to address defence cooperation on environmental issues in the context of regional security.

This paper will discuss the concepts of the state, security, the environment, defence, sovereignty and environmental security. In so doing it will provide background on the difficulties which exist in certain definitional areas.

The State

International law defines the state as:

...a group of people, living together in a fixed territory, organised for political ends under an independent government, and capable of entering into international relations with the rest of the world.¹

States generally possess population, territory, government, independence and the capability to conduct international relations, although some states act with greater autonomy than others. States possess a lawful monopoly over the use of violence to enforce their

1. Salonga and Yap, Public International Law 68, Third Edition, 1966, cited in Gamboa, M.J., *A Dictionary of International Law and Diplomacy*, Oceana Publications, New York, 1973, p.245

internal laws and usually possess a capability to use armed force externally.

While the state is relatively easy to define, the most contested concept in international relations theory is security.

Security and International Relations Theory

Security is a fundamental concept of international politics but it is elastic and ambiguous in its meaning. The Oxford Companion to Politics of the World states that:

In the most fundamental sense, to be secure is to feel free from threats, anxiety or danger. Security is therefore a state of mind in which an individual, whether the highest political leader or the average citizen, feels safe from others.²

Security is a subjective and imperfect relative measure of circumstances; states, like individuals, experience neither perfect security nor insecurity. The search for security is a preoccupation of states because they operate within the anarchic international political system. Apart from the United Nations and a few associated agencies such as the International Court of Justice, which operate either through the consent of sovereign states or collective action, the world operates without an overarching government. The ultimate responsibility of the state is to provide for its own security, and traditionally, all other considerations are subordinate to this 'national interest'.³ Closely associated are the concepts of 'self-preservation' and 'self defence', and the state must ultimately be able to provide this unilaterally and selfishly, according to the concept of 'self-help'.⁴

The international relations theory that describes the operation of states within this anarchy is known as *Realism* and it remains the prevalent means of understanding the international system. Realism

2. Krieger, J. (Ed.), *The Oxford Companion to Politics of the World*, Oxford University Press, Oxford, 1993, p.820

3. Plano, J.C. and Olton, R., *The International Relations Dictionary*, Fourth Edition, ABC-CLIO, Santa Barbara, California, 1988, p.255

4. Evans, G. and Newnham, J., *The Dictionary of World Politics: A Reference Guide to Concepts, Ideas and Institutions*, Simon and Schuster, Sydney, 1990, pp.362-363

recognises that the search for increased security by one state may cause a perception in another state that its own security is in turn threatened, with the result being suspicion, hostility, arms races or even pre-emptive war. A strand of realist theory known as *Neo-realism* copes with this challenge by emphasising the linkages and international systems that operate between states.

On the other hand, the international theory which places less emphasis on states than either the international system or the individuals within it, is known as *Idealism*. Much idealist theory is being incorporated into modern international relations, but states remain the primary referent and they retain a privileged position in the operation of the human world.

Barry Buzan, in his work *People, States and Fear*, de security as an 'underdeveloped concept'.⁵ By this he means thinking about security has tended to emphasise the political relationships between-nation states and particularly their military aspects.

He contends that there are five reasons for this unbalanced understanding of security. First, the idea has proved very difficult for analysts and concrete definitions are elusive.

Second, the concept of security was overshadowed by the power struggles between nations that have dominated the history of the twentieth century. Security became an apprent synonym for military power, particularly during the Second World War and Cold War. This can be explained during the Second World War because the survival of nation-states assumed paramount importance as the opposing sides became intractably committed to military victory. During the Cold War the emphasis on military aspects of security was understandable because the threat to national survival, and indeed global survival, posed by nuclear war was arguably greater than any other threat. Overall, the 'realist' paradigm that states are the primary referent in considerations of security was reinforced during most of the twentieth century. The ability of a state to deter military attacks against its borders and interests was the security bottom line. In many cases this so-called security was achieved at the expense of the people who inhabited the state, the region or in some cases the world. For

5. Buzan, B., *People, States and Fear: An Agenda for International Security Studies in the Post-Cold War Era*, Second Edition, Harvester Wheatsheaf, Sydney, 1991, pp.3-12

example, many states enhanced their security with repressive internal regimes; others improved their military capabilities in search of more security but actually posed security dilemmas for their neighbours and caused regional arms races; and others developed weapons systems which, if ever employed in anger, would likely lead to catastrophic effects for the entire world.

A third reason for security being an underdeveloped concept is that the challenge to the realist paradigm from the idealist school generally preferred the grander term peace and this led to the development of Peace Research and Peace Studies as a separate discipline.

Fourth, the field of strategic studies has dominated the study of security and it has generally focused on the realist state-centric paradigm and new developments in weapons. Policy-making has been largely dominated by the Anglo-American, Western-centric approaches, which are not necessarily relevant to the needs of developing nations.

And fifth, security policy practitioners have seen great value in maintaining the symbolic ambiguity of the term “security”. It provides leverage within political debate and there is no greater appeal to authority than the national security⁶. The term “national security” is defined as the relative measure of a state’s ability to safeguard its lawful boundaries, bolstered by the threat or use of military force. National security emphasises the national interest above individual, regional or global interests.

Security has historically remained underdeveloped as a concept but our understanding was advanced during the 1980s. Theoretical developments, in both the realist and idealist schools, emphasised the interdependence of factors other than military power: political, economic, societal and environmental factors. But perhaps the critical catalyst for the broadening of our understanding of security was the end of the Cold War. The preoccupation with superpower rivalry was transcended by terms such as multi-dimensional security and cooperative security, and non-traditional threats began to receive more attention.

6. *Ibid.*

The concept of security has generally broadened from traditional, narrow considerations of national military power. Security can now be seen to operate at four broad levels; individual, state, region and international, and to encompass issues in the military, political, economic, societal and environmental sectors.⁷

Threats to security may operate at any or all of the four broad levels of security and may originate from any of the five security sectors. This paper will now discuss the environment and its conceptual relationship to security.

The Environment

An environment can be narrowly defined as the surrounding objects and conditions, natural and resulting from human activity, about a referent point. Thus an individual exists within an environment.

Modern international relations theory uses the term “natural environment” to denote the natural world, including the land, sea and atmosphere, and all natural forces and living things within it. The environment includes soils and minerals; natural flora and fauna; noise and visual conditions; climate; and the weather.⁸ The natural environment is susceptible to alteration by man-made forces such as the exploitation of natural resources, agriculture, industry, settlements, pollution and armed conflict.

The natural environment poses many threats to mankind from sources ranging from violent earthquakes and tidal waves, through less dramatic climatic variations such as droughts, to dangerous plant

7. Buzan writes that, “the security of human collectivities is affected by factors in five major sectors. Generally speaking, military security concerns the two-level interplay of the armed offensive and defensive capabilities of states’ perceptions of each other’s intentions. Political security concerns the organisational stability of states, systems of government and the ideologies that give them legitimacy. Economic security concerns access to the resources, finance and markets necessary to sustain acceptable levels of welfare and state power. Societal security concerns the sustainability, within acceptable conditions for evolution, of traditional patterns of language, culture and religious and national identity and custom. Environmental security concerns the maintenance of the local and the planetary biosphere as the essential support system on which all other human enterprises depend. The five sectors do not operate in isolation from each other. Each defines a focal point within the security problematic, and a way of ordering priorities, but all are woven together in a strong web of linkages.” *Ibid*, pp.19-20

8. Corcoran, R., *The Collins Australian Dictionary of Political Terms*, Collins Dove, North Blackburn, Victoria, 1994, pp.68-69

and animal life. We have traditionally viewed these ecological threats as acts of fate and separate from the national security agenda; the expansion of human activity has increased mankind's influence over the natural environment and simultaneously increased the dependence of states on the natural environment.⁹

The natural environment, and the man-made forces and activities which interact with it, make up the all-encompassing term, 'the environment'. Unfortunately the terms "natural environment" and "the environment" are also used interchangeably and this may lead to misunderstandings.

Changes in the environment may become a threat to national security if they cause a major reduction in the viability of human life over a wide area. For example, the small island nations of the Pacific may be submerged if global warming causes sea levels to rise and this loss of territory could force them to cease operating as states. National security may also be threatened if changes in the environment cause disharmony between states. For example, the problems posed by acid rain originating from the eastern European countries and falling in Germany and France.

Fortunately, these threats, and the overall threat to the global environment, are becoming better understood. 'Environmentalism' is a social movement which seeks to promote greater concern for the natural environment and emphasises the symbiotic relationship between humanity and nature.¹⁰ This concern can be seen in the concept of the world operating as a 'global commons', in which all humanity must cooperate to maintain its resources.¹¹

The environmental movement, which espouses environmentalism, has gained acceptance since its beginnings in the 1960s and the increased awareness achieved by the 1972 World Environment Conference in Stockholm. Since then, Green parties have achieved influence in several countries and mainstream political parties and governments have officially included

9. Buzan, *op cit*, p.131

10. Krieger, *op cit*, p.267. *The Longman Dictionary of Politics, Civic and Environment*, Longman, Melbourne, 1997, p.79

11. Ziring, L., Plano, J.C. and Olton, R., *International Relations: A Political Dictionary*, Fifth Edition, ABC-CLIO, Santa Barbara, California, 1995, p.112-113

environmental issues in their policies. The 1992 UN Conference on Environment and Development in Rio de Janeiro provided further formal recognition of the desirability of the protection of the natural environment as part of an overall philosophy of 'sustainable development'. Disagreements over the operational definition of sustainable development and over the relative national priorities of the environment and development, particularly in developing nations, pose a current challenge to environmentalism.

This paper has defined the environment and will now briefly consider the relationship between defence and the environment.

Defence

States possess the right to self-defence and most states maintain a capability to exert violence against external actors. The term defence has become a generic term for national military and armed forces.

This paper defines 'defence' as the military resources of a country and includes all elements of the militarised forces of the country, including those forces which are offensive in orientation, and including the civilian defence bureaucracy and those elements of industry which are devoted to defence. The terms "defence forces" and "armed forces" are virtually synonymous and are used according to national tastes. Some nations include paramilitary law enforcement capabilities, which perform a role in the internal aspects of national security, within their defence force. Defence is relatively straightforward but sovereignty is a concept that is currently undergoing a gradual transformation.

Sovereignty

Sovereignty is supreme power and since the Treaty of Westphalia of 1648, the international system has recognised that states possess sovereignty over all aspects of their internal operations. Sovereignty does not imply absolute freedom of external action as states are subject to the restraints of international law and other less formal international constraints.¹² The concept of national sovereignty was reinforced by the 1945 Charter of the United Nations. The Charter

12. Nolan, C.J., *The Longman Guide to World Affairs*, Longman, New York, 1995, p.276

implies that all states possess equality as actors in the General Assembly, although the permanent five members of the Security Council were granted special additional rights.

The unrestrained pursuit of the national interest is likely to disrupt the increasingly interdependent international system and is likely to be resisted by other states. For this reason, some states are willing to cede or limit some aspects of national sovereignty for their own, or a greater good. For example states are forming economic aggregations, such as the European Community, which possess powers hitherto held by national governments.

The interventionist operations of the United Nations in troubled states such as Iraq, Somalia, Rwanda and the former Yugoslavia also indicate that the world community is willing to over-ride the concept of sovereignty in times of humanitarian crisis. The policy of states acting in concert with others to achieve common objectives, 'multipolarity', is also being found to be more effective than more traditional unilateralism and bilateralism. The widespread recognition of the interdependence of the international system is to be seen in the desirability of collective action rather than the traditional concept of self-help.

The many concepts that have been covered in this paper intersect in the concept of environmental security.

Environmental Security

Environmental security is an example of the broadening of the concept of security from its traditional preoccupation with military power into the realm of threats to security, which are associated with the environment.

Marvin Soroos examined the concept of environmental security and found that there were four reasons for its acceptance. First, conceptual reasoning, which holds that any threat to human well being is a security threat. Second, theoretical arguments which involve the environment in cause-and-effect relationships which lead to interstate conflict, and the degradation of the environment that results from armed conflict. Third, the political rationale which utilises the worst-case scenarios about the future of the environment as a lever to energise collective action. And fourth, the normative

case which presumes the primacy of environmental values and their necessity for the survival of mankind.¹³ As a result of this logic, some scholars now assert that environmental and economic security have risen in importance in relation to military security itself.¹⁴

Not all scholars agree with the widespread adoption of the term environmental security, although most concede that environmental issues may be a valid cause of inter-state conflict. Opponents of the concept reject it on five grounds. First, a broadened meaning for the term security tends to reduce its clarity. Second, the methods of dealing with environmental threats are different from those used to counteract military threats. Third, security is inherently biased toward the status quo whereas changes are actually required to redress environmental problems. Fourth, environmental security measures may perpetuate economic and social injustices. And fifth, environmental threats may reinforce nationalist sentiments and the states system and reinforce the security dilemma.¹⁵

It is reasonable to conclude that the widespread use of the concept of environmental security in many fields of endeavour, including academic, government, non-government, scientific, journalistic and even military, have validated it as a term within international security discourse.

Australia and Environmental Security

The environment provides a compelling example of the operation of a security dynamic which can have concrete repercussions at the individual, state, regional and international levels. The effects of changes to the environment vary from the unobservable, through the subtle to the catastrophic. States can take action to minimise the impact of mankind on the environment but many challenges are too large or widespread for any one state, and require multi-lateral responses.

13. Soroos, M., "Global Change, Environmental Security and the Prisoner's Dilemma", *Journal of Peace Research*, Vol 31, No 3, 1991, pp.317-319

14. Maddock, R.T., "Environmental Security in East Asia", *Contemporary Southeast Asia*, Vol 17, No 1, June 1995, p.20

15. Soroos, *op cit*, pp.319-320

Once the seriousness of a threat to security has been perceived the leadership of a state must allocate appropriate resources to counteract the threat. This applies equally to environmental threats as to the threat of armed conflict. States are already utilising their defence forces in many tasks, which do not involve the use of armed force. Humanitarian relief, disaster relief, law enforcement and peace support operations are examples of the non-combatant use of defence forces and recent events have seen the activation of defence resources to counteract ecological threats. The deployments of Australian Defence Force (ADF) personnel to Papua New Guinea and Irian Jaya to coordinate the distribution of drought relief provide excellent recent examples of non-combatant environmental security missions.

It is noteworthy that the recognition of the need for defence forces to participate in environmental security is not new. In 1992, Rear Admiral Walls, later to become Vice Chief of the Defence Force, when discussing the operational roles of defence forces asserted that, “Navies are a fundamental and logical part of environmental security”.¹⁶

Australia’s current policy is consistent with this approach. The recent foreign and trade policy, *In the National Interest*, asserts that Australia will take a “broad view of security”. On Australia’s security interests the policy includes the proliferation of weapons of mass destruction and the containment of terrorism, and it declares:

Nor should Australia's security interests be seen exclusively in terms of potential military threats or regional conflicts. Over the next fifteen years it is likely that even more attention will be paid to so-called non-military threats such as pandemics, illegal migration, refugee flows, environmental degradation, narcotics and transnational crime. For many countries these are a more immediate concern than the prospect of invasion or military intimidation.¹⁷

Australian defence policy also gives some attention to these emerging security issues. The most recent strategic review,

16. Walls, R.A.K., 'Environmental Security: An Operational Perspective', text of an address given to the seminar 'Defending the Commons: the RAN and Environmental Security', *Maritime Studies*, May-June 1992, p.7

17. *In the National Interest: Australia's Foreign and Trade Policy White Paper*, National Capital Printing, Canberra, August 1997, pp.2-3

Australia's Strategic Policy, notes that threats to security particularly in the South Pacific "...could include natural disasters, environmental damage and trans-national crime".¹⁸

Conclusion

This paper has provided a conceptual discussion on the definitions of key terms associated with the concept of environmental security. The broadening of the security agenda has enabled environmental security to gain an important status in the contemporary security lexicon, although it is yet to be fully accepted.

The Oxford Companion to the Politics of the World gives a succinct summary of the current situation:

As the twenty-first century approaches, there is evidence of diffusion of power concerning environmental policy away from the state. Although the state remains the innate source of authority, its behaviour is increasingly influenced and constrained by cross-boundary transnational forces. There is also a substantive change toward more comprehensive efforts at regulating and managing the environment, possibly reflecting a deeper recognition of environmental interdependence and nascent willingness to subordinate sovereignty, to some extent...Finally, at both the national and global levels there is an emergent awareness of the dilemma that actions considered normal and legitimate, in both ends and means, could be detrimental to the environment or have environmentally threatening consequences. Action, to some extent, is increasingly being scrutinised for the implicit environmental costs.¹⁹

States now operate within a global system that seeks to minimise harm to the natural environment. In turn, state resources will increasingly be turned to activities, which either minimise harm to the natural environment or actively seek to maintain or enhance the environment. Defence forces are not immune from this process and by virtue of their efficiency, capabilities and deplorability they will

18. *Australia's Strategic Policy*, Department of Defence, Canberra, December 1997, p.26

19. Krieger, *op cit*, p.270

increasingly be activated by states in response to environmental challenges.

THE ROLE OF NON-GOVERNMENTAL ORGANISATIONS (NGOs)

**Mr. Michael Rae
Program Leader-Resource Conservation
World Wide Fund For Nature-Australia (WWF-Australia)**

Introduction

Non-Government Organisations (NGOs) have a great interest in and much to constructively contribute to the identification and resolution of environmental problems. Security and defence aspects of environmental issues are no exception.

NGOs form a vital part of civil society. NGOs represent groups of individuals with concern, expertise and practical experience of the environmental and related issues germane to subjects under discussion in the Regional Asia-Pacific Defence Environmental forum. The knowledge and experience of NGOs provide a valuable resource to national, regional and global efforts to tackle the many environmental problems evident across the world. Together with governments, international governmental organisations and the business sector, NGOs are working in many different combinations and partnerships to resolve these issues.

It is self-evident that some environmental issues have security dimensions. These security dimensions may be focussed on a nation's internal security, such as civil strife owing to localised food or water shortages, or may have international security implications. Issues of the latter type include competition between nations for access to collapsing regional fisheries, or disputes over fresh water supplies from a trans-border river system.

Many commentators have identified natural resource disputes as a security threat likely to increase in severity if natural resource depletion and/or degradation continues as world populations and natural resource demands increase.

Many NGOs, including WWF, recognise the importance of these issues and want to engage with all relevant parties, including defence agencies, in their peaceful resolution.

NGOs

There are a vast number of NGOs active across the Asia Pacific region. In the environment area, NGOs range in size and scope; from the multinationals with supporter numbers and budgets measured in the millions, such as WWF and Greenpeace, through to very small, locally focussed NGOs such as village community groups and local resident associations.

Because NGOs have very strong links back to local communities they are in strong positions to deliver targeted goods and services directly to people. This ability of NGOs is the reason that many governments' international development assistance programs channel resources through NGOs in order to maximise the efficiency and efficacy of provision.

NGOs also have the capacity to synthesis information from a variety of different sources. This capacity can, at times, be better than that of small developing country governments.

NGOs have ensured that they are well connected into national, regional and international debates on environmental issues. NGOs are regular participants in international conferences and, in many cases, co-operatively muster resources that rival those of the largest national governments, including policy research, analysis and advocacy.

By effective networking, large and small NGOs have amassed significant quantities of information about environmental issues across the world. While the Internet was a device developed primarily by and for military purposes, NGOs have been amongst its most enthusiastic and skilled users. This means that the NGO community has the means and contacts to constantly update information on changing and emerging issues from even the most remote places.

Many NGOs have their own websites and conduct policy debates on both private and public sites.²⁰

20. For example, WWF has a range of webpages linked through its homepage at www.panda.org

Clearly, not every NGO will have the interest or capacity to efficiently cope with requests for information or dialogue from defence agencies. That such diversity and capacity exists should not be thought of as a constraint or impediment to defence agency contact with NGOs. Persistence in identifying willing and able NGOs will be rewarded through the provision of well reasoned argument and information, probably of a type not easily obtained through any other source.

Security Issues

WWF believes that an improved dialogue between NGOs and all arms of government, including the defence agencies, would be of great benefit to the peaceful resolution of environmental issues. By regular information exchanges, greater levels of trust will result between all parties, government and non-government alike. Improved communication and understanding of issues can only assist in preventing conflict.

The environmental problems faced by the world are very complex and the more minds that can cooperatively be put to the task of finding answers the better.

This paper will not attempt to identify such issues but the subjects identified for this workshop provide a short list of the many possibilities.

Stewardship

A dialogue between NGOs and defence agencies will also serve to improve the defence agencies' stewardship. "Stewardship" refers to the conduct of a defence agency's activities so as to minimise harm to the environment, if not enhance the impact of the agency on the environment.

Many companies and government agencies are recognising that public disquiet about their environmental performance can threaten their continued existence, their "licence to operate". Governments responding to community concerns can act to close or severely restrict the operation of companies or agencies. Defence agencies are not immune to such pressure.

Regular dialogue with NGOs can act as a form of insurance against such actions by improving communication and understanding between the agency and its community.

By building understanding and trust, defence agencies and NGOs can work together, with other participants, to resolve environmental issues that centre on the defence agency's operations.

Positive indirect outcomes from such a dialogue and a commitment to co-operative action include improved staff and family morale. Nobody wants to work or be linked to a poor environmental performer - whether that poor performance is actual, or perceived. A demonstrated commitment to excellence through a strong environmental management system can have wide benefits to both the agency's bottom line and its public image.

An Australian perspective on Environmental NGO and Defence Agency Co-operation

To date, there have been only a few occasions where Australian defence agencies and NGOs have collaborated, either in policy dialogue or fieldwork, on environmental issues. WWF-Australia has participated on a few of these limited interactions and can report promising results.

The new East Coast Armaments Complex (ECAC) is a useful case study. The proposal to relocate ECAC from the site of the 2000 Olympic Games in Sydney to the shores of Port Phillip Bay near Melbourne was not without controversy. The new site is part of a relatively undisturbed wetland ecosystem that hosts thousands of migratory waterbirds listed under international conservation agreements among China, Japan and Australia. Much of the greater wetland area is listed under the Ramsar Convention for the protection of wetlands of international significance. The new site is also the wintering ground of one of Australia's most endangered birds, the Orange-bellied Parrot.

Many Federal and State government agencies, local community groups and conservation NGOs had a strong interest in ensuring that the establishment of ECAC did not jeopardise the natural values of the site. Concern that the Orange-bellied Parrot would not be further threatened was very high on the agenda.

WWF was very pleased that the Australian Defence Force (ADF) was a very willing recipient of information and advice from NGOs about how ECAC could best address the protection of the parrot. A program of feral predator (fox and cat) removal was undertaken and a predator-proof fence erected around the site. As a consequence, ECAC's presence can be argued to have resulted in an improvement of the conservation values of the site, in that it has enhanced protection of the Orange-bellied Parrot.

WWF sees the ECAC result as a "win-win" for the ADF and the environment and hopes such co-operative efforts will continue, especially as the ADF develops new facilities and training areas and as it decommissions and divests itself of unwanted sites.

Conclusion

NGOs have a strong interest and expertise on environmental issues. They have potential to be both an ally and a resource for defence agencies.

ENVIRONMENT AND SECURITY: CONCEPTS AND DEFINITIONS

Dr. Richard Matthew
School of Foreign Service, Georgetown University

Introduction

Exploring linkages between the environment (the natural physical and biotic world) and security (freedom from danger) has long been a familiar theme of world politics. Geography confers advantages (the Swiss Alps) and disadvantages (Poland's flat topography) that are well known to military planners. Important resources are often unevenly distributed (oil in the Middle East) or hard to monopolize (fresh water in the Jordan River Basin). Disease vectors and curtains have protected some regions from, and rendered others highly vulnerable to, foreign invasion.

Recent research on this topic has been extensive and diverse. One noteworthy strand of inquiry argues quite persuasively that many contemporary expressions of inequality, instability and conflict have deep environmental roots. In *Guns, Germs and Steel*, for example, Jared Diamond describes our contemporary world order (or disorder) as the product of patterns of population movement and food production that have been determined largely by environmental imperatives.

A second strand, which became prominent in the 1970s and has received considerable attention since the end of the Cold War, focuses on the security implications of human-generated environmental change such as land degradation, deforestation, global warming, air pollution and biodiversity loss. Some forms of environmental change pose direct threats to national interests, regional stability and the welfare of humankind. Many other forms amplify and complicate problems such as poverty, mass migrations, ethnic rivalry, civil violence and interstate tension and conflict. This research, which is the subject of this paper, has produced or reinforced a number of interesting and controversial terms, concepts, scenarios and prescriptions that have attracted the attention of security specialists and policy makers worldwide.

Continuity and Innovation in Security Thinking

As the political scientist David Apter argued in the 1950s, modern culture places a great value on innovation. This can perhaps best be explained in terms of the interactive impact of democracy, technological change and market capitalism. Citizens are subjected to an endless stream of new policies, products and services. Indeed, the rate of innovation of the twentieth century is unprecedented, a flood that at times overwhelms and confuses people. A hundred therapies promise to cure every illness; computer software becomes obsolete before it is mastered; speculators move huge blocs of capital from one region or sector to another in minutes causing sudden financial crises. Custom and tradition are buried under novelty; in their absence, our sense of security and our confidence in the future weaken.

The rate and magnitude of change pose special problems for those mandated to maximize security. High-tech weapons are cheap and readily accessible throughout the world; transnational criminal organizations endlessly find new ways to cross borders; terrorists use state of the art technologies to sow fear and evade detection. In light of this, a number of influential writers have argued that we need to “rethink security.”

In simple terms, security means freedom from danger. The field of security studies has traditionally focused on two things to be secured: first, state sovereignty, or the political independence and territorial integrity of the state; and, second, the health, welfare and culture of the inhabitants of the state. Maximizing the security of the state and its people has involved assessing vulnerabilities (due to geographic, demographic, economic and other variables), and assessing threats.

There are three basic forms of threat. Internal threats from corruption, crime, state sponsored violence, ethnic rivalry and the like have been the greatest source of insecurity for many countries. External threats, especially due to aggressive states seeking tribute or territory, have been the staple of the discipline of world politics (which, in fact, emerged in response to the two world wars). Transnational threats, that is threats that cross borders but are not explicitly linked to the foreign policies of other states are, in the minds of many analysts, a rapidly growing source of concern. These

threats may be intentional, as in the case of terrorism, or unintentional, as in the case of transboundary pollution. They have increased due to technological innovations that have created higher levels of mobility and greater access to goods, services and information. Technology is thus a mixed blessing, the same plane that can deliver vital medical supplies anywhere on the planet in hours can also deliver lethal microbes, nuclear materials or illegal drugs just as quickly.

Throughout history the external threat of foreign aggression has been a principal concern of national security communities. While some analysts have argued that nuclear weapons and democracy have reduced this threat in many regions of the world, its continuing relevance is generally accepted. The salience of transnational threats, however, is currently the subject of much discussion. How broadly should they be defined? Are they best understood as national security issues? What institutions are best suited to respond to them? Within this discussion, the status of environmental change is especially controversial.

Scientific evidence is quite compelling in demonstrating that human-generated environmental degradation is pervasive, severe, worsening and transnational. Its principal forms include climate change and global warming; air and water pollution; resource scarcity; biodiversity loss; fisheries exploitation and maritime pollution; and ecosystem degradation due to deforestation, agriculture, coastal development and urbanization. Its leading causes include inefficient production processes, high levels of consumption, poor waste management, population growth, economic development and urbanization.

Environmental degradation has clearly caused adverse affects to human health and welfare as well as social infrastructure throughout the world. In numerous case studies it has been related to humanitarian tragedies, intrastate violence and regional instability. It has been posited as a potential source of serious interstate conflict in the near future. It has been identified as an important variable in the collapse of the Soviet Union, and one likely to have a negative impact on Russia and its neighbors for many decades. Concerns have been raised about the transnational environmental impacts of countries such as China and Indonesia that are developing rapidly. Some analysts believe that the potential for devastating epidemics of lethal

or debilitating diseases is growing in many regions of the world as deforestation uncovers new pathogens, mismanaged drug therapy encourages drug-resistant strands of disease, population growth overwhelms sanitation systems, and rapid transportation systems magnify disease vectors.

History tends to support this view. It is almost certainly the case that environmental change has stimulated very important social advances—the transitions from hunting and gathering to agricultural to industrial economies are closely related to periods of resource scarcity and climate change. But in the process of adaptation, many civilizations have been decimated and even eliminated by disease, hunger and severe weather events. Thus while it is true that the human species has proven remarkably innovative when confronted with environmental challenges, it is equally true that many peoples have suffered in the process.

Concerns about the rapid and unprecedented pace of human generated environmental change undergird many of the calls to rethink security. Continuity in security thinking and practice remains crucial—the world will continue to face familiar forms of internal and external threat. But today innovation is equally crucial in light of compelling evidence that our world faces new and serious environmental (and other transnational) threats.

Concepts and Definitions

As noted earlier, both scholars and practitioners have long accepted that the environment is linked to security in important ways. At the close of the twentieth century, a new dimension has been added to this linkage due to the fact that human activities are modifying the environment in novel ways and on an unprecedented scale. Insofar as security planning is concerned, technology has probably made mountains, oceans, plains and natural resource endowments somewhat less important in assessments of a country's vulnerability or strategic value. Today, susceptibility to cross-border pollution, vulnerability to the adverse impacts of global warming and ozone depletion, and economic reliance on access to maritime fisheries are among the environmental issues that are replacing the earlier set of concerns in defining the contemporary terms of security.

Ironically, the challenges we face today are the unintended consequences of our efforts to enhance security and welfare. Unfortunately, our efforts have involved:

(a) extracting resources (such as fish, fresh water and timber) faster than they can be replenished;

(b) loading toxic and other waste materials into our land, water and air faster than they can be broken down and neutralized; and

(c) drastically modifying large ecosystems (from rain forests to coral reefs) such that they can no longer support many species or effectively provide important environmental services such as climate control.

As a result, throughout the world humankind is experiencing scarcity (especially of food and water), microbial invasion, loss of option values, and excessive exposure to toxic substances and particulates.

The variety and magnitude of environmental change, and the attention it has received, have affected the ways in which it has been linked to security. Some have used the linkage for purely rhetorical purposes. For example, some environmentalists have employed the language of security simply to gain attention and mobilize public concern. And some policy makers have incorporated the language of environmentalism into their activities as an additional justification for their budgets. These are, after all, two politically charged vocabularies and it is inevitable that they will be harnessed to different agendas. But many people are simply trying to determine what the real implications of environmental change are for security. In this regard, four views have emerged in the past decade.

TABLE 1. <i>Perspectives on Environment and Security</i>			
ECOLOGIST	HUMANIST	STATIST	REJECTIONIST
Preservation of Nature	Individual Human Welfare	Conventional National Security	Not a Security Issue
<i>Sessions; 1995</i>	<i>Myers; 1993</i>	<i>Homer-Dixon; 1994</i>	<i>Deudney; 1990</i>

The *ecologist view* contends that we are recklessly transforming and destroying nature. Its objective is to secure the environment from

the threats posed by human activity. By “following nature,” that is, by adapting ourselves to natural patterns, rhythms and thresholds, we will not only cease those activities that are destroying our life support system, but we may also recover some of the rich purpose of life that has been lost in our consumer society—spirituality, beauty, truth and simplicity.

The *humanist view* focuses on the welfare of humankind. We live in the age of globalization, and throughout the world individuals are threatened in a multitude of ways, many of which are due to the increase in interaction and exchange enabled by technological advances. According to this view, there is a close connection between the productive technologies that have exploited and degraded nature and the economic, political and cultural structures that have exploited and degraded large segments of humankind. Awareness of environmental change gives us an opportunity to rethink our relationship with nature and with other humans. From this perspective, the objective of world politics should be to maximize human security—to ensure that everyone has reasonable and fair access to the environmental goods that are essential for a healthy existence, and to ensure that everyone lives in societies that respect human dignity and maximize opportunities to live safe and healthy lives.

The *statist view* considers the relationship between these new forms of environmental change and the objectives and practices of national security communities. How do we protect access to environmental goods beyond our borders? How do we protect ourselves from negative externalities— such as air pollution or sudden population flows? Does environmental change generate instability, conflict and violence? If so, how do we predict where and when environmental change will create a situation in which we may have to use force? Do militaries contribute to environmental change? Can security assets be used to address environmental problems?

The *rejectionist view* argues that environmental issues should not be described as national security issues. There is little evidence, its advocates argue, that environmental variables are a significant cause of interstate war, and military and intelligence organizations are not well-suited to addressing environmental problems. Saddling them with an environmental agenda is likely to dilute their war fighting capabilities and lead to suboptimal environmental outcomes. In its

extreme form, the rejectionist view suggests that environmentalism is an alarmist movement that should not be allowed to shape policy in any sector.

In large measure, the various perspectives on linking environment and security reflect different, rather than alternative, values and aspirations. Few people are likely to choose the condition of the environment, or the condition of humankind, or the condition of the state, as the single and unconditional reference point for all reasoning and action. We are more complex than that, and more appreciative of the simultaneous separateness and interconnectedness of things that make up our world. Thus we realize both the appeal of each perspective, and the reality of compromise, tough decisions, changes of heart and dirty hands.

Awareness of the legitimacy of—and tensions among—the various perspectives adds complexity to the task of linking environment and national security—where does the linkage begin and end? It also puts this project into a useful context by reminding us that (a) environmental change is more than just a national security issue; (b) traditional security assets may be of limited use in the grand scheme of things; and (c) involving the military in this arena comes with certain risks because the military has been designed to address a different problem set. Nonetheless, there are ways in which environmental change is clearly relevant to the traditional security community.

National Security and Environmental Change

There are two general ways in which environmental factors and national security can be linked. The first concerns the ways in which environmental change might threaten national interests and hence become relevant to the mandates of military and intelligence institutions. The second concerns the ways in which security institutions and practices affect the environment, and also the ways in which they might be used to reverse this trend.

1. Environmental Threats to National Interests

(a) Monitoring and addressing tension, instability and conflict caused, amplified or triggered by environmental factors.

*An obvious area for the involvement of the security community is in tracking environmental change that might trigger or exacerbate regional instability and civil or interstate violence. UNEP's first Global Environmental Outlook report, released in 1997, makes clear that environmental degradation and scarcity are worsening worldwide, especially in parts of Asia-Pacific, West Asia, Africa and Latin America. According to researchers such as Thomas Homer-Dixon, the potential for environmentally escalated institutional failure, ethnic conflict, urban violence and mass migration is high and likely to increase. In these cases militaries may be called upon to respond. Understanding the sources of conflict, developing early warning systems, and having appropriate response strategies in hand could be essential to successful conflict resolution efforts. At the very least, militaries may be required to create and maintain peace until satisfactory institutional arrangements are in place. To this end, both the U.S. Department of Defense (DOD) and the CIA are developing early warning systems. Similarly, an early warning system is being developed in Canada through the *Global Environmental Change and Human Security Project* directed by Steve Lonergan.*

(b) Protecting access to environmental goods abroad.

One popular interpretation of the Gulf War is that advanced industrial states acted to protect their access to oil in the Middle East. Clearly there were other objectives and rationales shaping the decision to use force, but protecting access to environmental goods outside of one's borders is likely to remain an important aspect of world politics. In many cases technology can be used to develop substitutes for scarce resources; in other cases trade will be a more economical approach. But substitution and trade will not always succeed. In recent years numerous conflicts have taken place over access to fisheries, and some observers believe that competition over access to scarce fresh water resources may increase in the years ahead. Moreover, it is conceivable that states will consider using force to protect goods such as rain forests—which regulate climate, serve as

important carbon banks and contain high levels of biodiversity—if diplomatic solutions prove unsuccessful. While historically these areas have been regarded as under the jurisdiction of the states in which they lie, attempts to underscore their importance to the world community have increased in the past decade.

2. Using Security Assets to Advance Environmental Goals

(a) Greening the military.

Environmentalism can be (and is being) advanced by “greening” military training, testing and war fighting activities. There is no doubt that in the past the military—especially in the U.S. and former U.S.S.R.—has been a major polluter. But in the past few years, the U.S. Department of Defense has decreased toxic waste by fifty percent. In cooperation with Sweden it has developed guidelines for environmental standards. It has worked with Russia and other Arctic nations to reduce radioactive contamination of the Arctic region. The Australia-Canada-U.S. trilateral is another example of an attempt to address environmental problems cooperatively. Base clean up has been somewhat less successful, and anecdotal evidence suggests that throughout the world, militaries continue to treat the environment in a reckless manner. Reducing human impact on the planetary environment is a central goal of sustainable development. Insofar as militaries harm the environment, they have a responsibility to reassess—and modify—their behavior.

(b) Using military and intelligence assets to support environmental initiatives.

Intelligence and defense possess highly sophisticated resources that can assist in environmental assessment and monitoring, and in developing “green” technologies. This issue has received considerable attention in the U.S. in the 1990s. Under the aegis of Vice President Gore, the CIA permitted civilian scientists to examine archived material that might be useful in assessing environmental degradation. The so-called Medea Group concluded that archived satellite imagery was of great scientific value. The National Intelligence Council is exploring ways to make the CIA's data gathering and analysis capabilities available to environmental consumers, including foreign and non-governmental organizations.

The technology is so sophisticated that satellite imagery can be used to diagnose the health of forests as well as monitor deforestation. It can penetrate water well enough to assist in evaluating the condition of fisheries. It already has been used to track and help fight forest fires.

Some observers are highly skeptical of this initiative, on the grounds that the CIA's penchant for secrecy and other responsibilities might taint its public offerings. They advocate the development of commercial satellite systems. But the technological sophistication of intelligence assets may not be achievable in the private sector for some time. Thus the ongoing efforts to build bridges between the CIA and a new generation of consumers remain important.

Similarly, many militaries possess extensive resources that might be applied to environmental policy initiatives, including technology-driving, environmental restoration, treaty monitoring and, possibly, enforcement. Experiments with recycling technologies and ecosystem restoration by the U.S. military may serve as models for future endeavors. Discussions on using the U.S. military or NATO or UN forces to monitor compliance with international environmental law are at a preliminary stage and face a fair amount of opposition.

(c) Promoting dialogue, building confidence and transferring technology.

Another promising approach to linking environment and security is through creating opportunities for dialogue and fostering military-to-military partnerships. Imperfect information is an important source of misunderstanding, suboptimal policy and tension—dialogue can build trust and help identify shared interests. Unfortunately, many international fora are constrained by the perception that advanced industrial states are seeking to control the international environmental agenda, maintain the status quo, and shift the burden of environmental rescue onto the developing world. Conferences on environmental security can provide a new context for dialogue, perhaps surmounting some of the obstacles evident in other venues. These may have collateral benefits insofar as they create greater awareness of the concerns, incentives and beliefs of other countries. In the past five years, NATO has hosted four Advanced

Research Workshops on environmental themes, bringing together military and civilian specialists from NATO countries, Eastern and Central Europe and Russia. Conferences such as the one hosted by the Asia-Pacific Center in June 1997 are also important steps in this direction.

(d) Providing disaster and humanitarian assistance.

While all states are vulnerable to the adverse effects of environmental change, the capacity to respond varies enormously. In particular states with weak or corrupt governments, economic problems, and/or ethnic tensions may be unable to respond effectively. In these cases, severe environmental change can generate large-scale humanitarian crises. Already, under the auspices of the United Nations, the international community has been called upon to provide emergency relief in many parts of the world. Often, these operations require military assistance and there are sound reasons for predicting more rather than less of these demands in the future. But, as the case of Somalia amply illustrated, various logistical and resourcing problems need to be resolved for this mechanism to become wholly effective.

It is important to note that in many small countries, the military is a vital resource that will be called upon to help implement and monitor policies and assist in managing disasters and other crises. Because these will often have an important environmental component, environmental awareness may be crucial to success.

Conclusions

We live in a turbulent and complex world. Security establishments must be prepared to address the threat of nuclear, biological and chemical weapons. They must be ready to fight conventional and civil wars. They must devise ways to counter other uses of force such as terrorism. But they cannot afford to ignore the transnational threat to security posed by environmental change, or the role they play in causing environmental problems.

There are fruitful ways of linking environmental change to a conventional understanding of security, and security assets can be applied to addressing some environmental problems. To ignore the

role of environmental change in fostering conflict and regional instability would be foolish, even if it is rarely the primary cause of such problems. To avoid using military assets for environmental ends perpetuates a “we versus they” mentality that is at odds with the pervasive, inclusive nature of environmental problems, and with the need to address them with all available tools. At the same time, linking environmental change to national security does not provide a comprehensive framework for analyzing and addressing environmental problems, the bulk of which do and should lie outside this framework.

Selected References

- Brown, Lester. 1977. “Redefining National Security.” *Worldwatch Paper* 14.
- Butts, Kent. 1994. “Why the Military Is Good for the Environment.” Jyrki Kakonen (ed.). *Green Security or Militarized Environment*. Brookfield: Dartmouth Publishing Company.
- Connelly, Matthew and Paul Kennedy. 1004. “Must It Be the West Against the Rest?” *The Atlantic Monthly* 274, pp. 61-83.
- Dabelko, Geoffrey D. 1996. “Ideas and the Evolution of Environmental Security Conceptions.” ISA Paper.
- Dalby, Simon. 1995. “Neo-Malthusianism in Contemporary Geopolitical Discourse: Kaplan, Kennedy and New Global Threats.” ISA Paper.
- Deibert, Ronald J. 1996. “Military Monitoring of the Environment.” *Environmental Change and Security Project Report* 2, pp. 28-32.
- Deudney, Daniel. 1990. “The Case Against Linking Environmental Degradation and National Security.” *Millennium: Journal of International Studies* 19: 461-476.
- Deudney, Daniel and Richard A. Matthew (eds.), Forthcoming 1998. *Contested Ground: Security and Conflict in the New Environmental Politics*. Albany: SUNY Press.
- Feshbach, Murray. 1995. *Ecological Disaster: Cleaning Up the Hidden Legacy of the Soviet Regime*. New York: Twentieth Century Fund Press.
- Gleick, Peter. 1991. “Environment and Security: The Clear Connections.” *The Bulletin of the Atomic Scientists* 47, pp. 17-21.
- Gleick, Peter. 1993. “Water and Conflict: Fresh Water Resources and International Security.” *International Security* 18.
- Homer-Dixon, Thomas. 1994. “Environmental Scarcities and Violent Conflict: Evidence from Cases.” *International Security* 19, pp. 5-40.
- Homer-Dixon, Thomas and Marc Levy. 1995/96. “Correspondence,” *International Security* 20, Winter, pp. 189-198.

- Homer-Dixon, Thomas and Valerie Percival. 1996. *Environmental Scarcity and Violent Conflict: Briefing Book*. Toronto: University of Toronto Press.
- Kaplan, Robert. 1994. "The Coming Anarchy." *The Atlantic Monthly* 273, pp. 44-76.
- Keohane, Robert O. and Joseph Nye Jr. 1977. *Power and Interdependence*. Boston: Little, Brown.
- Levy, Marc A. 1995. "Is the Environment a National Security Issue?" *International Security* 20, pp. 35-62.
- Lipschutz, Ronnie D. 1989. *When Nations Clash: Raw Materials, Ideology and Foreign Policy*. New York: Ballinger.
- Mathews, Jessica. 1996. "Overlooking the 'POPs' Problem." *The Washington Post*, March 11.
- Matthew, Richard A. 1995. "Environmental Security and Conflict: An Overview of the Current Debate." *National Security Studies Quarterly* 1, pp. 1-10.
- Matthew, Richard A. 1995. "Environmental Security: Demystifying the Concept, Clarifying the Debate." *Environmental Change and Security Project Report* 1, pp. 14-23.
- Matthew, Richard A. Fall 1996. "The Greening of American Foreign Policy." *Issues in Science and Technology* XII:1, pp. 39-47.
- Matthew, Richard A. 1997. "Rethinking Environmental Security." N. P. Gleditsch (ed.), *Conflict and the Environment*. Dordrecht: Kluwer, pp. 71-90.
- Matthew, Richard A. Forthcoming 1998. "Security and Scarcity: A Common Pool Resource Perspective." S. Barkin and G. Shambaugh (eds.), *Common Pool Resources and the Environment*. Albany: SUNY Press.
- McKibben, Bill. 1989. *The End of Nature*. New York: Random House.
- Mohammed, Nadir A. L. 1994. "The Development Trap: Militarization, Environmental Degradation and Poverty and Prospects of Military Conversion." Organization for Social Science Research in Eastern Africa, Occasional Paper 5.
- Mohammed, Nadir A. L. 1996. "Environmental Conflicts in Africa." NATO ARW Paper.
- Myers, Norman. 1989. "Environment and Security." *Foreign Policy* 74, pp. 23-41.
- Myers, Norman. 1993. *Ultimate Security: The Environmental Basis of Political Stability*. New York: Norton.
- Ponting, Clive. 1991. *A Green History of the World: The Environment and the Collapse of Great Civilizations*. New York: St. Martin's Press.
- Rummel, R. J. 1997. *Power Kills: Democracy as a Method of Nonviolence*. New Brunswick: Transaction Press.
- Sessions, George (ed.). 1995. *Deep Ecology for the Twenty-First Century*. New York: Random House.

- Simon, Julian. 1989. "Lebensraum: Paradoxically, Population Growth May Eventually End Wars." *Journal of Conflict Resolution* 33, pp. 164-180.
- Springer, Allen L. 1996. "Unilateral Action in Defense of Environmental Interests: An Assessment." ISA Paper.
- Ullman, Richard 1983. "Redefining Security." *International Security* 8, pp. 129-153.
- UNEP. 1997. *Global Environmental Outlook*. Oxford: Oxford University Press.
- Westing, A. 1989. "The Environmental Component of Comprehensive Security." *Bulletin of Peace Proposals* 20, pp. 129-134.
- Wilson, E. O. 1992. *The Diversity of Life*. Cambridge: Harvard University Press.
- Wolf, Aaron. 1997. "International Water Conflicts and Conflict Resolution: "Water Wars" and Water Reality." ISA Paper.

CHAPTER IV

PLENARY SESSION II – ENERGY, ENVIRONMENT & GLOBAL CLIMATE CHANGE

Energy and Environment

This plenary session covered the total life cycle of energy from exploration, development, and processing/refinement; transportation, storage and distribution; and to the ultimate use. As regional economies develop, energy consumption will continue to rise and the clear link between environmental security and energy security will become more evident.

The world will face a number of increasingly severe environmental security challenges that will be caused or aggravated by the search, transportation and ultimate use of energy. Additional energy consumption will create: an increase in maritime traffic, especially tankers; increased risk of marine pollution, especially from oil; greater risk of marine disaster causing damage to ecosystems such as coral reefs. Finally, the ultimate use will contribute to increases in air pollution and global climate change from the burning of fossil fuels.

Questions

- What are the key trends and drivers that will shape future energy and environmental choices in the region?
- What are the environmental security implications of fossil fuels, hydroelectric, or nuclear power?
- What are the implications to regional economic stability of energy choices?
- Will the changing attitudes (local, regional or international) toward the environment likely drive the choices or patterns of future energy consumption in the region?

- What are the implications of growing energy demands?
- Will the current energy use patterns change (*e.g.* shift from coal to oil)?
- Will import dependence change the environmental security picture?
- What is the role of technology in shaping use or exploration in the future?
- What are the potential impacts to the military of future energy policies or trends?
- How could states of the region cooperate in the joint management of natural resources (*e.g.* dispute prevention/resolution)?

ENERGY AND THE ENVIRONMENT - AN INDONESIAN PERSPECTIVE

**Mr. Kar Sukardi, Vice Chairman, Environmental Impact
Management Agency (Bapedal) Jakarta -
Indonesia**

ABSTRACT Major increases in Indonesia's population economic development and related utilization of natural resources have resulted in substantial demands for new energy sources as well as environmental degradation which threatens the future welfare of the country.

The Government of Indonesia is continuing to respond aggressively to these demands and threats.

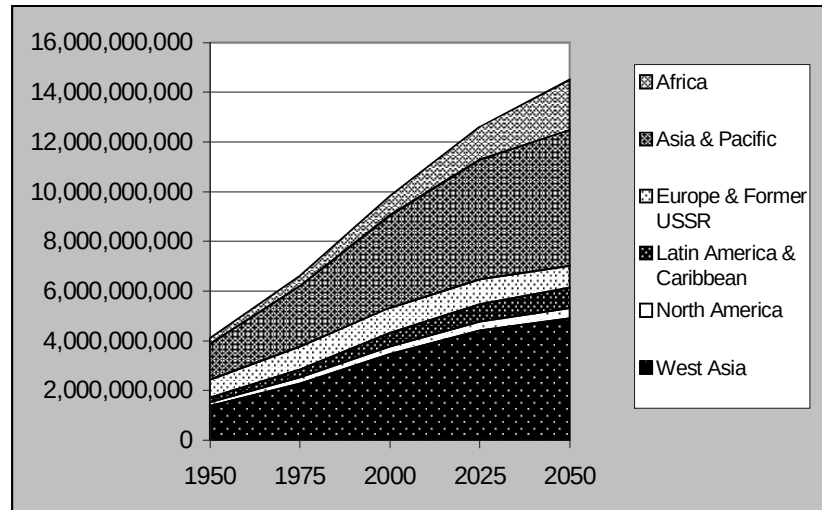
The paper provides a short global and regional context identifies the nature of this growth and related problem traces recent and continuing Indonesian Government responses thereto and discusses some strategic issues.

GLOBAL AND REGIONAL SETTING

Changes in energy consumption and the environment are driven by population and economic growth, and their related developments, e.g., water utilization, food production, industrial activity and the provision of housing, transport and the like.

The world's existing population of about 5.5 billion is expected to grow by 4.7 billion, to a little over 10 billion by the middle of the next century with 95 percent of this growth in developing countries. As can be seen from **Figure 1**, a substantial part of this growth will occur in the Asia Pacific Region.

FIGURE 1:
World Population-Recent and Projected Trends.



While South-East Asia is currently experiencing unusual short-term economic decline, this will recover and the long-term regional and global trends are illustrated in **Table 2**.

TABLE 2. Gross Domestic Product-Recent and Projected Trends.							
Gross Domestic Product Billion 1990 US\$	Total				Average Annual Change (%)		
	1950	1990	2015	2050	1950-90	1990-2015	2015-2050
Africa	102	413	1,009	4,300	3.6	3.6	4.2
Asia & Pacific	395	4,661	11,990	30,753	6.4	3.9	2.7
Europe	1,719	8,143	15,063	27,274	4	2.5	1.7
Latin America	184	1,145	2,431	6,905	4.7	3.1	3
North America	1,722	6,031	13,075	21,625	3.2	3.1	1.4
West Asia	73	570	1,572	6,905	5.3	4.1	4.3
World	4,195	20,964	45,140	95,954	4.1	3.1	3.2
Source: Global Environment Outlook, INEP 1997							

Similar trends are provided for primary energy consumption in **Table 3.**

TABLE 3. Primary Energy Consumption-Recent and Projected Trends.							
Primary Energy Consumption (Projections)	Total				Average Annual Change (%)		
	1950	1990	2015	2050	1950-90	1990-2015	2015-2050
Africa	1,231	7,396	16,528	58,859	4.6	3.3	3.7
Asia & Pacific	4,814	68,663	185,143	336,144	6.9	4	1.7
Europe	30,691	129,933	185,490	205,483	3.7	1.4	0.3
Latin America	1,938	14,323	22,067	55,405	5.1	2.3	2.3
North America	37,398	88,824	132,650	121,604	2.2	1.6	-0.2
West Asia	389	11,424	26,431	59,097	8.8	3.4	2.3
World	76,459	320,563	571,309	836,592	3.6	2.3	1.1
Source: Global Environment Outlook, UNEP 1997							

An indication of the Asia & Pacific region's dynamic growth can be drawn from the above figure and tables.

By 2050, it is expected that the region's population will quadruple (from 1950) to about 5.2 billion, providing half the World's population, Gross domestic product will increase about 80 times over the same period to provide about one-third of the World's product. Energy consumption will increase about 70 times to 40 percent of the World's consumption

If these forecasts are realized, the region will dominate all other World regions.

The United Nations Environment Program (UNEP) 1997 Global Environment Outlook Report records significant progress in the last decade in confronting Global environmental challenges in both developing and industrial regions.

This has involved institutional developments, international cooperation, public participation and the emergence of private-sector action. Legal frameworks, environmental impact assessments, economic instruments, environmentally sound technologies and cleaner production processes have been developed and applied.

Nevertheless, the Report goes to say that “despite this progress, from a global perspective the environment has continued to degrade during the past decade, and significant environmental problems remain deeply embedded in the socio-economic fabric of nations in all regions

Global structures and environmental solidarity remain too weak to make progress a world-wide reality. As a result, the gap between what has been done and what is needed is widening.

INDONESIA: LAND AND PEOPLE

Indonesia is an archipelago of over 17,000 islands, straddling the equator for about 5,000 kilometers. The topography is extremely varied from permanent snowfields on the peaks in Irian Jaya to coral atolls within the adjoining oceans. The Nation's sea area (including the exclusive economic zone) covers about 7.9 million square kilometers and it has a land area of about 1.9 million square kilometers

In contrast to many developing countries Indonesia has plentiful natural resources. These include:

- a substantial work force of over 80 million,
- energy resources, both non-petroleum and petroleum based
- rich soils in Java and Bali and good soils in Sumatra, Sulawesi and some other islands,
- closed canopy forest in more than half of the country; and
- substantial biological resources and diversity

The lack of abundant water supplies is, however, a problem in the dry season particularly on Java.

INDONESIAN ECONOMY

In response to this population growth and the quest for higher incomes and living standards, people and businesses in Indonesia have reacted in ways which primarily reflect potential private benefits and costs. Balancing these interests against high costs,

infrastructure development needs and environmental concerns continue to be a challenge. For example:

- agricultural intensification has increased yields, farmers and their incomes
- natural vegetation has been cleared for agriculture and new urban areas
- coastal and mangrove vegetation has been cleared for new fish and shrimp farms;
- commercial logging has expanded greatly; the phase-out of log exports has led to dramatic
- expansion of local timber industries and related employment,
- mining, petroleum and gas Production and quarrying have increased; and
- new industries have sprung, up everywhere.

The steady economic growth since the early 1970s and the expectations confirm these activities for the longer-term future. Average annual GDP growth from 1984 to 1994 was 7 percent. The target in the current Five Year Development Plan (REPELITA. VI) is 6.2 percent. Agriculture remains a significant economic sector employing about half of the country's workforce. However during REPELITA VI (1994/5 to 1998/99 the share of manufacturing in GDP is expected to rise to 24.1 percent, outstripping agriculture (at 17.6 percent) for the first time. Inflation was above 10 percent in the 1980s, but until recently was largely brought under control, albeit at higher levels than in developed countries. With the economy growing faster than the population, income per capita has risen from the very low levels of the early 1960s to USD 1,000 in 1991. All of this resulted in substantial increased demands for supporting urban infrastructure.

While more recent economic events have reversed these trends, recovery is expected over the next year or so with a return to substantial development and related pressures on energy resources and the environment.

THE INDONESIAN ENVIRONMENT

Industrial output has increased eight-fold since 1970 and could expand a further thirteen times by the year 2020. The 1994 World Bank Report "Indonesia Environment and Development: Challenges for the Future" forecasts that, while the share of total industrial pollution in urban areas will decline from 70 to 60 percent by 2020, the absolute level of industrial pollutants in Indonesia's cities-assuming current policies and practices - will expand nearly ten-fold. To this must be added major increases in domestic pollution resulting from population growth

These changes have had major environmental impacts, particularly on the quality of air and water, and on the loss of soil productivity, flora and fauna. Bio-diversity has been reduced. Atmospheric pollution by particles and chemicals, and problems in the disposal of urban and industrial solid and liquid wastes are further major consequences of growth that need to be addressed aggressively.

REPELITA VI and the second 25 Year national Development Plan, both of which started in April 1994, emphasized sustainable development through improvement in the quality of the living environment, support for economic growth, reduction in regional development disparities and poverty alleviation. Perhaps the most significant change reflected in REPELITA VI was to shift the focus of GOI development programs from overcoming current service deficits to a more forward-looking emphasis on the investments needed to realize the economic potential of regional areas, including their functions as service centers for regional development, and related infrastructure requirements.

To accelerate decentralization and implementation of plans, emphasis is being placed on better use of resources, mobilization of local revenues, developing financing mechanisms, and increasing cost recovery by municipalities and their agencies. Better coordination and strengthening of local agencies is also being sought. Financing policies for urban services emphasize local government revenue improvement as well as greater efficiency in the deployment of the revenues, and increased use of the central government lending and special grant mechanisms as the means of financing development under local management.

INDONESIA'S ENERGY RESOURCES

The annual production of petroleum (crude and condensates) runs at about 550 to 600 million barrels; natural gas at 3,000 billion cubic feet; LNG 1.4 million MMBTU, LPG 2.8 million tons, and coal at about 50 million tons. Present reserves of oil and natural gas will be depleted in 17 and 33 years, respectively. Indonesia has potential coal resources of about 37 billion tones, but only 4.6 billion tones are proven

The demand for electricity in Indonesia has shown strong growth at around 16.5 percent per annum over the last 25 years. The percentage of the population that has access to electricity increased from 3.4 percent in 1968/69 to 38.7 percent in 1993/94. The target for the end of the current five-year Plan is 60 percent of all households.

Total consumption increased from 1.4 TWh in 1968/69 to 63.4 TWh in 1993/94 and is expected to reach 115.3 TWh in 1998/99. Despite this dramatic growth in usage, Indonesia's per capita consumption remains low at 266 kWh. During REPELITA VI, hydro and thermal-power generation will increase by 9,500 megawatts; and 10,500 kilometers of transmission lines will be built

INDONESIAN INSTITUTIONAL RESPONSES

Significant progress has been made in basic welfare in Indonesia during the past 20 years. Life expectancy, infant mortality rates, daily calorie intake and literacy have improved substantially. The incidence of poverty has declined dramatically, but around 13 percent of the population or 25 million, still live below the poverty line. Addressing this issue is a high Government priority.

Indonesia's environmental management response flows from its 1945 Constitution which stipulates that "land, air, water and other natural resources contained therein are controlled by the State and utilized for the greatest well being of the people". This provision is the foundation of Indonesia's goal of achieving ecologically sustainable development.

For this purpose an Act Concerning Basic Provision for the management of Environment (Act Number 4 of 1982) was enacted. The main mission of the act was to incorporate environmental

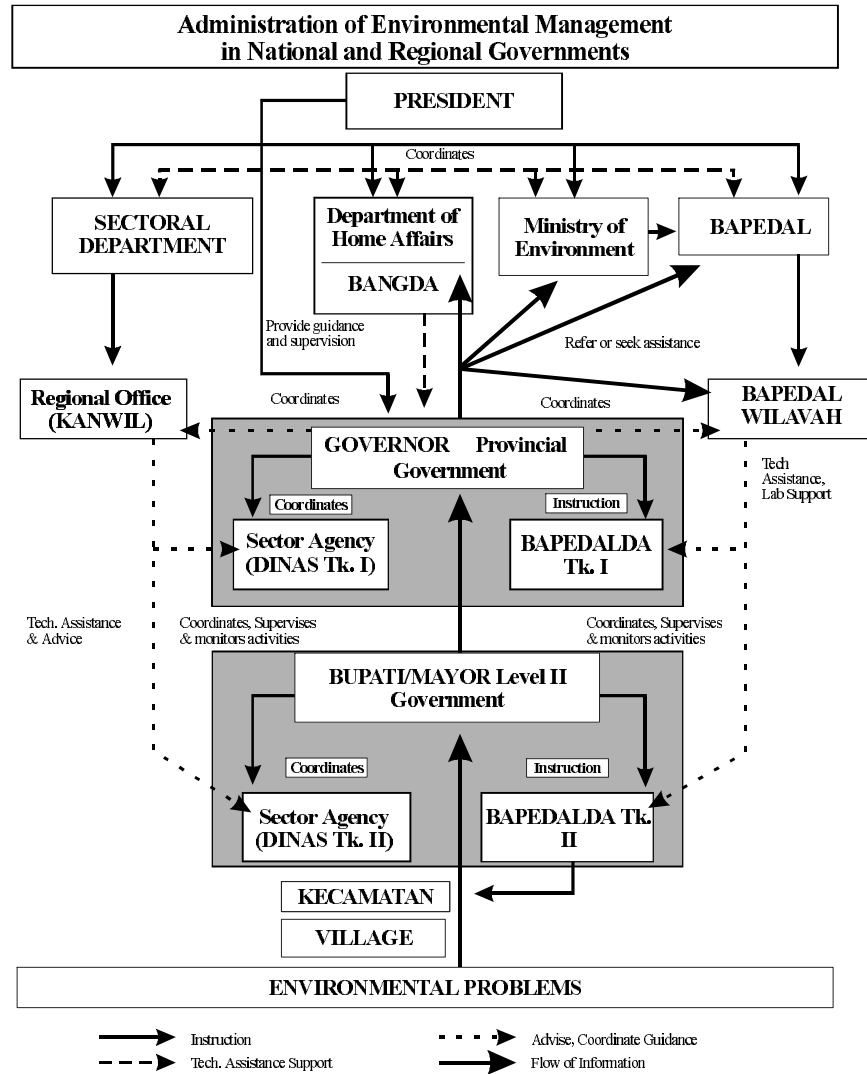
considerations and to integrate the sustainable use of natural resources into the national development processes. This was revised in 1997 (Act No 23); to increase its coverage and strengthen its enforcement provisions

The Office of the minister of State for Environment (MOE), established in 1978, is a coordinating body with regard to sectoral agencies (agriculture, water resources, forestry, mines and energy and the like) which retain primary responsibility for environmental protection and the achievement of ecologically sustainable development

Due to the increase in the number of environmental problems which needed a more direct operational involvement, the Environment Impact Management Agency (BAPEDAL) was established by Presidential Decree No. 23 of 1990, and further developed and regionalised through Presidential Decree No 77 of 1994. BAPEDAL's role is to assist the President in environment impact management which includes the prevention and control of environmental pollution, environmental deterioration and the rehabilitation of environmental quality, in accordance with the prevailing, statutes and regulations. BAPEDAL's priorities include institutional and human resources development, and the clean rivers, clean cities, business performance, hazardous waste management, cleaner production, environmental impact analyses, blue sky, laboratory development and clean beach programs.

While primary responsibility for environment protection rests with sectoral agencies the minister of State now coordinates their environmental budgets and performance for the Environment. Introduced in 1995, this unique program provides for the Minister of Environment supported by expert panels to review, question and endorse draft environment related budgets of sectoral agencies, before submission for inclusion in the national Budget. The expenditure performance of these budgets is also monitored and taken into account when considering the next round of proposals. Poor or good performance can lead to reduced or increased future budgets, respectively.

FIGURE 2:
Government Structure For Environmental Management.



STRATEGIC CONSIDERATIONS

Population

Energy and environment issues are directly related to population and economic growth, which are directly related one to each other. For example, without national economic growth to match or exceed population growth, people's welfare will deteriorate and poverty will increase.

On the other hand, as economic growth continues and welfare improves, this brings greater pressure to bear on natural resources and environmental quality, although the resulting larger middle class may bring pressure on Governments for environmental reform.

Uncontrolled population growth can result in severe poverty and environmental degradation of strategic regional significance.

Energy and “Greenhouse Effect”

Apart from local environmental damage in its production and use, increased energy consumption, which primarily involves the combustion of fossil fuels in one form or another, contributes significantly to global climate warming or the “greenhouse effects”.

By 2050, energy consumption in the Asia and Pacific region is expected to increase about 70 times to 40 percent of the World's consumption

This dramatic growth will bring pressure on available energy resources with some countries already moving to nuclear power generation as other fuels are depleted. The potential environmental consequences of this are seen by some as more extreme, and could lead to substantial inter-country conflict

The most important man-made greenhouse gas is carbon dioxide, a principal source being the combustion of fossil fuels. Table 4 shows 1995 production figures from fossil combustion only for the top 25 producers. While the Asia and Pacific region contributed only about 30 percent of the world's production, this will increase fourfold to about 40 percent by the year 2050 on present trends.

TABLE 4: National CO₂ Emissions.				
Countries	CO ₂ Emissions (TONS)	Population (Million)	CO ₂ /Cap (Tonnes)	Percent of World Total
United States	5,288.52	263.06	19.88	23.7
China	3,006.77	1,200.24	2.51	13.6
Russia	1,547.89	148.20	10.44	7
Japan	1,150.94	125.57	9.17	5.2
Germany	884.41	81.66	10.83	4
India	803.00	929.36	.68	3.6
United Kingdom	564.84	58.61	9.64	2.6
Canada	470.80	29.61	15.90	2.1
Ukraine	430.62	51.55	8.35	2
Italy	423.82	57.27	7.40	1.9
France	362.02	58.14	6.23	1.6
South Korea	353.10	44.85	7.87	1.5
Poland	336.11	38.61	8.70	1.5
Mexico	327.56	94.78	3.46	1.5
South Africa	320.88	41.46	7.74	1.5
Brazil	287.48	159.22	1.81	1.3
Australia	285.99	18.05	15.84	1.3
Spain	246.98	39.21	6.30	1.1
Iran	232.99	64.12	3.63	1.1
Saudi Arabia	227.06	18.98	11.96	1
Indonesia	227.04	193.28	1.17	1
Kazakhstan	185.58	16.61	11.18	.8
Netherlands	178.83	15.45	11.57	.8
Taiwan	166.88	21.30	7.83	.7
Turkey	160.50	61.46	2.60	.7
Source: International Energy Agency				

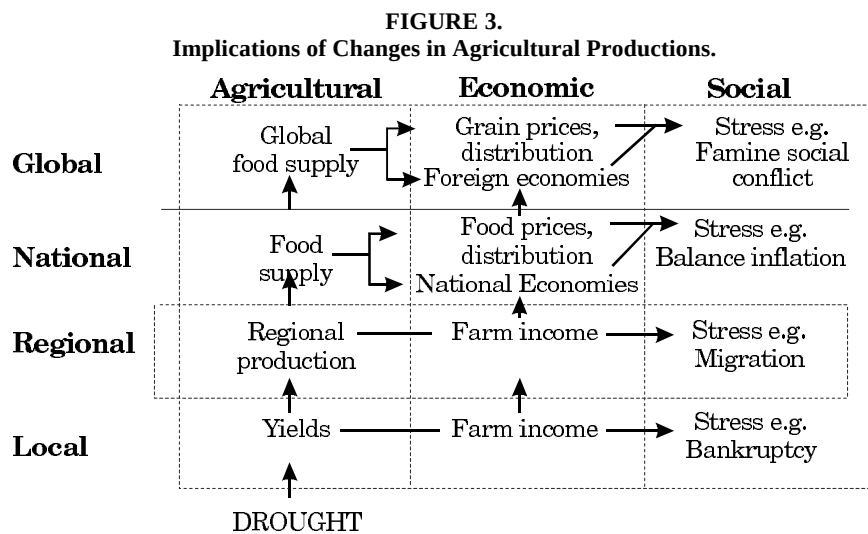
Ramifications of the “greenhouse effect” include potential for sea level rise and related displacement of large populations, and changes in climate, agricultural and forestry production, fisheries and the prevalence of pests and diseases.

For example a modest sea level rise of 20–30 CMS over the next 50 years could lead to many millions of displaced persons (or environmental refugees) from low-lying areas such as Bangladesh, Thailand, Indonesia the Pacific Islands, and other similar locations. Substantial numbers of these could end up on the “World stage” with major regional pressures on the World community for resettlement that would dwarf previous experiences in this area, the most recent of which was the aftermath of the Vietnam War. The associated loss of sovereign land and economic disruption could also create substantially greater strategic questions than the long running Spiritless Islands debate.

Agriculture

Agricultural production will vary as a result of greenhouse, increasing in some areas and decreasing in others.

This will assume strategic significance because of substantial increases in food demand resulting from population growth. The economic and social implications of a change in production for an agricultural commodity are illustrated in **Figure 3**.



Shipping

Indonesia and its 7.9 million square kilometers of territorial waters, lies across some 5,000 Kilometers (east-west) of ocean with very limited shipping access to Japan and other economies to the north. The bulk of shipping passes through the Malacca Strait between Indonesia and Singapore.

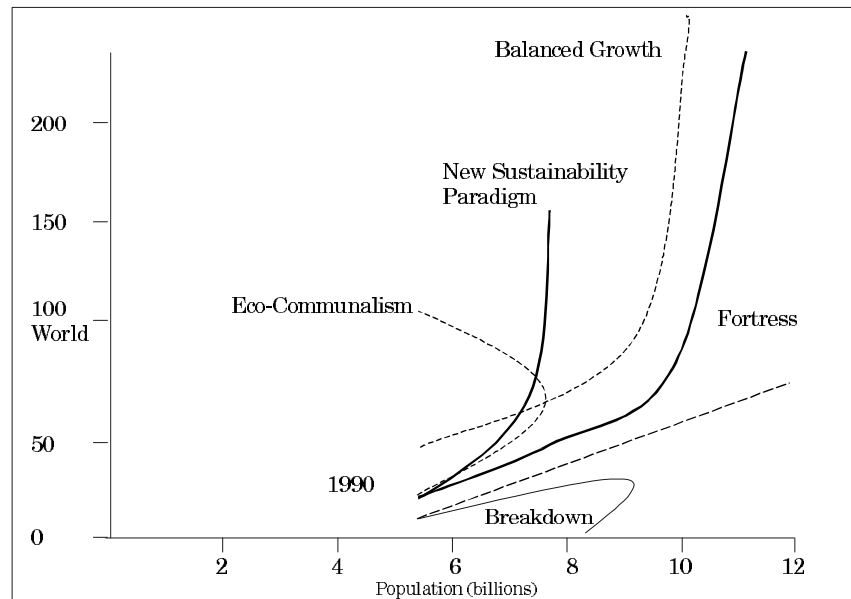
This results in a substantial risk of shipping accidents which could cause extreme environmental and public health damage from oil spills and the release of toxic substances to surrounding water and land. Indeed, this is of strategic importance to all countries receiving and shipping goods.

General

An interesting futures scenario model was developed in the 1997 UNEP Global environment Outlook Report as reproduced as **Figure 4** below.

FIGURE 4:
Population and Economic Growth from 1990 - 2100 Under Different Development Scenarios.

Gross World Product (Trillion US\$) 250



This shows qualitative contours for three classes of scenarios a central “Conventional Worlds’ class, a pessimistic “Barbarization” class, and an optimistic “Great Transitions” class.

The Conventional class follows a balanced growth scenario with stronger political Interventions to provide greater social equity and environment protection.

The Barbarization class follows a breakdown or destructive scenario involving anarchy, government and social failures, massive migration, economic collapse and environmental deterioration. An alternative scenario in this class is one of a minority elite forcibly imposing their will on the impoverished majority by seizing control of critical natural resources for their exclusive use at the expense of the wider social and ecological environment.

The Great Transitions class follows a deep green utopian vision that emphasizes bio-regionalism, local democracy, small technology and low population and economic development with dramatic improvement in environmental conditions. An alternative sustainability scenario would seek to alter the character of urban industrial civilization leading to a high-quality environment

These alternatives raise a number of questions of relevance to this Workshop, e.g.

- Which of these or a mixture of then is most plausible?
- Can the policy reforms of “balanced growth?” achieve sustainability?
- What critical points could kick the system into global or regional “barbarization”?
- What policies and actions are necessary to reduce this risk?

REFERENCES

Indonesia Legislation, Government of Indonesia.

REPELITA VI (1994/95 - 1998/99) Indonesia's Sixth Five Year development Plan, Government of Indonesia, 1994.

Environmental Impact management Agency, Functions and Programs, BAPEDAL 1995.

Global Environment outlook, UNEP 1997.

A Profile of Environment Protection in Indonesia and Australian Assistance, PCI Project 1994.

Regional BAPEDAL Institutional Development Program, BDTAP Working Paper No 5, Dr William L. Collier 1993.

Indonesia Environment and Development Challenges for the Future, World Bank 1994.

The Greenhouse effect - Living in a Warmer Australia, Anne Henderson - Sellers and Russell Blong, NSW University Press 1989.

SRI LANKAN PERSPECTIVE

Mr. K.A.S. Gunasekera
Secretary, Ministry of Forestry & Environment,
Sri Lanka

Overview

Sri Lanka's annual per capita energy consumption is 4 GJ, which compares with 9 GJ for India, 8 GJ for Pakistan, 2 GJ for Bangladesh and 1 GJ for Nepal. Biomass provides about 70% of the total energy used. Petroleum products account for about 25% and electricity about 5%. The General pattern of energy consumption can be seen by the distribution of energy recorded in 1994:

Petroleum products	25.3%
Fuelwood	67.8%
Electricity	5.0%
Others	1.9%
(Source: Ceylon Electricity Board-1996)	

Domestic Consumption accounts for approximately 65% of the total energy consumption and industry consumes approximately 13%. Transportation accounts for approximately 13% of energy used of 52% of petroleum products. Hydropower currently provides the bulk of electricity used. About 51% of households are provided with electricity. Of the total installed electricity-generating capacity of 1564 MW, 1137 MW, was hydro and 427 MW was thermal. More thermal power generating plants are being installed or planned.

The annual electricity demand growth in Sri Lanka for the next 20 years is estimated to be around 8%. This means that Sri Lanka's annual demand will grow from 3803 GWh in 1993 to 14,360 GWh in the year 2013. Due to present delays in plant additions to the electricity generation sector, it is likely that a deficit in energy supply will occur in the near future.

In Sri Lanka, the transmission and distribution losses are also considerable and are estimated to be 18% of the total supply.

The inevitable growth in electricity demand and the widening demand supply gap will lead to price rises in oil and coal. This

undeniably requires finding means of conserving electricity and improving efficiencies in the industrial, domestic and commercial sectors.

Energy and Environmental Implications

1. Biomass

Biomass supplies approximately 70% of the total energy consumed in Sri Lanka. It is used in homes for cooking and in main industries. The large scale industrial uses included brick and tile manufacture and manufacture of smoked sheet raw rubber. A shortage of Biomass for energy generation is not expected, as sufficient quantities will be available from wood and crop residues from the home gardens, coconut and rubber plantations. The Forestry Master Plan anticipates a demand of 9.7 ml tons of biomass in 2020 while the supply is expected to be about 10.1 ml tons if the present practices continue. The biomass utilisation leads to CO² emissions. In 1992, estimated emission was 17,737.52 Gg. It also leads to indoor air pollution leading to respiratory diseases particularly in the rural homes. Since the biomass supply comes from natural forests as well as from home gardens, there is an inevitable adverse impact on biodiversity.

2. Power Sector

The implications of development of hydropower on the environment have been well studied. The reservoirs constructed for hydropower are known to have heavy environmental costs. The dam construction across the Mahaweli inundated some of the most fertile land in the hill country. They have also affected the habitats and the biodiversity in the inundated areas. These reservoirs also tend to change the ecology in the microenvironments.

Thermal power generated only 7.7% of the total power supply in 1992. Emissions from the power sector in 1992 is given below:

CO ₂	643.17 Gg
CH ₄	0.030 Gg
N ₂₀	Negligible
CO	0.191
NO _x	1.354

3. Fossil Fuels

Most fossil fuels have adverse impacts on the quality of air, land and water. Fossil fuels particularly coal and oil lead to CO and NO emissions as well as emission of particulates. In the context of Sri Lanka 75% of petroleum products are consumed in vehicle transport whereas industry consumes only 25%. Much of the air pollution in the major cities of Sri Lanka is caused by vehicular traffic. The situation is further aggravated by subsidies offered for diesel, which motivates large sale use of diesel for light vehicles. The vehicle population has increased considerably over the years. Motor cycles and three wheelers using two-stroke engines contribute heavily towards air pollution. Emissions from the transport sector in 1992 were:

CO ₂	2334.48 Gg
CH ₄	0.504 Gg
N ₂₀	0.074 Gg
CO	106.25 Gg
NOX	22.06 Gg
NMVOG	281.18 Gg

4. Alternative Energies

There is potential for development of alternative energies in Sri Lanka. In addition to primary sources of energy there are other sources such as solar energy, wind energy, micro-hydropower, biogas and biomass. Being a tropical country, Sri Lanka gets the sunlight virtually throughout the year and the solar energy can be harnessed with great advantage. Although a few experiments have been undertaken, it has not been pursued in a serious manner. There are possibilities in mini hydropower generation and also harnessing of wind energy. Presently the powers generated by the mini hydro plants are connected to the national grid. Wind power is being harnessed only at experimental scale.

There is a national commitment to utilise the renewable energies under the agreement of the Kyoto Protocol.

Sri Lanka has adopted the following strategies in respect of integrating environment into the energy sector.

i) Overall Energy Sector

Carry out sectoral environmental assessments for the Energy Sector. The Ministry of Forestry and Environment has prepared an inventory of Greenhouse gases emitted from energy and industry sectors.

ii) Biomass Promotion

Encourage establishment of village woodlots where possible, with private sector participation, and home gardens. Intensify the promotion of fuel-efficient stoves: several designs of fuel-efficient wood stoves have been manufactured and marketed. In rural areas where biomass is still unpriced, these stoves may be promoted for improving indoor air quality. Develop collection, storage and processing of urban biodegradable wastes for biogas storage and use.

iii) Hydropower Generation

Nearly all the available sites for large-scale hydropower generation are being developed and only a few sites identified as suitable for generating hydropower on a medium scale are yet to be tapped.

iv) Thermal Power

Use thermal power technologies causing minimum air pollution and use “cleaner” fuels with low sulphur content, etc. Under alternative technologies and alternative sites for coal and oil fired power-generating plants, select cleaner fuel types, less environmental sensitive sites and technologies that will cause minimum environmental damage. Steps should be taken to reduce transmission and distribution losses.

v) Design and implement a Transport Policy

A National policy will be designed considering air pollution and related issues. Development of mass transit railway is being considered. There will be an express policy of priority for public transport. Positive steps will be taken to improve train and bus services. These steps will include both physical and fiscal measures. A start will be made on electrifying the suburban railways, re consolidating and fragmented ownership and operation of buses, compensating bus operators for restrictions on fare increases and positive priority for buses on urban roads, including the location of bus terminals and stops in the interest of bus passengers.

vi) Renewables

Encourage new and renewable sources of energy (wind, solar, biomass, etc)

THE MONGOLIAN PERSPECTIVE

Mr. L. Dorjtseden
Ministry of Nature and the Environment
Mr. S. Jargalsaikhan
Energy & Environment Consulting
Mongolia

Country Profile

Mongolia, a landlocked country located in the heart of Central Asia, lies between the Russian Federation to the north and the People's Republic of China (PRC) to the east, west and south. With a total of 1,566,500 square kilometers, Mongolia is half the size of India, making it the fifth largest country in Asia and the seventeenth in the world. The steppe covers three-fourths of the national territory. The capital is Ulaanbaatar.

Mongolia has an average altitude of 1,580 meters above sea level. The relatively high latitude exacerbates the semi-arid continental climate, resulting in long, cold winters with average temperatures falling below freezing for six months of the year. Temperatures in January average about -25 degrees Celsius, but lows exceeding -40 degrees Celsius are often recorded. The climate has exceptionally sharp variations in temperature, not only between the seasons of the year but also in the course of a day. High atmospheric pressure and low humidity are other characteristics.

In contrast to its huge landmass, Mongolia's population is small (2.35 million 1996), although its rate of growth is quite high (1.5% per annum). The capital city, Ulaanbaatar, located in the north central part of the country, holds 25% of the population. The other major urban centers are Darkhan, Erdenet and Choir, all located in the north. The rest of the country is largely pastoral, with animal husbandry (sheep, goats, cattle, camels and horses) the main economic activity.

Exploratory geological prospecting has identified more than 80 types of mineral ore in Mongolia, the most important of which are coal and lignite, oil and oil shale, iron ore, ores of nonferrous and rare

metals, and fluorite. Large deposits of graphite, construction and industrial materials (marble, gypsum, limestone, granite, mineral dyes, quartz sands and others) have also been discovered.

Although the Mongolian economy has experienced considerable industrialization, particularly in recent decades, the agricultural sector remains the backbone of the economy, with 5.7 percent increase in the Gross Domestic Product (GDP) in 1995. The sector also has important links with the rest of the economy, providing inputs into many processing industries such as leather and shoe manufacture, wool processing, cashmere production, milk production and bread making.

In the early 1990s Mongolia's industrial sector saw stagnation and decline across all areas, comparing 1993 with 1992, total industrial output dropped by 13%, due to a lack of spare parts, other inputs and investment as the country passed through a transition period economically. However, 1994 was a turning point with an increase in production by 2.7 percent which continued in 1995 with an increase in gross industrial output by 20.7 percent, increase of 38.3 billion Tg compared to the previous year with a total industrial production worth 184.7 billion Tg. Production increased in most industrial sectors except fuel, electricity and thermal energy.

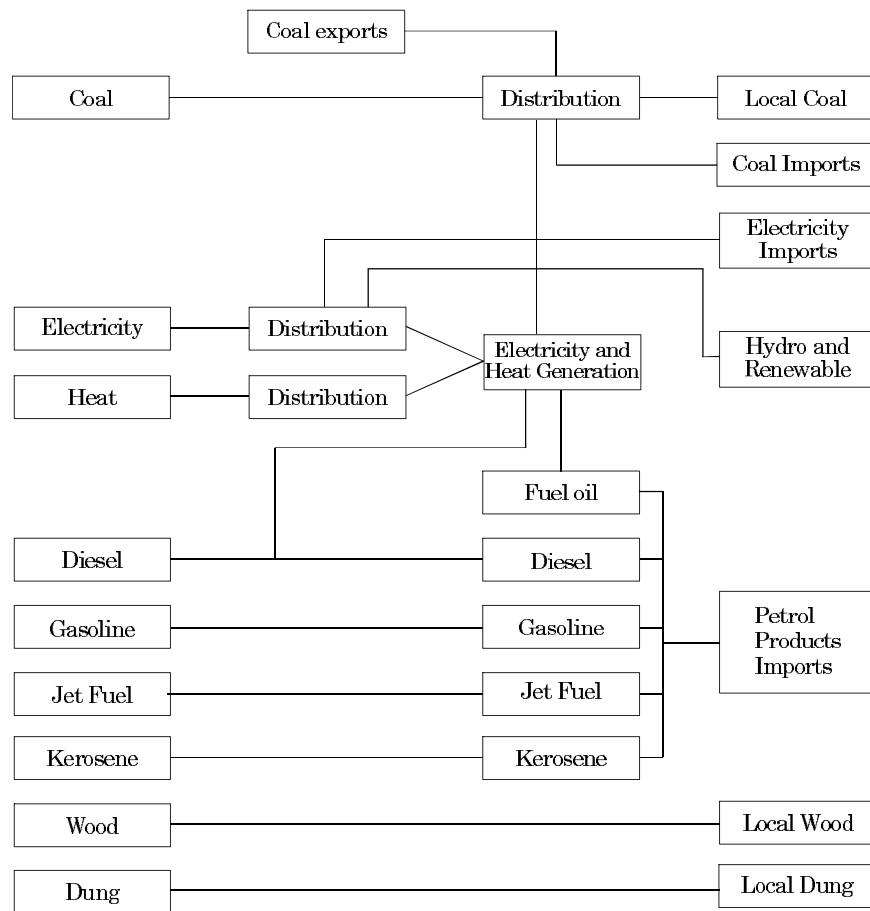
Overview of Energy Sector Development

The energy sector of Mongolia consists mostly of conventional energy sources. The fuel structure of Mongolia is shown in **Figure 5**. The conventional energy supply system consists of the coal sector, petro fuels and the electric power sector. In terms of the main sources of primary energy, coal is the most important energy source in Mongolia, accounting for close to 80 percent of the total primary commercial energy use in 1993 followed by petro fuels (19%). At present, Mongolia has no domestic oil production and all petroleum products are imported. In the future, Mongolia will develop its own oil fields; several foreign oil companies are doing exploration work with quality oil reserves having been discovered in eastern Mongolia.

<i>Solid fossil</i>	<i>Liquid fossil</i>	<i>Gaseous fossil</i>
Primary <u>Domestic</u> Coal • Sub-bituminous • Lignite • Coking Coal <u>Biomass</u> • Wood • Dung Imported • Sub-bituminous • Coking coal	Primary None	Primary None
Secondary	Secondary Imported • Gasoline • Diesel Oil • Residual Oil • Jet Kerosene	Secondary Imported • LPG

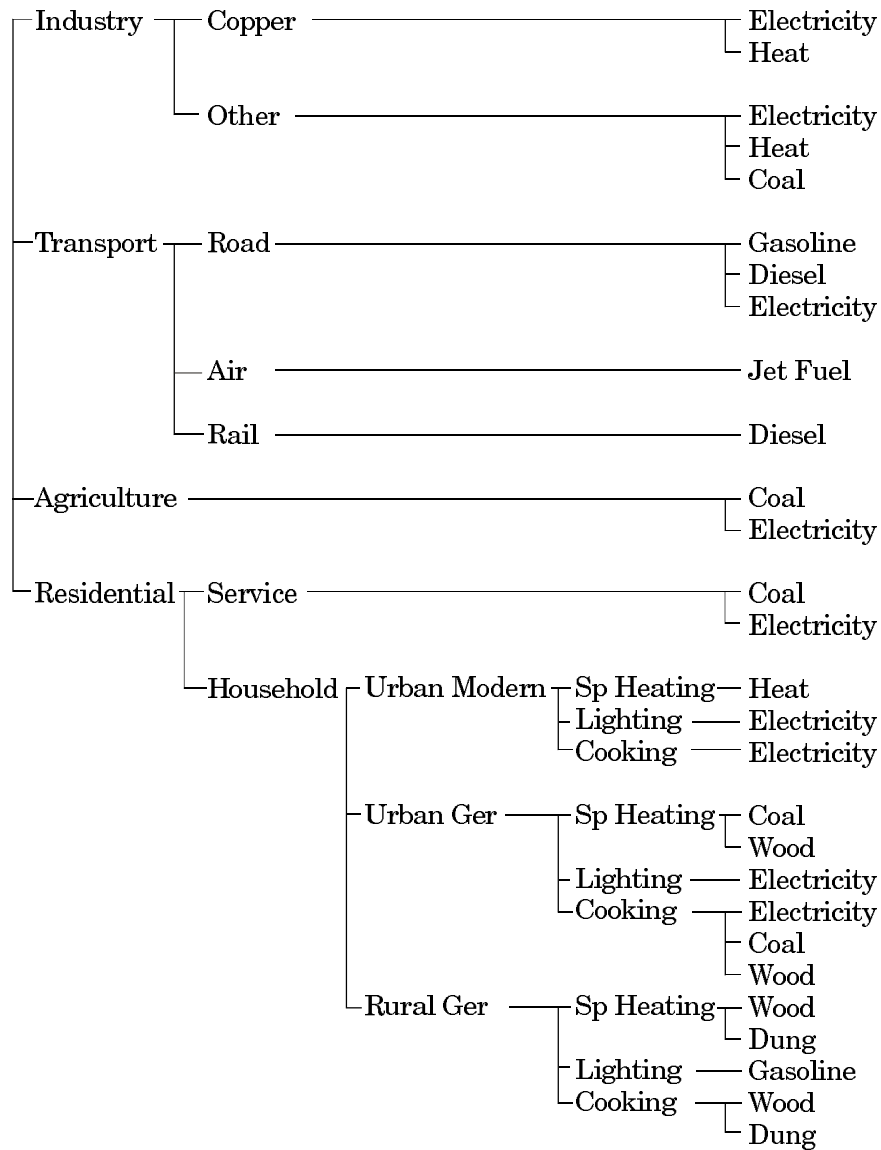
83

FIGURE 6.
The Transformation Structure in Mongolia.



In terms of energy end-use, households, industry, and transport are the biggest consumers. These sectors consume various types of energy in different ways. The Energy Demand Tree is shown in **Figure 7.**

FIGURE 7.
Energy Demand Tree.



Energy Supply System

The energy system of Mongolia consists of:

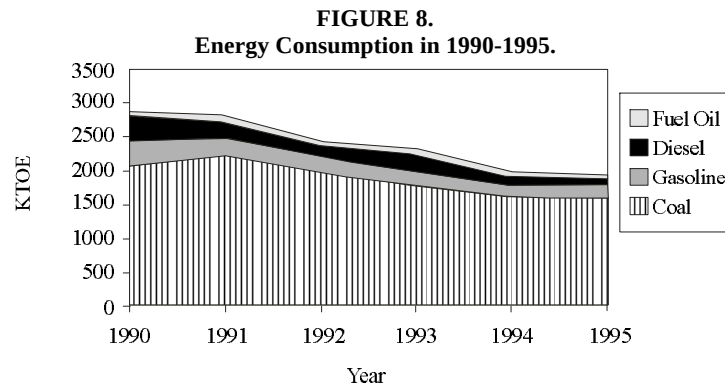
- Central Energy System (CES) with 5 coal-fired CHP, 8 Thermal Plants and several heat-only boilers and one small hydel (550kW);
- 20 province isolated energy systems with Heat Plants and Diesel Generators;
- 17 coal enterprises
- petroleum importing companies

The energy system has not the capacity to follow load fluctuations and meet peak demand in daily system operations. All power plants are coal-fired base load and peak demand is met by an expensive import of electricity from Russia.

Until 1989 when former Soviet aid terminated, Mongolia did not experience major supply shortage. During the last 7 years Government of Mongolia spent several hundreds million dollars of international aid and credit for emergency and rehabilitation of power generation units and coal mining.

Coal is only primary energy domestic source of Mongolia and accounts for nearly 77% of the total commercial energy supply. All petroleum products are imported; its main consumer is transport. Only about 20% of total imported petroleum product combusting for power generation (diesel electric generation consumes 8%).

Primary energy consumption trend is shown in **Figure 8**.

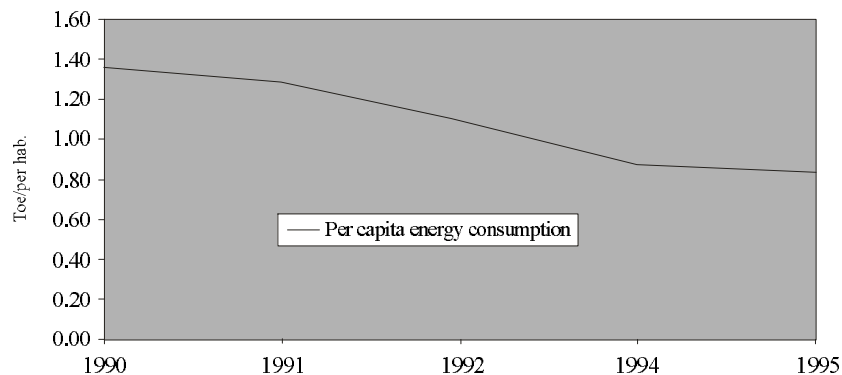


Overall Energy Demand Trends

The Electrification rate of Mongolia is comparatively high for a developing country about 85% in 1993; most residential centers, even in remote areas, have access to electricity and heat. District heating schemes exist in all major cities and towns.

Per capita energy consumption remains at a high level around 1.0 toe/year/person due to the harsh climate. **Figure 9** shows the per capita energy consumption trend.

FIGURE 9.
Per Capita Energy Consumption

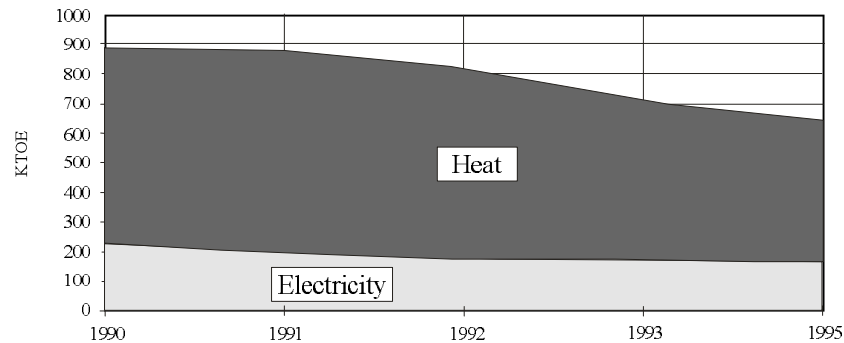


Per capita heat consumption is 5500 kWh/year due to the long heating season and high losses at the point of use. Annual load duration factors are around 44% for heating season which typically lasts 5600 hours per year.

Almost 55% of total energy consumption is used in space heating in households.

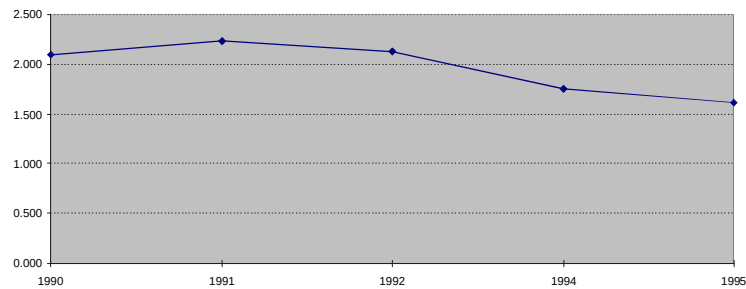
Heat and electricity demand in Mongolia is met as by local coal-burning a combined heat and power generation plants. The heat and electricity consumption trend for 1990-1995 is shown in **Figure 10**. The decreasing energy and electricity consumption could be explained again based on economic difficulties.

FIGURE 10.
Heat and Electricity Consumption in 1990-1995.



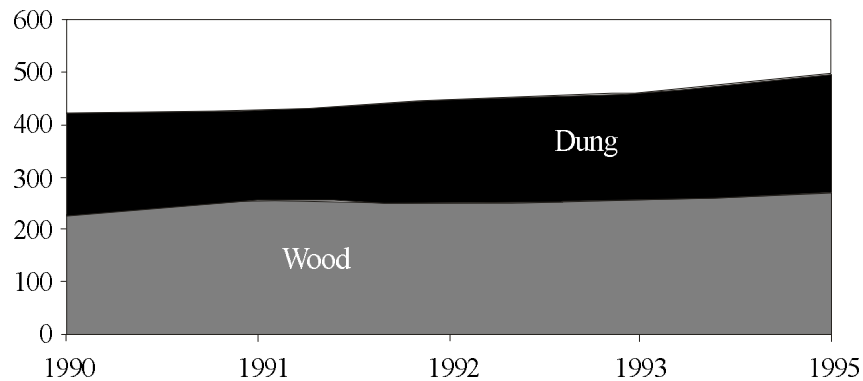
In terms of energy intensity, the Mongolian economy has an energy intensive picture due to a harsh climate condition, old energy inefficient technology, and poor practice of demand side management (see **Figure 11**, Energy Intensity Trend).

FIGURE 11.
Energy Intensity Trend (KTOE/Mtugr).



As a developing country, Mongolia makes substantial use of traditional fuels, 440 KTOE or 25% of total energy consumption in 1993. Data on non-commercial energy (wood and dung) which is presented here based on rough calculation. Indeed it is the only main energy source of nomadic herders and the majority of low income families, even those who inhabit urban areas. **Figure 12** displays the

Figure 12.
Traditional Fuel Consumption in 1990-1995.



trend of traditional fuel consumption. The chart shows that traditional fuel consumption increases opposite to other energy consumption for the period 1990-1995 (a period of transition for the Mongolian economy).

Sectoral Energy Demand Trends

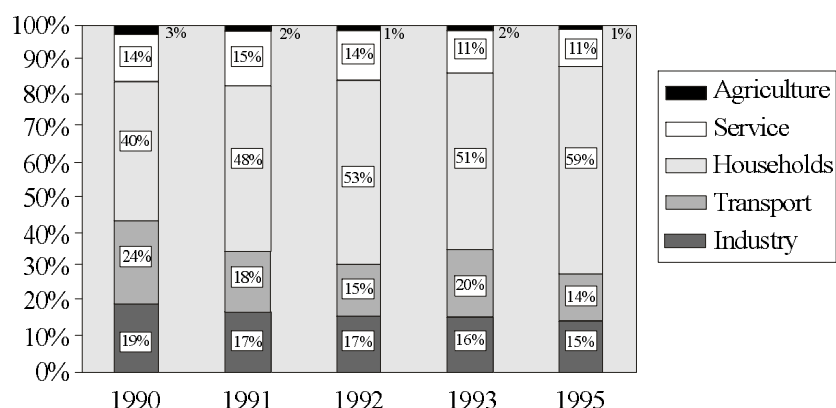
The sectoral trends relating to energy demand replicates the aggregate trend. **Figure 13** shows the sectoral final energy consumption structure for the period 1990-1995. Households, with an average 53% (including traditional energy 25%) weight in final energy consumption, is the largest consumer of energy. However households energy consumption is not principal determinant of sectoral energy demand because it is private consumption.

The sectoral energy trend should be analyzed between value adding economy sectors. In this respect the transport with 20% of the weight in final energy consumption is the primary determinant of the sectoral trend, followed by industry and service sectors, with respective weights of 16% and 12%. The analyzing period of 1990-1995 is the economic transition period for Mongolia and the industrial production activity dropped most seriously in this period, except for non-ferrous metal production, the output of main industrial commodities decreased up to 5-8 times in 1993 in comparison with

outputs for 1989. In the near future industry will be the primary determinant of the sectoral energy consumption trend of Mongolian economy.

Mongolian agriculture, with its nomadic tradition, has very low energy consumption, around 2% (this is motor fuel consumption mainly for crop land machinery). See Figure 13.

FIGURE 13.
Sectoral Energy Consumption Structure.



Industry: As the backbone of Mongolia's economy, the industrial sector is one of the largest consumers of energy. Industry and construction consume approximately 5% of coal supplied, some 66% of electricity supply and 12% of heat produced. The country's industrial sector is characterized by a small number of relatively large production enterprises. Only *Ardent Copper Mine* contributes to approximately 50% of the country's foreign exchange earnings and accounts for some 36% of electricity consumption and about 15% of peak power demand.

Transport: This sector essentially uses petroleum (consumes almost 100% of imported gasoline and 64% of diesel fuel in 1993) and a small amount of electricity, consumed by the electric powered public trolley-bus system in Ulaanbaatar. For road transport, the majority of freight trucks and even public buses are gasoline fueled leading to a proportion of gasoline *versus* diesel consumption ratio of 70:30. Due to an increasing diversification of transport vehicles in Mongolia, the number of diesel fueled vehicles is increasing.

Households are the largest consumers of final energy in the country. They account for 11% of coal, 48% of heat and about 25% of the total electricity demand. Heat demand is high because households living in multi-stored apartment buildings have high end use losses and building design is usually very inefficient in terms of energy.

Service sector: Public services include government offices and buildings, schools, hospitals and other non-commercial facilities owned by the government. As with households, service sector heat consumption is high and its use inefficient. It consumes around 40% of heat produced and 7% of electricity generated.

Agriculture is the smallest energy consumer, accounting for less than 2% of total end-use energy consumption. In the agriculture sector energy is used only for cropland preparation machinery. Due to economic difficulties, irrigation schemes, which were the main consumers of electricity in agricultural production, have been closed down since 1991.

Overview of the Present Environmental Situation

Centrally-planned development led to very substantial resource and environmental degradation. Since that time critical economic conditions have resulted in very limited funding for infrastructure, and institution and program development in the area of natural resource management and environmental protection, thereby reducing the capability of the new government to rectify the environment and resource problems it had inherited. Faced with overwhelming economic problems, the government has not perceived the environment as a high priority.

In common with most other centrally planned, command-driven economies, particularly those of the former Soviet Union, environmental and resource management considerations played virtually no effective role. Inadequate attention was given to planning natural resource utilisation, to the development of sustainable natural resource use policies, to resource restoration and protection, and to resource quality protection. This led not only to the loss and depletion of natural resources, but also to the degradation of environmental quality. Industries and population centres were developed without environmental safeguards. Atmospheric, surface water, and soil contamination is concentrated primarily around urban centres, and is

locally quite significant, in many cases exceeding health-based criteria.

All of these climatic factors combine to significantly limit the availability of renewable natural resources in Mongolia. Abundant water supplies exist only in certain areas in the north of the country. The rates of humus production, vegetative regeneration and growth, and livestock productivity are very low throughout the country in comparison to other countries in the region. Natural ecosystems are relatively fragile, highly susceptible to degradation by human activities, and slow to recover. In the south desertification is a problem; disturbed areas often become permanent sandy desert area.

Soil erosion, desertification and other forms of land degradation are considered high priority issues in Mongolia, in view of the strong dependence of Mongolia's economy and food supply on agriculture, and the reliance of other sectors, including mining, on land resources. The area degraded is growing annually. The development of strip mines and the deposition of overburden, spills and tailings all degrade land resources. Domestic and industrial construction and other forms of waste are currently deposited on the soil surface in overly-large, designated dumping sites on the outskirts of cities and towns.

The causes of desertification can be divided into two groups: *natural*, which includes limited humid periods, low precipitation rates, high wind velocities and duststorms, and extended dry and hot weather spells. The second cause is *anthropogenic factors* such as overgrazing, road construction, depletion of natural vegetation and soil cover and industrial impacts. These have reduced the productivity of rangelands, changed vegetation composition and depleted wildlife.

Most of the country is rangeland, and estimates about the amounts that are degraded vary, primarily through overgrazing. For the 1994 World Conference on Natural Disaster Reduction, the Government of Mongolia estimated that 76 percent of the nation's rangelands were subject to slight desertification, 20 percent to moderate desertification, and 4 percent to severe or very severe desertification.

Until about 1960, the area under cultivation in Mongolia remained a very small proportion of the country's total land area.

However, since that time an aggressive agricultural program, including a “virgin lands” program to spread primarily wheat farming to vast areas of steppe land was undertaken. The area under crops tripled in 30 years and the total lands under cultivation at the present time is around 1.3 million ha. Dry land farming is the prevailing practice. A considerable area is taken up by livestock feeds and fodder crops.

In 1994 the Mongolian *National Plan of Action to Combat Desertification* estimated that over 93 percent of the sown area is prone to wind erosion. Estimates vary, but between half and two thirds of the lands opened in the “virgin lands” program have been abandoned and are continuing to erode.

Mongolia’s endowment of renewable natural resources is therefore limited. The most urgent environmental and natural resource issues faced by Mongolia today are urban environment, particularly air quality, water supply and waste disposal; land degradation; water resources; and the underlying and critical need for institutional strengthening and capacity building. Other environmental issues include locally severe environmental degradation from mining and petroleum extraction, natural disasters, and natural heritage (including biodiversity).

The air quality issue in Mongolia is essentially an urban issue. The primary sources of urban air pollution is the soft coal-fired cooking and heating stoves of individual dwellings, the large, soft coal-fired thermal electric power plants, industry and vehicles. Urban air quality problems are exacerbated by the annual occurrence of a stationary temperature inversion over the urban areas, lasting from late fall to early spring, and accompanied by low winds. Air pollutant levels during this temperature inversion period frequently reach levels exceeding health-based criteria in many urban areas.

A significant portion of the land resources in Mongolia is currently degraded as a result of overgrazing, deforestation (including loss of forests to fire and insect damage), erosion and desertification. Crop cultivation is an important cause of soil erosion. Mongolian climatic conditions make high levels of soil loss associated with the tilling of the soil almost inevitable; this loss is aggravated by the inadequate use of soil protection techniques. Between 1960 and 1989 the area under cultivation increased greatly

(estimates range from 300 to 900 percent), mostly in the form of vast wheat fields, many of which (estimated at over 60 percent) have since been abandoned and are subject to wind and water erosion. Climate change, involving a gradual reduction in annual precipitation, appears to be a contributing factor to desertification and wind erosion, and a wide variety of increased economic activities ranging from overland vehicular traffic and improper waste disposal to mining, all are causative factors in or contribute to land resource degradation.

A rapid rise in water resource demand combined with increased levels of economic activity in key watersheds has resulted in the reduction of lake levels, river flow levels, and water table levels, and the negative influence on water flow regimes over a large part of the country. Domestic and industrial wastewater discharge has at the same time caused significant levels of contamination of surface waters.

Mongolia, having undergone a transformation from a socialist to a democratic form of government, and from a centrally-planned to a free-market economic system, is at a turning point in its history politically, economically, foreign relations, and also with respect to the management of its environment and natural resources. The decisions and initiatives taken (and to a large extent the degree and types of assistance provided to Mongolia by the international community) regarding environmental issues at this crucial point in its history will have a profound influence on the state of the environment and of natural resources in Mongolia throughout the country's new phase of development.

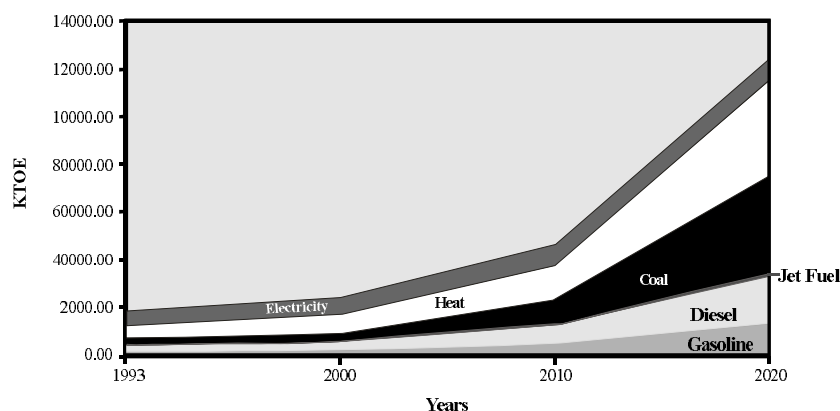
The country's total standing forest area was estimated at 17.5 million ha in 1994 according to the Commonwealth Forestry Review. This is 8.1 per cent of the territory of the country. For the most part, particularly in the broad central belt, the country is without forest cover. Forests located in north central Mongolia comprise about two thirds of the total forest area. The southern and southwestern part of Mongolia (Gobi region) contain arid forest and shrubland (90 per cent of which are represented by saxaul species). The forest species composition is: 60.7 per cent larch; 16 per cent saxaul, 7.8 per cent cedar; 4 per cent scotch pine; 7.3 per cent birch; and 4.2 per cent other species (fir, aspen and others) and shrubs.

Energy Sector Development Forecast

Final Energy Demand Projections

Projections of final energy demand were obtained from the run of MEDEE/S-ENV Model. **Figure 14** gives an overview of final energy demand by types of energy for the period 1993-2020 under a “Business as Usual” (BAU) scenario. As the modelled results show, the highest growth will have coal consumption by year 2020 about 20 times more than in the base year. This huge consumption of coal could be explained by increased building material production by almost 80 times, which has the highest share of coal demand for thermal uses.

FIGURE 14.
Final Energy Demand (By Type of Energy).



The projected final energy demand for diesel increases 8.13 times by the year 2020, gasoline 7.5 times. The high increase of motor fuel demand in non-ferrous subsectors and overall growth of transport sector demand could explain this growth. Heat and electricity demand is shown to grow 7.4 and 10.7 times respectively by the year 2020; a normal result relative to such economic growth. Heat is essential energy in Mongolia. It is interesting to see the heat demand structure by usage. **Table 5** indicates the usage and sectoral consumption structure of heat.

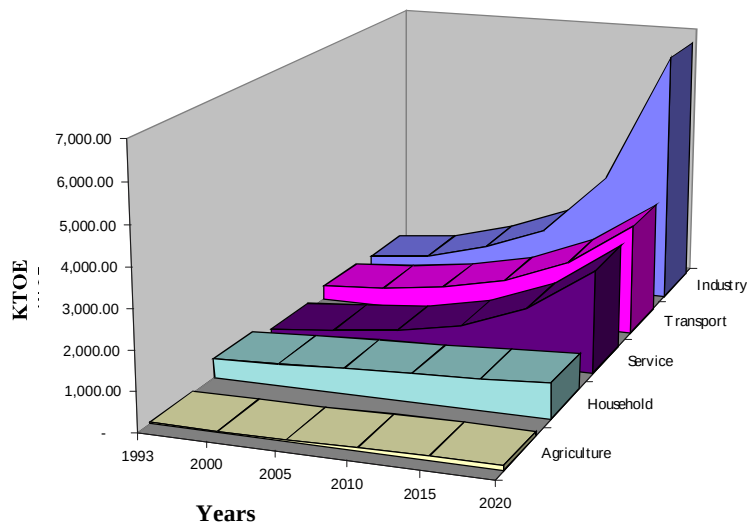
TABLE 5. Heat Demand Structure.						
Unit: KTOE						
	1993	2000	2005	2010	2015	2020
<i>By Usage</i>						
Industrial Process Heat	65.85	105.05	151.52	221.08	434.77	928.55
Space Heating*	470.52	660.33	861.43	1203.61	1872.57	3041.01
<i>By Subsector</i>						
Industry	65.85	105.05	151.52	221.08	434.77	928.55
Service	208.34	353.96	513.27	808.54	1431.33	2547.90
Household	262.17	306.37	348.16	395.08	441.25	493.11
Note: * Including heat for hot water supply Source: MEDEE/S-ENV Model Calculation Results						

Most of the heat produced in Mongolia is consumed by the Service and Households subsector for space heating and this trend will not change during the projected period. The space heating requirements of the Service subsector will increase faster than in other subsectors, its requirement expected to increase by almost 12 times by year 2020 against base year. However, industrial process heat demand will have the highest growth as related to industrial thermal requirements, for approximately 14.3 times during the studied period.

Sectoral final energy demand growth is shown in **Figure 15**. The final energy demand of main economic sectors, industry, transport and services, are increasing in line with economic development and will have a high growth rate after year 2010. This scenario did not assume any energy conservation measures the final energy demand is driven in direct proportion by production volume.

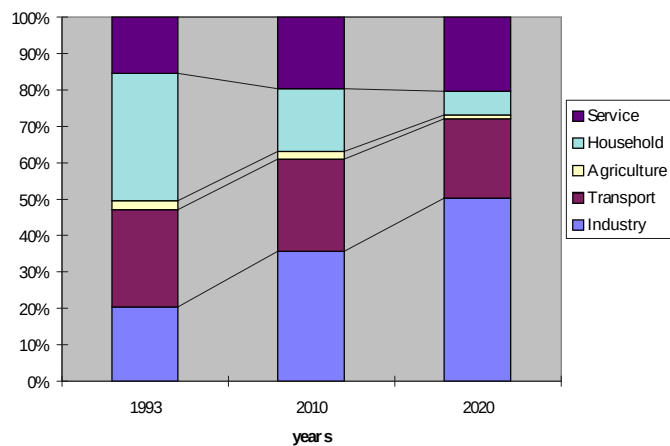
The structure of final energy consumption for 1993, 2010 and 2020 is presented in **Figure 16**. There is a clear trend of change in final energy consumption. In terms of final energy consumption shares by sector in 2020, industry is the largest consumer with weights of 50%, followed by transport, service and households respectively of 22%, 20% and 7%. The slowest growth of energy

FIGURE 15.
Final Energy Demand by Sector.



demand, for households, may be explained by projected low population growth in the future and high energy consumption levels at present.

FIGURE 16.
Structure of the Final Energy Demand in 1993, 2010 and 2020.



Energy Supply Forecast Results

Primary Energy Supply

The Energy supply forecast was obtained from the run of EFOM-ENV optimization Model. **Table 6** presents the evolution of the energy supply of Mongolia for period 1993-2020 obtained from the output of the optimization model in the run of BAU Case. The presented values correspond to the amount of gross primary production in the milestone years, *i.e.* the gross domestic production plus import, including T&D Losses the particular stage of supply; similarly for the generation of the electricity and heat production, which are included in the table, using primary energy sources such as coal and diesel as fuel.

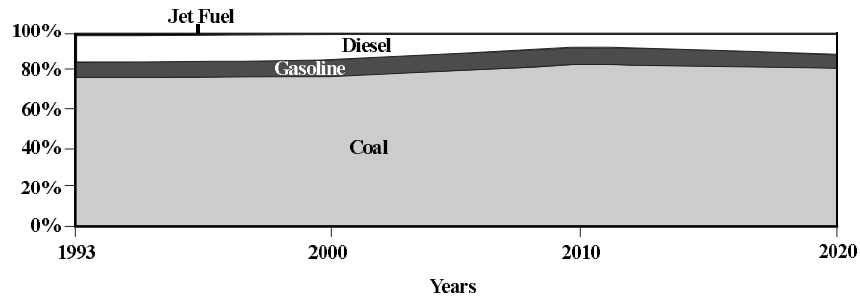
TABLE 6. Energy Supply, 1993-2020				
	Unit: KTOE			
	1993	2000	2010	2020
Primary Energy Supply				
Coal Extraction	1789.10	2519.00	5173.00	16250.00
Petroleum Import	543.21	718.46	1502.71	4051.00
Electricity (Hydropower and Import)	16.93	0.00	42.02	42.02
TOTAL	2349.24	3237.46	6717.73	20343.02
Energy Transformation				
Electricity Production*	231.57	322.55	700.32	2203.15
Heat Production	631.00	900.50	1676.50	4670.20

Note: *Including imported electricity and hydropower

It is clear that coal will be the dominant primary energy source in Mongolia; this primary energy supply increases steadily throughout the study period. No assumptions were made for fuel diversification; firstly there are enough local coal reserves, secondly no domestic natural gas production is expected. Although there are some oil reserves, it is still unclear whether oil production could affect total primary energy supply before 2010. The fuel mix of Mongolia is expected to remain simple; as shown by its projected evolution, in **Figure 17**.

Gross primary energy supply is expected to reach 20343.02 KTOE in 2020, while it was only at 2349.24 in 1993, representing a growth of almost 8.7 times over the 27 years period. The growth is

FIGURE 17.
Fuel Evolution.



expected to be faster in the last years of the studied period, 2010-2020, with a rate of over 10% per annum.

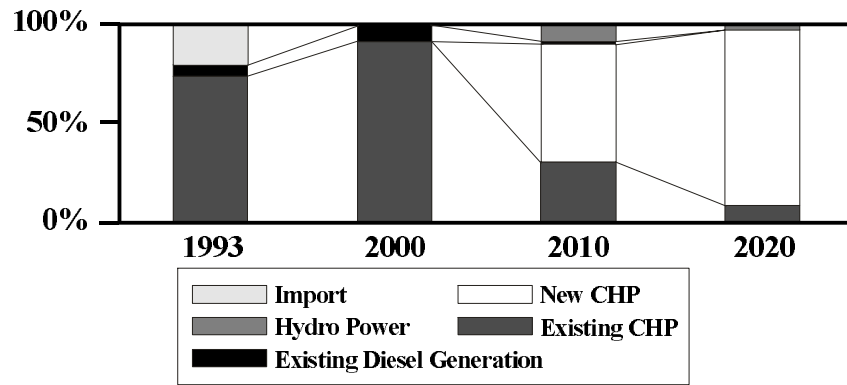
Energy Transformation

Current electricity capacity will satisfy demand up to 2010; it requires new generation capacity. The exceeding capacity will be met by *Egiin Hydro*, which is expected to have built a new CHP by 2005. According to the fast growth rate of electricity for the period 2005-2020 will require additional capacity. Heat demand will be met up to 2000 by the existing source; new sources will be required around 2000. New CHP and HOB will cover this demand. The fast growth of heat demand in period 2010-2020 will require new sources. It is expected that most heat consuming sources will be located in large cities with district heat schemes. To build a new CHP to meet electricity and heat demand concurrently is the optimum solution. The source structure of heat and electricity generation is shown in **Figure 18 and Table 6**. The CHP share in power generation will dominate the projected period. It is justified because the gross efficiency of CHP is higher than conventional Power generation. The location of CHP in the city is not the optimum solution from the perspective of environmental protection.

Environmental Implication of Energy Sector Development

The environmental effects of Mongolian energy sector development are drastic. The MEDEE/S-ENV and EFOM-ENV models results show that the power generation sector accounts for approximately 70 to 98% of the total greenhouse gas emissions (70%

FIGURE 18.
Electricity Generation Structure.



of CO₂ emission, 85% of SO₂, 70% of NO_x and 98% of TSP by year 2020). The most significant environmental issues in the energy sector are power generation related activities.

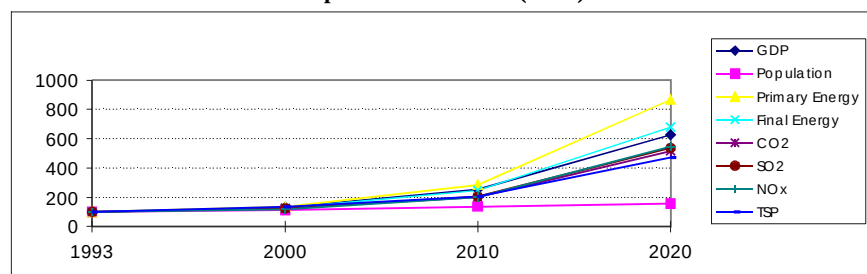
If no measures are applied to curb energy, particularly in terms of power generation-related emissions, between 1997 and 2020 only dust emissions would increase by a factor of 7.5, SO₂ emissions by a factor of 8.4, NO_x by a factor of 8.4 and CO₂ by a factor of 8.1. The sectoral breakdown is shown in **Table 7**.

TABLE 7. The Emission Sectoral Breakdown.					
		1993	2000	2010	2020
TSP	Power	150.3	227.05	413.58	1123.99
	Industry	0.05	0.08	0.27	1.15
	Transport	0.77	1.04	2.24	6.09
	Households	0.63	0.64	0.72	0.74
	Total	151.75	228.82	416.81	1131.97
SO ₂	Power	53.12	75.44	143.7	427.66
	Industry	1.67	1.8	9.62	46.76
	Transport	2.22	3	6.49	17.68
	Households	1.29	1.39	1.54	1.65
	Total	58.3	81.63	161.35	493.75
NO _x	Power	37.45	49.95	99.13	316.97
	Industry	1.18	1.29	6.87	33.45
	Transport	11.11	14.91	31.9	86.08
	Households	1.23	1.34	1.57	1.76
	Total	50.97	67.49	139.47	438.26
CO ₂	Power	6438.12	9170.97	17341.3	50797.49
	Industry	352.28	608.28	2014.73	9807.45
	Transport	1131.59	1509.87	3189.35	8496.8
	Households	693.96	780.48	958.21	1140.41
	Total	8615.95	12069.6	23503.59	70242.15
Source: MEDEE/S-ENV and EFOM0ENV Model Calculation, 1997					

Per capita emissions will increase correspondingly from 67.4 kg/cap to 318.9 kg/cap for TSP (dust), from 25.9 kg/cap to 139.1 kg/cap for SO₂, from 22.6 kg/cap to 123.4 kg/cap for NO_x and from 3829 kg/cap to 19786 kg/cap for CO₂. Some of the important environmental and energy related indicators of this scenario are presented in **Figure 19**.

Index 1993=100

FIGURE 19.
Important Indicators (BAU).



Alternative Case of Energy Sector Development

A possible alternative case of energy sector development should be analysed and considered in terms of overall resource conservation and environmental protection. Possible alternative energy sector development options should consider (i) coal beneficiation measures at the major mine sites; (ii) energy conservation and efficiency improvement measures both on the supply and demand side of energy; (iii) application of renewable and (iv) installation of environmental technology at power generation. A brief description of proposed measures presented below.

Coal beneficiation

Coal beneficiation could be a specific measure for Mongolia, because coal is the most important primary energy source and Mongolia has abundant coal reserves. It is expected that coal will continue to be the main fuel option for power and heat generation in the CES system and for heat generation in provincial centers. The existing coal supply system in Mongolia does not have a coal quality control and a coal preparation system at the mine site. Only coal mining and delivery to the consumer (long distance transportation) exists. Almost 70 % of coal is transported an average of more than 150 km by railway. Coal quality and efficiency often does not meet the minimum standard requirements, and in many cases, emergency situations at the power stations are caused by the low quality of coal. The coal arrives at the power plant, is mixed with rocks and other assorted objects, and accidents have caused piles to climb to dangerous levels of 2-3 days supply at the power plants.

Better quality control at the mines is required and installation of a 'selective' crusher and screening of equipment is recommended to reduce the amount of rock and inert matter transported to the power stations. Improved management of mine drainage systems is necessary to reduce the moisture content of the coal.

Coal beneficiation is technically highly feasible, and there are low institutional barriers because this is considered in the Mongolian Environmental Action Plan. Coal beneficiation has great potential for minimizing the transportation cost of coal, and reducing local

pollution caused by power plants, such as ash disposal, air pollution in the city.

Energy conservation and efficiency improvement

Electricity Transmission Technical and Non-Technical Losses Reduction Potential

The reduction of losses in the electricity transmission/distribution system involves redesigning and/or rehabilitating the existing old transmission/distribution lines, installing more energy efficient equipment in poles and/or in power substations and replacing old and inefficient pole-mounted transformers. On the other hand, non-technical losses could be reduced through strict monitoring and apprehension of pilfers of electricity. The transmission system of the Mongolian Central Energy System (CES) consists of 220 kV overhead lines and the length can be estimated at 1,958 km. The grid is connected to the Siberian grid by a 220 kV transmission line. The distribution system consists of 110 kV overhead lines that mainly feed secondary substations. The total line length of the 110 kV system is estimated to be 2,363 km. Voltages of 35 kV, 10 kV, 6 kV are used in distribution networks supplied by industries and distribution stations, while 0.4 kV is used in networks supplying residential and other public consumers. CES's technical and non-technical loss average about 12-14%.

District Heating System Loss Reduction

District heating systems exist in all major cities and towns. Heat losses in the heat distribution systems are high, and urgent measures are required such as minimizing leakage, replacement of valves and compensators, and reducing radiation losses. Building losses are also high and residential consumers have no means to regulate temperatures.

It is necessary to convert the district heating system in Ulaanbaatar to a variable flow system, and this would result in a substantial reduction in peak demands. Results of the Ulaanbaatar

Heat Rehabilitation Project² shows that the total loss (end-user heat and hot water losses and thermal losses reduce the potential to 268 Tcal/year with investment cost US\$38.00 million.

Small Combustion Efficiency Improvement

In areas where there is no centralized district heating system (from CHP and Heat Plants) heat only boilers with simple furnaces and coal stoves are used. About 1500 coal fired small boilers with low pressure exist in Mongolia, and its production was 245.5 KTCE or 30% of total heat production. More than 60% of Household have individual coal stoves.

The improvement of combustion efficiency in small boilers and furnaces as well as coal stoves is an attractive measures for conservation of coal and the reduction of air pollution in residential areas. Technologies on high efficiency burners, a combustion monitoring and control system, and basic housekeeping practices are available. The average efficiency of existing coal boilers and furnaces is estimated to be 40-60%.

Lighting Efficiency Improvement

This demand-side management case concerns the use of energy-efficient compact fluorescent lamps (CFL) to replace inefficient incandescent light bulbs (ILB). CFLs provide the same amount of light as an incandescent lamp but use roughly 70% less electricity. While CFLs are more expensive than ILBs, they are less expensive on a life-cycle basis due to savings in electricity and equipment costs.

Lighting demand of households and service sectors accounted for 32.18 KTOE in 1993 and it is expected to be 143.57 KTOE by 2020.

Currently, most households and about 30% of service and commercial buildings have incandescent bulb lamps and the rest use fluorescent bulbs. The most efficient CFL has an electricity consumption that is 30-70% lower than the incandescent bulb or the fluorescent lamp.

2. Asian Development Bank, TA 2610-MOON, Ulaanbaatar Heat Rehabilitation Project. Final Report, May 1997. COWI-AF Energikonsult Syd AB in co-operation with ECC, Energy Conservation Company, Mongolia.

Motor Efficiency Improvement in Industry

Industry is one of the largest consumers of electricity in Mongolia. Consumption of electricity in the industrial sector was 117.54 KTOE in 1993, and is expected to be 1592.64 KTOE by 2020. This is nearly 80% of total electricity consumption. Motors and pumps are the main consumers of electricity in the industrial sector. Existing motors and pumps come from old Russian designs and the efficiency is very low.

Building Insulation Improvement

Heat demand is essential for Mongolia and buildings have space heating installations. Almost 65% of the total energy demand from households and 90 % of the total energy use in the service sector are used for heating. The last study on heat losses found out that nearly 40% of heat is lost in houses and buildings due to heat loss through windows, walls and doors. Most multi-family buildings in bigger cities are very similar in design and construction to buildings in many parts of the former Soviet Union.

A study of local building standards³ found that heat demand in multi-family buildings could be reduced by about 60%. This study's proposed energy saving measures are shown below:

- Weather stripping in windows
- Installation of thermostat radiator valves and balancing valves
- Balancing the heating system
- Insulation of roof, 100 mm mineral wool

Vehicle Fuel Consumption Efficiency Improvement

Road and non-road vehicles and machinery consumed 417.38 KTOE of petroleum, and it is expected to be 3257.19 KTOE in 2020.

3. Project T.A. Number 1750-MON. Mongolia: An energy audit, efficiency and conservation study. Part C, Local building standards and efficiency of household appliances. AF-Energykonsult Syd AB, August 1994

Most vehicles and machinery are of the old Russian design, and are not equipped with fuel injection or other advanced control devices. The unit consumption of fuel is thus comparatively high. There are few vehicle service and maintenance centers; regular control of exhaust and gas fuel consumption does not exist. The results of some individual studies show that there is potential to reduce unit fuel consumption by about 20-25% by installing simple devices, tune of engine control and proper regular maintenance.

Renewable Energy

Hydro Power Development

In Mongolia there are about 20 hydro sites with installed capacities ranging from 5MW to 110MW. However, these are mainly situated in the mountainous western part of Mongolia, far from the CES grid. For this reason, they would probably be expensive to develop. Mongolia's cold climate also reduces the ability to exploit hydro power resources.

The specific climatic, topographic and demographic conditions in Mongolia are reasons for distinguishing two types of potentially successful hydropower projects⁴:

- Small scale schemes of up to 20 MW of supply to provincial centres;
- Medium scale storage projects for supplies to the CES grid or if located in more remote parts of Mongolia, in connection with the development of mining and /or energy intensive industries, or for power exported to neighboring countries

Photovoltaic (PV) Solar System

Mongolia is located in a region with abundant sunshine, typically between 2250 to 3300 hours each year. It is estimated that the southern part of the country receives a daily average of insulation between 4.3-4.7 kWh/m²/day. Current available information is not considered to be accurate or complete for a solar energy system

4. Mongolia -Power System Master Plan, 1995

design. Possible application of solar energy is mainly targeted for the nomadic herdsman's family. During the last 10 years, the use of different small solar-electric units has been introduced for rural households. PV systems have been shown to be the least expensive option when compared to small petrol type generators. PV systems are not yet economically viable on a large scale for grid based generation in provincial centers. For this reason, the potential application of PVs in Mongolia is expected to be limited to small scale (10-1000 W) remote applications for some time. Assessments indicate that in Mongolia, PV power systems are competitive with conventional energy sources for small power applications, for nomadic herdsman families (65,000 Nomadic families have no access to electricity, but are willing to pay for small generation systems).

Wind Power System

Wind energy conversion systems offer an alternative to the conventional methods of fossil-fueled power generation for rural electricity. Small stand-alone wind power systems for battery charging can be used for low power, high quality applications such as lighting and telecommunication. They are most likely to be installed in remote locations as a cheaper alternative to diesel generators that are set up or put in a grid extension. Wind energy technologies have proven to be the most cost-competitive for the bulk power market internationally. Mongolia has had very little experience with wind energy. There have been few systematic assessments or monitoring of the potential of wind energy resources in Mongolia. According to the meteorological data made available by the Institute of Renewable Energy, the annual mean wind speed in the south eastern part of the country is in the range of 4 to 5 m/s, which is marginal in terms of the potential cost that is compatible with other technologies, with the exception of very small (50W) wind generation systems for remote areas.

There is considerable potential to supply many nomadic livestock herders in the Gobi desert with small portable wind generation systems. There is a need to conduct a wind velocity survey to determine the technical feasibility of this option in Mongolia.

Based on a study made by the Energy Research Institute, larger scale wind turbine generators (100-150 KW) could be placed in 52 provincial centers in the southern part of Mongolia. The most promising site should get priority for establishing the technical and economic feasibility of operating 100-150 kW wind turbine generators in parallel with existing diesel generators.

Biomass Energy System (Gasifier Technology)

Bioelectricity is shown as a potential and feasible option to meet all the current and projected electricity requirements of rural areas in the majority of developing countries. It is possible to install sustainable biomass based electricity generation systems in island provinces instead of installation of expensive power generating sets to generate all the electricity required.

Bioelectricity systems could be installed in any rural location where biomass can be grown and harvested. It is possible to set up an electricity generation capacity from 20kW to multiple megawatts. Electricity can be generated all year and 24 hours a day. No storage costs are involved.

The average demand of electricity in remote villages in Mongolia is calculated to be around 150-250 KW. From 384 rural villages in Mongolia, there are about 50 remote villages that are located in the northern part of Mongolia that are feasible to install biogasifiers.

Installation of environmental technology at power plants

The potential impact of environmental constraints on energy demand and supply is crucial for a sustainable growth of energy demand. However, the cost (external) incurred to the environment due to energy production and energy use is still very uncertain and only very rough estimates exist. On the other hand, abatement measures are costly and capital intensive.

Mongolia is a country with low air pollution. Air pollution problem exists only to a small extent in Mongolia's capital city, Ulaanbaatar, during the winter season. Nevertheless, current energy demand forecast as included in this study and the expected rapid growth of the economy may result in a severe deterioration of the natural environment imposing health risks and other externalities to

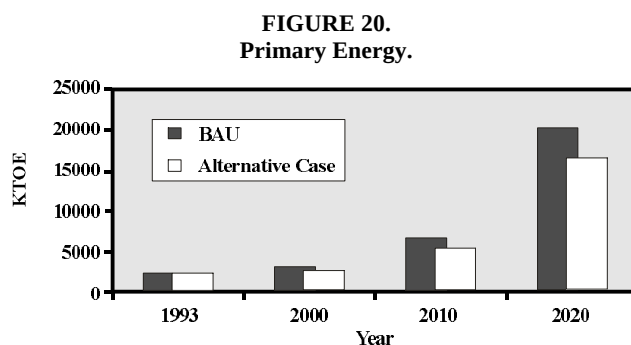
the population. An environmental case is defined aiming at limiting the pollution caused by energy production and consumption. As a result, a set of cost-effective measures to reduce environmental side-effects will be generated. In this case, the control of the four principal energy-related air pollutants will be considered:

- ⇒ TSP (dust)
- ⇒ Sulfur Dioxide (SO₂)
- ⇒ Nitrogen Oxides (NO, NO₂)
- ⇒ Carbon Dioxide (CO₂)

Current measures to control emissions at the main power plants and heat only boilers in Mongolia are inadequate. Only the CHP #4 in Ulaanbaatar has ESP (electro-static precipitator). Actual performance of this ESP is low. All other CHP have only wet scrubbers (not limestone) for flue gas treatment. None of the heat only boilers have installed wet scrubbers. one of the CHP and heat only boilers have treatment facilities for SO₂ and NO_x. The alternative case considers (i) the installation of electro-static precipitator (ESP) for treatment of TSP (dust) at all existing CHP and at new CHP and HOB; (ii) the installation of wet limestone scrubber for treatment of SO₂ at all existing CHP and at new CHP and HOB; and (iii) the installation of Selective Catalytic Reduction for treatment of NO_x at all existing CHP and at new CHP and HOB.

Comparison of Business as Usual and Alternative Case

Figure 20 compares the final energy demand of BAU and the Alternative Case.



The implementation of all measures considered in the alternative cases will result in cumulative savings of 5,624.4 KTOE primary energy which is almost equal to annual primary energy requirements for 2010.

The cumulative effects of all cases on emission reduction are presented below in **Figure 21**, **Figure 22**, **Figure 23** and **Figure 24**.

FIGURE 21.
TSP Reduction Impact.

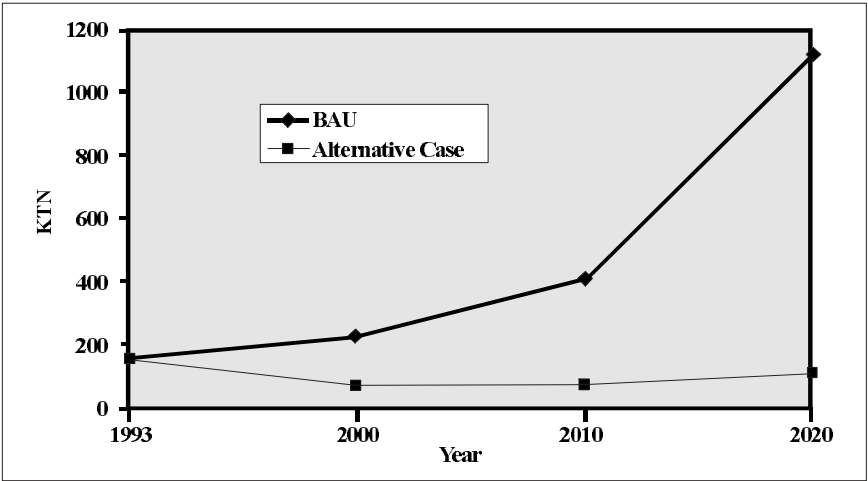


FIGURE 22.
SO₂ Emission Reduction Impact.

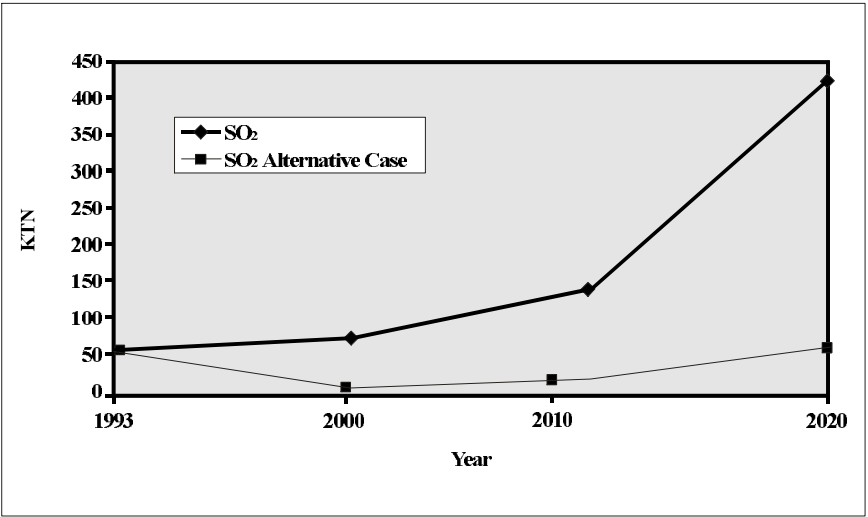


FIGURE 23.
NO_x Emission Reduction Impact

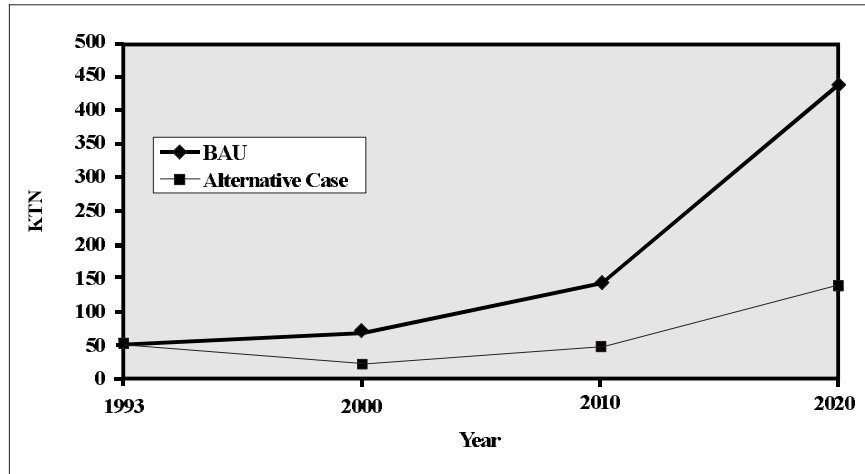
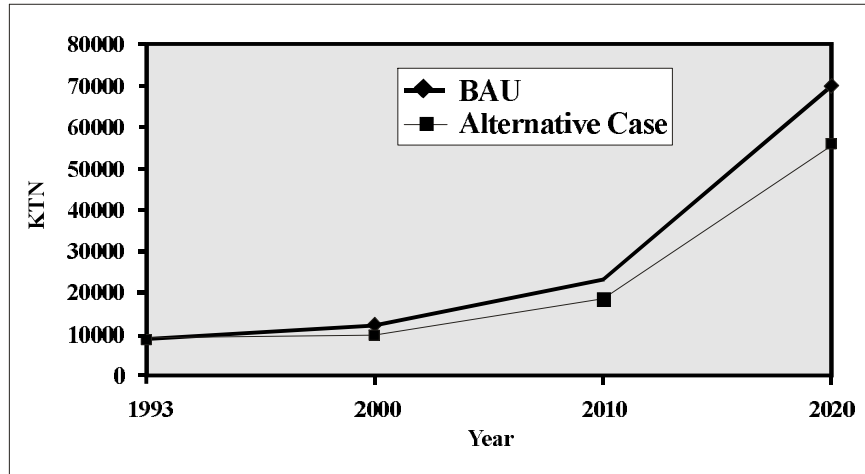


FIGURE 24.
CO₂ Emission Reduction Impact



DISCUSSION

Several issues and perspectives were considered during the examination of energy as a security concern. In addition to addressing the possible environmental impact of energy consumption and related factors such as transportation, the participants argued that it is equally important to explore the socio-economic and strategic contexts within which these processes take place.

These issues are reflected in the environmental security challenges identified by workshop participants.

Environmental Issues and Challenges

1. Strategic energy planning

Planning for future energy consumption was identified as a key environmental and economic challenge.

One important area of agreement is the need for long-term, strategic planning to confront the challenge which arises from the incompatibility of projected increases in future energy demand and a drastic reduction in the availability of natural energy resources through overuse. In other words energy, which is based on non-renewable resources, may well become a strategic resource.

The aim of strategic energy planning should be to improve current energy efficiencies and to develop alternative energy options.

The relationship between strategic and natural resource planning is another factor in energy planning which must be addressed, particularly where access to natural resources is vital to a country's security profile.

Strategic energy planning should also focus on minimizing the impact that energy use has on climate change – particularly in terms of sea-level rise– which was classified by participants as an important dimension of environmental security.

2. Pollution prevention and remediation

The movement of energy resources, primarily by sea and land, presents a high risk to the environment. The possibility of accidental

spills during transportation was identified as a significant environmental concern. The environmental damage which occurs as a result of such incidents may include the temporary (and possibly prolonged) loss of biodiversity, and devastation of coastal, marine and terrestrial ecosystems. In turn, this environmental damage can have long-term primary and secondary economic and social effects. Local communities may be affected through loss of food sources (if coastal habitat or agricultural crops are affected), economic resource base (for example, fish stocks) or through the health impacts associated with air pollution and pollution of waterways, which might arise from energy-related pollution incidents.

Severe pollution may also result in a more widespread impact on national economies. Clean-up and remediation efforts are complicated and demanding of resources, including time and money (thereby exacerbating the economic costs associated with pollution incidents).

Efforts to reverse any economic damage may have regional as well as national implications. Broader transnational environmental pollution issues, such as water quality degradation, air pollution and soil contamination arising from energy-related pollution incidents all have the potential to trigger and increase regional tensions.

Those contributing to the discussion concluded that prevention through a precautionary approach makes better environmental, economic and strategic sense than reacting after the fact through remediation. The participants nevertheless agreed that remediative strategies must also be well developed.

3. Equity of energy access

Energy resources, whether indigenous or imported, are fundamental to the existence of a state and were recognized as being critical to the maintenance of the economic, social (and cultural) fabric of any country. Nevertheless, access to energy resources is not equally distributed, either as a gross measurement or on a per capita basis.

Inequitable access to energy is a potential source of tension, within and between groups and states. Most natural energy resources are sovereign assets; clearly some countries are energy resource-rich while others are energy resource-poor. The challenge is to develop

energy cooperation on a regional and global level to ensure fair and equitable access to energy resources. There is a dynamic aspect to such access, requiring reassessment and regular consultation and dialogue. The development of alternate energy-resources will contribute to the development of energy-equity strategies.

4. Energy transportation and security of energy supply routes

The movement of energy resources was identified as an important energy-related environmental security issue. The transportation of energy resources occurs daily by sea and land, within countries, across borders and across regions. The economic and social importance of energy requires that sea and land routes be kept open and secure for such movement, particularly where there is a transnational or global component to energy transportation. These routes must also be as navigationally safe as possible to minimise the risk of oil spills and other environmentally-damaging incidents. Further, they should be physically secure to reduce the risk of piracy and terrorism incidents.

The participants concluded that regional agreements which govern these potential threats are important in ensuring that energy resource movements are not interrupted by third parties, whether they be other countries or non-state groups.

5. Linkages between economic growth and energy resources

Energy resources are crucial to national development. They constitute a significant factor in shaping the economic, social and cultural profiles of individual countries and of people within those countries. Indeed, development (which is most often pursued through economic growth which can be energy intensive) is always identified as a fundamental national goal. It is clear that there are differences in levels of development and in access to the resources for development. Agreements and arrangements toward sharing the stewardship of energy resources should include cost-sharing mechanisms which address this problem in the short and long-term.

It was suggested that developed nations should lead these arrangements in the short-term, particularly in the development of alternative energy resources. Developing countries should nevertheless be expected to contribute to these stewardship arrangements.

Opportunities for Defence Cooperation

The participants identified opportunities for defence cooperation among the civilian and defence sectors. The discussion considered the applicability of defence assets and resources to specific areas of energy management. The defence sector might make a valuable contribution to discussions and negotiations on energy-related agreements, for example.

1. Information sharing

Defence sectors in a number of countries have developed considerable expertise in the development and implementation of various energy-related management strategies. This expertise includes information and lessons learned in areas such as energy reduction, the use of alternative energy resources, and environmental protection.

The participants recommended that mechanisms for information sharing across national defence establishments should be established. One related suggestion was that the Trilateral partners assume a facilitating role in this respect.

2. Regional agreements

The workshop participants felt that there was an opportunity to develop bilateral and multilateral arrangements for regional cooperation toward protecting the movement of energy resources. In particular, there is a distinct role for the military with respect to monitoring, reporting and where applicable, enforcement. It should be noted that these arrangements should not be initiated by the defence sector, nor should these be primarily defence arrangements. The participants suggested that responsibility for the negotiation and implementation of such agreements might proceed through a non-military, multilateral forum such as the *ASEAN Regional Forum* (ARF), *Asia Pacific Economic Cooperation* (APEC), the *United Nations Environment Program* (UNEP) or the *Coordinating Body on the Seas of Southeast Asia* (COBSEA is a UNEP body established by the ASEAN countries in 1981 to coordinate the *Action Plan for the Protection and Development of the Marine and Coastal Areas of the East Asian Region*).

3. Regional Oceans Policies

The development of regional oceans' policies could potentially make an important contribution to the safety of navigation and the prevention of marine and coastal pollution. It was suggested that, where applicable, such policies would build on existing national oceans arrangements. Here, the opportunity for defence cooperation results from coinciding maritime and naval interests. Regional oceans policies might therefore include an examination of defence support issues as well as issues related to safe navigation. ASEAN and the *United Nations Development Program* are possible organisations which might facilitate the development of regional oceans policies.

4. Defence leadership

Defence forces, supported by defence research efforts, should continue to provide leadership in pursuing energy efficiencies at a level appropriate to each nation. This could include the acquisition of more efficient equipment; the development and implementation of environmentally responsible operating procedures; and continuing research efforts into energy efficiency. Opportunities should also be pursued for cooperation and information exchange among defence forces and establishments.

5. Defence support

Defence assets, including personnel and equipment, can be used to supplement civilian disaster relief capabilities. In making this recommendation, the participants suggested that this support be extended to non-disaster situations. The issue of defence assistance during disaster relief operations was a recurring theme throughout the workshop.

The level of support available will be nation-specific. Any such support will be more effectively delivered where information is available on the extent of individual national capabilities. Regional arrangements would facilitate this information exchange. It was strongly recommended that individual Defence Forces develop and provide the appropriate data to the relevant civilian authorities at a national and regional level. Regional plans to address emergencies requiring multinational responses in critical areas, such as those which might be related to energy-disasters (oil spills in the Malacca

Strait, for example) should be developed and implemented. Responsibility for this should lie with the appropriate emergency response agency; in some circumstances the emergency response and national defence agencies might be one in the same.

6. *Engagement on environmental issues*

All multinational forums should be encouraged to consider and discuss environmental protection in general and energy-related issues in particular. The objective of this type of dialogue is to ensure a high level of awareness of the environmental implications of all decisions. Clearly these issues are considered by a number of existing organizations, such as the *Commission on Sustainable Development*, the *Organisation for Economic Co-operation and Development* (OECD) and UNEP to name but a few. At a regional level, such fora could include ARF, APEC, COBSEA, the *South Pacific Regional Environment Program* (SPREP) and the *South Pacific Commission*. In addition to bilateral relations, such discussions could contribute further to confidence-building measures, while enhancing cooperation between countries.

Global Climate Change

Many of the world's climate scientists have concluded that if the countries of the world do not work together to cut the emission of greenhouse gases, temperatures will rise and disrupt the global climate. In fact most scientists say the process has already begun. Disruptive weather events such as El Nino are increasing. Disease-bearing insects are moving to areas that used to be too cool for them. Average temperatures are rising and glacial formations are receding. Climate Change poses significant potential environmental security threats. The consequences of global climate change will continue to challenge decision-makers in the private, public and military sectors alike.

There are potentially two types of impacts on the military from global climate change - direct and indirect. Direct impacts include international or national Global Climate Change Policies that could affect the military's ability to conduct multilateral military operations, operations in international airspace and waters, or domestic operations and training. Greenhouse gases include not only carbon monoxide (primarily from the burning of fossil fuel), but also five other gases, three of which are used world wide in weapon systems. Policies that control the use or release of these gases could restrict a military's ability to operate or train. The Kyoto Protocol provides three important provisions for the military:

1. Emissions from multilateral operations pursuant to the United Nations Charter are exempt from emissions limits.
2. Emissions from fuel used in international maritime or aviation (bunker fuels) are exempt from emissions limits.
3. Emissions relating to multilateral operations may be divided in various ways, depending on what is best for a given situation. The default procedure under the Kyoto Protocol is for the military emissions that occur in another country to be counted there. However, the agreement provides for emissions to be shared bilaterally or multilaterally.

Domestically, militaries must address two broad categories of activities: the first is military operations and training, and the second includes facilities and non-tactical vehicles. The military goal in domestic policy development and implementation should be to ensure their ability to conduct military operations with trained and ready forces. For the second category of activities, the military may choose not to seek special treatment for its facilities and non-tactical vehicles and reduce emissions of carbon dioxide through improved energy management at their facilities and purchases of alternatively fueled or more fuel efficient vehicles.

Other direct impacts include flooding of coastal bases; typhoons and hurricanes could force the costly evacuations of ships or planes; and severe storms (typhoons, hurricanes, rain or snowstorms) could cause significant damage to military installations or disruption to operations.

Indirect impacts could be regional instability or conflict caused by loss of cropland land, fresh water, or traditional fishing grounds; increases in vector borne disease, flooding, droughts, or wild fires; and mass movement of refugees. Increases and decreases in rainfall may have secondary impacts - the delivery of goods may be hampered in regions that depend on barge transportation, mining or other related activities may be halted. These human and environmental disruptions could threaten international political stability. They have the potential to create situations where troops would need to be deployed for humanitarian or peacekeeping missions or to protect regional or national interests.

This workshop will investigate the role of regional militaries in responding to these challenges.

Questions

- Does the military have a role in reducing GCC gas emissions?
- What are the potential impacts to the military of future GCC policies or trends? Will they likely impact military training and operations. If so, how should militaries respond? Through regional cooperation?

- How can the military improve energy management at their facilities?
- Should militaries purchase alternatively fueled vehicles or more fuel efficient vehicles?
- What is the relationship of regional energy strategies to Global Climate Change strategies?
- Does the military have a role in protecting citizens from floods and other natural disasters?
- What is the military's role in responding to national, regional and international climate change driven disasters and other human tragedies?
- What is the military's role in identifying and monitoring vector borne diseases? In responding to outbreaks of epidemics?

THE IMPORTANCE OF CLIMATE PROTECTION ISSUES FOR SMALL ISLAND NATIONS

**Mrs. Ruby Saha
Mauritius**

**Please note that the views and opinions expressed herein are personal and do not commit the Government of Mauritius, for whom the Author works*

Abstract

Small island states are becoming increasingly vulnerable to the negative impacts from the higher stormwater baseline that is occurring with rising sea-level. Concomitant with this phenomenon, extreme events are expected to become increasingly more important.

These countries already face a daunting challenge in attempting to establish priorities for the many social and economic problems they undergo and they certainly have not got the financial capacity to respond adequately to the threat of sea-level rise. In addition, such countries have made very small contributions to global emissions.

This intended focus of this paper is the Vulnerability of Island Nations.

Overview

The thrust of Mrs. Saha's presentation was the likely impact of climate change on the small island nations of the world, based on predictions made by the scientific community. The issues arising out of global warming constitute yet another platform where the small islands of the world share a common family problem.

Small Island States of the World

The small island states of the world comprise over 70 states of vibrant communities of various cultural origins that operate at varying levels of economic performance. Whilst there is scientific uncertainty regarding the timing and regional impact of global

warming and numerous scenarios are being worked out to determine who would be the likely winners and losers, there is no doubt regarding the specificity and vulnerability of small ocean islands and coastal areas lying just a few metres above sea-level. They would all be losers:

“A rise in sea level would (i) inundate and displace wetlands and lowlands, (ii) erode shorelines, (iii) exacerbate coastal storm flooding (iv) increase the salinity of estuaries and threaten freshwater aquifers and otherwise impair water quality, (v) alter tidal ranges in rivers and bays, (vi) alter sediment deposition patterns, and (vii) decrease the amount of light reaching ocean bottoms”. (p. 6 IPCC Impacts Assessment Report, 1990).

Such areas are currently exacerbated by population growth, competition for resources including freshwater, land and human capability resources; environmental degradation; problems of governance; food security; health care and the mitigation of disasters often caused by unfavourable weather conditions and made more difficult by problems of poor infrastructure.

Specificities of Small Island States with reference to SW Indian Ocean Islands

To facilitate an understanding of the specific issues which concern island states, it is interesting to focus briefly on a group of islands very familiar to the author, the South West Indian Ocean Islands. The objective of this focus is to demonstrate that these islands are more heterogeneous than homogeneous - there are high islands as well as low islands; they are all struggling for survival upon a narrow resource with a varying degree of success and that climate change through global warming and sea level rise only contribute to problems which already exist.

The SW Indian Ocean Area is dominated by a string of high islands, of volcanic or granitic origin, rather than by low islands. There are numerous low islands of coral formation, but by historical accident or rather through the incidence of their lower comparative potential for human settlement as opposed to the high islands, the coral islands of the SW Indian Ocean are much less populated than the high islands. Such islands do have economic significance for

fishing, agriculture and of course in determining the economic zones of the parent country.

Mauritius, Comores, the Seychelles, and Reunion feature among some of the islands of the Region. In terms of wealth, there are strong and pervasive differences amongst the countries of the region themselves, with Mauritius displaying a per capita income of \$3,700 in 1990 as compared to Comores with a per capita income of less than US\$ 400. Such differences are due to a host of socio-economic factors including political history, governance and political stability.

Amongst the islands, Reunion is the largest island with 2,511 sq km and also the highest, rising to 3,009m. It is a French Department, tied integrally to the French economic system. The island rises very abruptly from the coast and economic activities are dominated by agriculture, mainly sugarcane, which may be grown to the 1000-m isoline depending on aspect.

The surface water availability in Reunion is very negligible compared to the large amount received as precipitation. This is due in part to the nature of the terrain, the radial pattern of the rivers, the smallness of the island and the porosity of the basalt. There is however an intensive internal hydrographic network and research effected around the island has led to the identification of hundreds of sources. Research undertaken since the 1950s has led to the discovery of an enormous water lens that has cumulated into the geologic material at the base which acts as a catchment for infiltrated rainwater, delaying its discharge to the surrounding ocean. Reunion is very vulnerable to the cyclone track and continually experiences damage to its road infrastructure as a result.

Mauritius is slightly smaller than Reunion, with 1,865 sq km, is more densely populated with 1.2 million population, lower, older and more dissected. Independent since 1968, Mauritius has become, since the late eighties, one of the booming economies of Africa, south of the Sahara, with three major economic sectors, manufacturing, agriculture and tourism spearheading the economy. Mauritius was one of the pioneer implementors, within Africa, of an Environment Investment Program during the nineties. The commitment of Mauritius to the preservation and enhancement of the environment is strong. Agriculture has in the past been sugar-based, but over the last few years, there has been significant improvement in agricultural

diversification leading to a large amount of self-sufficiency in vegetables and rootcrops, as well as export of high value goods like cut flowers and fruit.

Mauritius receives heavy precipitation, with a skewness towards the Central Plateau and the South East, as a result of a combination of a large number of factors-prevailing winds, ocean current, relief slopes - however there is rapid runoff towards the sea. Surface water is available to a larger extent than in Reunion, but the groundwater resources are enormous although they are not exploited to the maximum extent possible. There have been cases of saline intrusion in the north of Mauritius.

Rodrigues, a dependency of Mauritius, lies some 500-km east of Mauritius, with some 35,000 population. It is some four-fifths of basaltic origin whilst its east and southwest coasts are of coral formation. It is characterised by a high population growth, subsistence farming and agriculture aimed at export to the mainland. There is heavy precipitation in the summer months and in view of the denuded vegetation cover, heavy run-off accompanied by soil erosion. There is an ongoing afforestation program in Rodrigues to counteract the degradatory effects of soil erosion.

The Comores Archipelago is a volcanic island with a rocky coast, no natural ports, a heavy rainfall and a luxuriant vegetation. Although the Grand Comores receives heavy rainfall, the soil is permeable and there are no rivers. Exploitation of the water lens has started. The Comores feature among some of the poorest countries in the world. They have severe resource limitations and are subject to considerable environmental strain resulting from traditional human activities such as abstraction of building materials from beaches and reefs and agricultural and silvicultural practices, which practices result in considerable loss of vegetative cover and soil erosion.

The Seychelles Archipelago comprises a mixture of two categories of islands, granitic and coralline and comprises some 60,000 population. The three largest islands, Mahe, Praslin and La Digue harbour the largest population and most of the activities that may have an environmental impact such as tourism. All the towns of the islands are no more than 2 km from the sea. Tourism is the main foreign exchange earner while fisheries constitute the next growth industry.

In addition to the above-named high islands, there are many low coral islands in the SW Indian Ocean, but with much less population. It may be said that all the small islands of the SW Indian Ocean share constraints on land, especially land suitable for agriculture and residential construction, natural resource and water supplies. The terrestrial resource base is essentially limited to agricultural potential, forest products as well as magnificent scenery. There are no significant mineral deposits on any of the islands under consideration, except for aggregates (sand and gravel) or guano found in certain outlying areas. Mangroves and coral reefs feature among the main foci of marine life in these islands.

Current Climate Pattern

The SW Indian Ocean Islands have some climate patterns, which again have some similarity with other island regions of the world.

In terms of current climate pattern, these areas

- ◆ Belong to the range of humid tropical climates and, normally excludes arid areas;
- ◆ Have two distinct rainfall seasons (where near the equator)
- ◆ Away from the equator, the bulk of the rain is concentrated within the summer months;
- ◆ The coastal areas, particularly on the windward side receive their rainfall throughout the year as a result of the land/sea breeze effects; those on the leeward side as permanently dry;
- ◆ The Inter Tropical convergence, the intensity, location and orientation of the monsoonal wind systems, tropical cyclones, subtropical anticyclones, jet streams, extratropical weather systems, easterly/westerly waves, global teleconnections are among the systems which affect the climate of the area;
- ◆ Further from the equator, temperature becomes a significant variable with a clear distinction between cold winters and hot summers;

- ◆ The high islands have a marked temperature differential with altitude and these differentials determine the local environmental humidity.

Predicted Climate Change in the Islands

There are two main thrusts whereby climate change may impact on the small islands -

The *first* would be through global warming with primary as well as secondary consequences;

The *second* would be through predicted increases in sea level rise and again there are both primary and secondary consequences thereof.

Both areas of global warming and sea level rise are compounded with complexity, mainly because the state of the art is such that it seems to be very difficult to predict any type of change accurately on a global level, let alone on a regional level.

It is known that any global temperature anomalies would affect regional temperature patterns, which have impacts on the moisture transporting monsoonal wind system and other rainfall generating systems. For the small islands located in the inter-tropical zone, this may imply an increase in the occurrence of tropical cyclones as well as a change in the cyclone track, changes in the degree of the intensification of storms; enhanced precipitation in regions with heavy rainfall, longer periods of drought in dry regions and other frequencies of climate extremes induced by the heat trap effects of greenhouse gases.

Besides changes to weather patterns, global warming is also predicted to accelerate the present sea level rise which could inundate low lying coastal lands and islands. Both global warming and its secondary consequences as well as sea level rise may have far ranging economic and ecological consequences on the small island nations, already strained by issues of population density, narrow resource base, carrying capacity, fragile ecosystems and problems of coastal zone management.

The Scope of Climate Change Impact on the Tropical Islands

Given the heterogeneity of small islands, their varying locations, size, socio-economic base and geomorphological characteristics, the speculation reached in respect of climate change cannot be standardised for all of them. In fact, the state of the art is such that it seems very difficult to predict any type of change accurately. Specifically there is great uncertainty about the likely cyclone track movements, a phenomenon that has a significant influence on the whole ecological and human settlement pattern of the SW Indian Ocean Islands.

Three factors appear to be certain – there will be a global warming albeit with reduced effects nearer the Equator, there will be a change in precipitation, and a rise in sea level. Tentative regional predictions for the SW Indian Ocean Region are as follows:

- ◆ temperatures increase, but with marked regional variations in the amount of warming;
- ◆ regional and temporal variations of precipitation are uncertain. However models have shown that in lower altitudes, enhanced precipitation will occur in regions with heavy rainfall, but dry regions may become drier;
- ◆ Global warming will accelerate the present sea level rise. This could inundate low-lying coastal lands and islands and reduce coastal water supply by increased salt water intrusion;
- ◆ Frequencies of climate extremes induced by the heat trap effects of greenhouse gases will change. The Inter Tropical Convergence Zone will shift northward and systems formed may become more intense. Storm tracks may change with devastating impacts on coastal areas and islands by floods and storm surges.

The combined effects of the changes are expected to have a considerable change over the climatic patterns, ecosystems, hydrology and socio-economic activities of the small islands, but in view of the varying locations, size, geomorphological characteristics as well as the uncertainties in climate change itself, the impacts cannot be predicted with any degree of precision.

We may look at the thrusts of climate impact on small islands from the broad perspectives of *regional effects* and *detailed impact* depending on whether the island is a low island (of coral origin) or a high island (granite or basaltic).

Regional Perspective

From the regional perspective, the main issues are cyclones and cyclone tracks, precipitation and temperature. In terms of cyclones, it should be noted that at the present moment, not all tropical islands are subject to cyclones. Two notable examples are the Seychelles and Singapore, known for their luxuriant and mature vegetation.

Should islands, hitherto unhit, become affected by cyclones, the result may be catastrophic as the vegetation is not resistant, whilst longstanding buildings may not have been conceived as cyclone proof.

Turning to the precipitation aspects, there may be enhanced extremes. The process of soil erosion and sedimentation in the small but high islands of volcanic origin will be accentuated.

A reduction in rainfall leading to technical drought conditions may have some catastrophic effect on the industrial ambitions of the small emerging nations unless the underground aquifers retain substantial water and it is exploitable. On the other hand, heavy precipitation may induce flooding and storm drainage systems may be choked.

A rise in temperature may have some effect upon agriculture if there is no room for the crops to migrate to higher latitudes. It will also decrease levels of comfort to buildings. Architecture will have to be adapted to the environment through judicious siting, layout, aspect and use of appropriate materials.

Low Island Perspective

Besides the regional impact, climate change and consequential sea level rise may affect islands from the perspective of whether it is a low island (of coral origin) or a high island (granite or basaltic). We will look at low islands first:

Growth Rate of Coral Islands and Reefs

So far as the small islands are concerned, one major question is the effect of a continually rising sea level on coral reef growth. Marshall and Jacobsen (1985) noted that coral growth kept pace with sea level rise during the most rapid rises in the early Holocene times when rates of accretion were measured at 5-8 m/1000 years.

There is optimism in parts of the SW Indian Ocean about the beneficial effects of a certain sea level rise as the coral reefs are not thriving under the low tidal conditions. However those fingertype corals, which would be likely to keep pace with rising sea level, are also fragile and are likely to be destroyed upon recurrence of storms and swells.

Groundwater Vulnerability

Another issue for low islands is groundwater vulnerability. The low coral reef islands are characterised by the absence of rivers and by dependence on the freshwater lens. The basic issues that need to be outlined in the event of a continuous sea level rise would relate to recharge, island size and water quality. As recharge on the low coral islands is only by rainfall, the changing rainfall and temperature patterns will alter the amount of water available for recharge whilst higher temperatures will also cause more evapo-transpiration.

Over time, rising sea level may be expected to erode coastlines and flood low-lying portions of islands. Decreased island size will also mean less surface area for infiltration and potentially a smaller volume of aquifer available for the storage of freshwater. Water quality would also be affected by decreasing lens size due to decrease in recharge, smaller aquifer, saline intrusion or tide movements. Vulnerability would also be increased in the event of seepage of sewage disposal systems. This is in turn linked to demography and increased pressure on land.

Resource Base

Finally, we need to review the resource base of the low coralline islands, which are normally limited to agriculture, tourism and fishing. In the light of the risks of saline intrusion through both sea level rise and the occasional storm flooding, special varieties adapted

to salinity have to be encouraged and not other plants. There are extensive implications for hotel structures which have been built right along the coast in response to client wishes.

Human Considerations

There are also the very important human and sociological considerations for the resident population, the implications on the resource potential (fishing, tortoise, agriculture) and the policy implications of long term development programs.

One of the main considerations for economic survival and security will be groundwater and detailed studies will be required on ground water resources and the degree of abstraction that may be allowed without affecting the equilibrium.

High Island Perspective

The effects of sea level rise and climate change on high islands are also likely to have an impact for reasons relating to higher levels of investment, higher economic activity and denser human settlements. We will limit ourselves here to coastal vulnerability, groundwater vulnerability and the economic base.

Effects of Fringing Reefs

Most tropical high islands are encircled by a continuous or semi-continuous barrier of fringing reefs, which enclose sheltered lagoons and mitigate to a very significant extent the action of strong waves, swells and surges coming from across the ocean.

In terms of coastal vulnerability, it is noted that the presence of fringing reefs, in good physical condition is an important factor in the coastal protection of high islands. However, within a Global Warming and change in sea level rise scenario, the action of strong waves, swells and surges coming from across the action may damage the reefs. On the other hand, in light of the more induced precipitation and flood conditions of the high islands, more sediment in the form of soil and sand would be deposited in the lagoons thus contributing to the further deterioration of the reef.

In brief the fringing reefs will become increasingly vulnerable, with consequential effects of further wave and erosion action on the mainland.

Groundwater Vulnerability

Going now to groundwater vulnerability, we should note that on account of their higher population density, the high islands are very dependent on fresh water resources underground although not to the same absolute extent as to the coral islands.

Groundwater vulnerability will be subject to the parameters of recharge, island size, water quality, and sea level rise. Decrease in lens size through flooding as well as saline intrusion through rising sea level and recurrence of storm water conditions may also lead to a decrease in water quality. In view of the population density, there are risks of seepage from sewage disposal systems.

Economic Base

In the high island countries, the coastal areas are the nerve-centre of all the economic activity. In the Seychelles and Reunion, all major economic activity is located along the coastal plains on account of their difficult terrain. In Mauritius the more equable relief has allowed the dispersion of population and industrial investment inland, but nevertheless there are substantial investments along the coast.

In most of the high islands, the most expensive infrastructure - represented by capital cities, ports and air ports (representing extremely heavy investment) are located along the coast. Such sites are already sensitive to storm surges and occasional swells from the ocean would become increasingly vulnerable to sea level rise.

The high islands, with their magnificent scenery, are also the centres of a very selective tourism policy and high investment, expensive high class hotels have been built along the coast just a few steps away from the high water mark so as to provide the client with the maximum comfort and minimum walking distance from the sea.

The high islands are also agricultural islands par excellence. Hence again too rapid change of the weather pattern to which the

plants are sensitive may affect agricultural productivity, one of the main sectors of their economy.

Global Warming and Sea Level Rise Issues For Small Island Nations

There is little doubt about the vulnerability of small ocean islands to the onslaught of climate change through global warming and the extreme events that may accompany it, including sea level rise.

Taking into consideration on the one hand the vulnerability, smallness and weakness of the economies involved and the lack of involvement in the cumulation of processes which have led the world to this quasi-irreversible situation, and, on the other hand, the disproportionate burden of the potential impacts of global warming on these areas, it is obvious that there are strong equity considerations that arise in the management of information, let alone the sharing of responsibilities over this new phenomenon affecting the world.

A checklist of the issues that arise would be as follows:

Equity

Small island-states are an obviously vulnerable group, not only because of their greater susceptibility to sea level rise, but also their heavy dependence upon natural resources that may be affected by climate change and commodities that may be affected by abatement. This is an important equity issue not only because the impacts differ, but also those most vulnerable to climate change are those contributing least to its causes.

Abnormality of the Burden

The review of the vulnerability of small islands as spelled out in the foregoing sections bring out the disproportionate and abnormal burden (including quasi-annihilation in the case of the atoll islands) that such areas would undergo as part of the impact of climate change and sea-level rise. The prospects are likely to be irreversible.

No Capacity for Resilience

Countries with larger surface areas and higher elevations can offer higher prospects of resilience and adaptation. In small ocean islands, the degradation of water supplies through saltwater intrusion can alone dictate the end of any sustainable prospects for present, let alone future generations. Their economic resilience is weak and impacts, when they occur, are wide-ranging.

Problems of Capability

There is also the question of differentiated physical capability to deal with the problem. In view of the dimensional aspect of the problem, retreat is quasi-impossible in our subject areas, and provided aquifer supplies remain sustainable, the question of adaptation may be evoked. But the cost implications of such options, the scope of which has been given earlier, would be beyond the reach of most of the countries involved.

Differential Absorption Capacity

It should be noted that some of these areas already suffer from consequences of resource shortage and poverty. The capacity of many small islands and their economies to absorb the impacts of irreversible events is much smaller than in the case of larger areas. Some of these areas feature among the poorest countries in the world, and where the populations are barely surviving. In such conditions, there may not be awareness of the climate change phenomena. Even if there is such awareness, the issues do not warrant lasting interest on account of the immediacy of survival priorities.

Limited Responsibility for Build-up of Greenhouse Gases

The small ocean islands and the developing coastal states have had little to do with the processes that are causing an accelerated warming of the atmosphere. Their consumption patterns, since times immemorial, have been modest, often on survival lines, and have nothing to compare with the consumption patterns of the North.

Unequal Use of Global Commons

The atmosphere is an international public good into which other countries mainly from North America and Europe have emitted greenhouse gases and where small countries have made relatively low contributions. The *International Institute of Applied Systems* (IIASA) has prepared an extensive database of cumulative emissions dating back to 1800 on a regional breakdown. Their results suggest that North America accounts for about a third of contribution from fossil fuels, Europe over a quarter, and the former USSR 14%. The industrialised countries together account for 84% of the total. Within that perspective of cumulated historical emissions, actions to reduce the effects of climate change should be strengthened at the global level. Here we are referring to the need for reducing emissions within a shorter timeframe than is being proposed and the need for developed countries to adopt more sustainable life styles.

Differences in Wealth and Consumption

The welfare impacts of cutbacks in greenhouse gas emissions differ greatly according to personal wealth. Activities of the poor that result in emissions are those related to basic needs, for example, energy for cooking, agricultural activities and occasionally for travel by public transport. Emissions from the rich are dominated by use of private cars, central heating of excessively large buildings and use of a wide range of consumer goods.

Policy Instruments: Their Pace

The unquestioned commitment of the industrialised countries to ecological security is being seriously compromised by the slow pace with which they are introducing limitation measures on greenhouse gases. This speaks of little or no concern for the vulnerability of the small innocent and fragile nations, which have been at the receiving end of actions that, have “exhausted” the Global Commons.

Inter-Generational Issues

The bulk of the world population, as projected in the future, would occur in the developing world. Agenda 21, Chapter 17, suggests that up to three-quarters of the World’s population could be

living within 60 km of the shoreline by the year 2020. World Bank experts suggest that two-thirds of the population of developing countries (3.7 billion) is expected to be living along the coast by the end of this century. It is evident that the issues raised here would relate not only to the present populations, but also to the unborn generations of the areas we are discussing.

Physical Issues

The physical issues arising from the above review raise both proactive and reactive responses.

Need for Integrated Planning

The pervasive proactive policy option would be to adopt a highly integrated approach to development, bearing in mind the added vulnerability being brought about by climate considerations. This would include reviewing all areas of policy, ranging from basic sectors such as energy, water, and agriculture to activities like planning and siting as well as training and research.

Set of Complications

Climate change admittedly presents the decision maker with a set of formidable complications on account of the large uncertainties, the potential for irreversibility, long time lags between emissions and effects and wide regional variation. Irrespective of the possible consequences of climate change, policies that assist adaptation to climate change and have zero net costs are clearly justified. If the evidence suggests that damages can be expected from climate change, then the expectation of damages provides a rationale for going beyond no-regrets policies to those that incur positive costs.

Need for Awareness

A precondition for such a pervasive policy approach in small island countries would be the need to develop a comprehensive awareness of the risks of climate change. Small nations particularly many of those with “island culture” are focussed on internal concerns and under normal circumstance are unlikely to be moved by global commonalities, especially “non rangible ones” with a long

timeframe. Nations may well be conscious of climate change, but this would not necessarily propel them to action, unless they are sufficiently convinced that it was in their interest to act.

Need to Arouse Political Interest

Such a process would require an acute level of public awareness that would create a demand for political action, as well as a scientific effort that could address the critical issues in the debate.

Need for Review of Investment Decisions

Prevention of irreversible effects is the best policy, through careful monitoring research and planning. There is a need for national Governments to review and assess, as of now, all current major investment decisions in areas where sea level implications could be drastic. Other key areas where research should be focused could be the coral reefs and coral islands, coastal change, assessment of groundwater vulnerability, fish movement, port infrastructure and agriculture.

Need for Inter Generational Equity

The gap in life styles between developed and developing countries and the long term environmental impact that it would appear to be producing, with unequal effects on some countries as opposed to others raise the issue not only of generational equity, between the wealthy and the poor of the world but also issues of inter generational equity - how about the unborn generations? Policies should reflect the need to bridge the gap between lifestyles on a contemporary basis, but also across the generations so as to reduce the welfare impacts on future generations.

Need for International Cooperation

There is no escaping the conclusion that if the world is to reduce greenhouse gas emissions, all developing countries must be active participants in the process and to that end, a climate of solidarity based on social and economic considerations as well as differentiated responsibility for priority action, with developed countries taking the active lead, with concrete initiatives.

Developing countries need to be won to that cause. Although they also stand to be losers if they do not comply, they perceive, and rightly so, their immediate survival problems to be their immediate priority and that the GHG problem has to be resolved by the nations that were responsible for it.

Resource Transfers

Action by developing countries will require transfer of technology and financial resources from developed countries. Any evaluation of such action will need to consider the evolution of energy policy and planning in the developing countries. Any energy transition and major efficiency measure will require major resource transfers to deflect existing policy paths towards more environmentally acceptable options.

Emphasis on Precautionary Policies

A climate of solidarity will pave the way for the introducing precautionary policy measures such as energy conservation. Energy pricing may eventually play an important role in containing and reducing the problem.

“Recent World Bank studies show that getting energy prices right makes good economic as well as environmental sense.” (B. Larsen and A. Shah, Proceedings of the Tsekuba Workshop of IPCC WG III, p.34).

Avoidance of Environmental Colonialism

It is also important that any resource transfers effected in connection with Joint Implementation measures are not accompanied by an attitude of environmental colonialism.

Avoidance of Distortion of Existing Air Arrangements

The transfers associated with Joint Implementation in developing countries should not displace existing aid arrangements which, in the normal order of things, are helping to shape social and economic policies and move countries out of the survival stage. They should be seen clearly as arising

“from the mutual desire on the part of two equal partners to come to some agreement and without any sense of gift”. (T. Jones, OECD, Proceedings of the Tsukuba Workshop of IPCC WG III, p. 212)

In the same above-mentioned paper, Jones also speaks of the risks of cream-skimming by the developed country partner, who would “pick off” the cheapest abatement option, leaving the developing countries to pay a higher price later on when they begin to abate themselves.

Emphasis on Energy Efficient Technologies

It is essential that the significant development paths of the developing countries be steered towards more sustainable practices than presently possible with inefficient technology.

The developing countries should be given the opportunity to leapfrog into more energy efficient technologies, as a fundamental ingredient in the process of economic development (Goldemberg, Jose in the “Regions and Global Warming”, edited by Schmandt and Clarkson, 1992, Oxford University Press, 235 pp.).

If this is properly conducted, the growth and further development of the developing countries will become less of a threat to the future stabilisation of the atmospheric composition. The technical and financial resources must come from the developed countries.

Reactive Remedial Measures

Proactive measures may need to be supplemented by actual reactive remedial measures such as soft engineering options or hard options in areas where vulnerability has appeared to take an irreversible turn. Such remedial measures can be expensive and beyond the affordability and institutional capabilities of many small nations. This will call for international solidarity.

Conclusion

The Need for International Solidarity

Island nations live today in a threatened world. The threat to their survival stems from the wrongdoings of others. International

co-operation to address climate change in a fair, equitable and cost effective manner is essential. We hope that this message today will bring greater understanding of island issues arising out of climate change.

ENVIRONMENTAL CHANGE AND HEALTH: IMPLICATIONS FOR THE AUSTRALIAN DEFENCE FORCE AND REGIONAL SECURITY

Ms. Kathleen McCarron
Strategic Health Intelligence, Department of Defence,
Australia

There is growing scientific concern that the long-term impacts of climate change may represent the greatest environmental health risk to face humanity.⁵ A consensus is emerging on the potential direct and indirect implications for climate change for human health “despite the complexity surrounding its accurate assessment”⁶. Direct impacts involve the loss of life and illness from the increased frequency, severity and geographic extent of extreme climatic events, such as heatwaves and floods. Indirect impacts include changes in food supply and quality due to the disruption of agriculture and fisheries, the spread of infectious disease and the climate enforced mass migration of people. The present period of unprecedented ecological change and the growing economic and social crises that are driving vast movements of hosts are together contributing to the resurgence of old pests and the appearance of new ones. Important components in this rapid evolution are the vulnerabilities of ecosystems, the instabilities in climates and governments.

A fundamental national security obligation of governments is providing and assuring the safety and well being of their citizens. To the extent that authorities lapse in these duties, unmitigated health burdens will add to discontent, conflict, and desire for political change.

Today we will look at some selected health related issues that may go some way to developing the nexus between climate, disease,

5. McMichael AJ, Woodward AJ, van Leewen RE, *The Impacts of Energy Use in Industrialised Countries upon Global Population Health Medicine and Global Survival* (1994); 1: 23-32

6. McMichael AJ, Martens WJM, *The Health Impacts of Global Climate Change: Grappling with Scenarios, predictive models and multiple uncertainties*. *Ecosystem Health* (1995); 1: 23-33.

and instability – and the possible implications for the Australian Defence Force (ADF).

Good health has an intrinsic value: a healthy population is also a basic and renewable resource for economic development and is essential to increased national achievement and productivity. The character of climate and environmental change is global in its nature, human populations are vulnerable parts of the ecosystems and deterioration in the global environment will impact on the global human population – a significant resource. Deterioration of the health of the human population will also see a significant increase in the burden placed on health systems.

Leading climatologists have projected more frequent El Nino events, with greater variation in storm frequency, onset, intensity, and duration, accompanying a continued increase in greenhouse gases. Human diseases transmitted by vectors such as mosquitoes are spreading beyond traditional territories. Local seasonal variations of climate, and the Southern Oscillation Index (including El Nino) are now recognised as critical factors influencing outbreaks of most vector-transmitted diseases. The possibility that global warming will increase the range for vectors carrying infectious disease to areas beyond their present tropical and subtropical latitudes cannot be ruled out.

Climate change scenarios for Australia suggest conditions that would significantly increase arbovirus activity such as Ross River virus and Barmah Forest virus and Murray Valley Encephalitis. Vectors for dengue, yellow fever and malaria already exist in Australia; pessimistic scenarios suggest the (re)establishment of these diseases. The potential also exists for the introduction of viral haemorrhagic fevers and Japanese encephalitis with the immigration of human carriers. These diseases are not currently endemic in Australia, but could become significant issues if Australia receives large numbers of environmental or political refugees, displaced by climate change and sea level rise.⁷

7. Myers N, Kent J. *Environmental Exodus: An Emergent Crisis in the Global Arena*. Washington, DC: The Climate Institute (1995); McMichael AJ, Beers MY. *Climate Change and Human Population Health: Global and South Australian Perspectives* Transactions of the Royal Society of South Australia (1994); 118: 91-98.

Sudden climatic events have had significant impacts on populations in remote areas living in marginal environments as has occurred in 1998 with famine in Irian Jaya and the drought and subsequent famine in Papua New Guinea. This year has seen the ADF involved in combined operations with the PNGDF in famine relief in PNG and is currently involved in a combined operation with the Indonesian Armed Forces in Irian Jaya providing famine relief in remote areas where the current El Nino and severe frost wiped out food supplies.

The availability of fresh-water resources varies widely; many areas of the world are semi-arid, with highly variable rainfall and recurrent droughts. In some parts of central Africa, the rainfall is not only unreliable but is less now than it was 30 years ago. In Asia, water supply per capita is less than half the global average, and that continent's water run-off is the least stable and unpredictable as a source of water of all the major landmasses. In Africa, there is less run-off than the global average, but the main problem is the underdevelopment of water resources in relation to the needs and potential. Overall it appears that about 50 developing countries are approaching a situation of severe scarcity of water.

The amount of water on the planet is finite, with predicted population increases and inefficient use of water the situation is likely to deteriorate. The World Bank has predicted that wars of the 21st Century will be fought over access to water. Countries such as Iraq, Iran and Egypt, Turkey, China, Korea and the sub-continent are all troubled by shared access to regional river systems. To illustrate this point Turkey has dammed the upper reaches Tigris/Euphrates river system, which supplies nearly 90 percent of Iraq's water. Iraq has openly indicated that it is prepared to mobilise armed forces over the supply of water.

Water is likely to become scarcer in the future. Major Asian cities in particular are likely to suffer as the underground water diminishes and the situation is unlikely to improve in the short to medium term. Contaminated ground water will increase the exposure of personnel to toxins and serious water-borne disease. Epidemics of diarrhoeal disease will become more frequent and extensive. Current levels of pollution are unlikely to improve in the short to medium term.

Water resources can no longer be taken for granted and the ADF will need to consider water availability in addition to quality when deploying on operations to some areas.

Relatively new diseases with the potential to claim millions of lives are spreading out of the damage caused by humanities incursions into new environments. Deforestation, uncontrolled urban growth, poor irrigation, expanding agriculture and modern air transport are all aiding the development of these new diseases and their spread.

Some of the viruses emerging from the world's rainforests are highly infectious and lethal. Ebola for instance has up to an 88% fatality rate.

In June 1996 the United States Government identified emerging infectious diseases as a national security issue. In response the National Science and Technology Council (NSTC-7) and the Committee on International Science, Engineering, and Technology (CISET) developed a public health policy to address the substantial issues of emerging infectious diseases.

In 1800, 1.7% of the world's population lived in urban communities. By 1970, 33% lived in urban communities and this percentage is expected to rise to 50% by 2010. Increased urbanisation, uncontrolled migration and rapid population growth in many poor countries have assisted in creating suitable environmental conditions for serious diseases that thrive under conditions of overcrowding, inadequate sanitation, poor water supply and inadequate health infrastructure.

In 1992, the National Health and Medical Research Council (NHMRC) published a book called "Ecologically Sustainable Development - the Health Perspective"⁸ in which it is noted that human health is dependent on the health of ecosystems, at both the local and global level. The NHMR said the "human activities are, at present, causing irreversible ecological damage" But, it said, the problems are very complex. Human health is after all a product of biology, environment, life-style and health care service. A person's health may be improved by city living because of better health-care

8. NHMCR *Ecologically Sustainable Development - The Health Perspective* June 1992

services, but made worse by air pollution. In cities in many developing countries, growing faster than governments can provide adequate services, lack of water and sanitation and crowded conditions which increase the spread of disease, will more than off-set any advantages from access to medical services. Cholera resurfaces when sewerage systems collapse. It reappeared in the Americas in 1991, Eastern Europe in 1995 and in parts of South East Asia in 1997.

In addition to poverty and environmental damage we have social chaos. In *The Coming Anarchy*⁹, Robert D. Kaplan describes how resource scarcity, crime, overpopulation, tribalism and disease are destroying the social and environmental fabric of our planet. He describes the anarchy that is already occurring in West African states where Kaplan lived for a number of years. Loose family structures are largely responsible, he says, for the world's highest birth rates and the explosion of HIV on the continent. They provide a weak shield against the corrosive effect of life in the cities. Desertification and deforestation (also tied to overpopulation) are said to be driving more and more Africans out of the countryside. A classic and extreme example of resource scarcity, environmental degradation, overpopulation and disease was the civil war in Rwanda. The civil war was attributed to the animosity between the Tutsis and the Hutus – land degradation and resource scarcity is said to have prompted/exacerbated the conflict. Political instability and disease often reinforce one another. Disease heightened political competition among ethnic rivals during the Rwandan crisis.

With rapid population growth, industrialisation, integrated markets, international travel and environmental changes, new patterns of interactions between man and reservoirs of disease causing microorganisms will instigate opportunities for rogue pathogens to affect regional stability. The 1994 plague outbreak in India, for example, had an impact far beyond its epidemiological boundaries. The ensuing panic resulted in the abrupt shutdown of major industries, including aviation, exports, and tourism, as stigmatisation of products fanned irrational fears of contamination.

9. Kaplan, Robert D. "The Coming Anarchy" *The Atlantic Monthly* v. 273(2) February 1994: 44-76

The outbreak cost India's economy an estimated \$US2 billion.¹⁰

To sustain health requires dedication of systems for delivery of services and treatment. Adequate medical infrastructure with trained professionals, facilities, and financing requires a stable political environment to provide both resources and public support. When economies and governments fail, or are chronically enfeebled, health systems rapidly falter, leaving populations more prone to illness and weakening by economic, environmental disasters and social instability.

Accelerated rates of infectious diseases such as diphtheria, measles, AIDS, tuberculosis, and vector borne diseases can be expected in regions where health infrastructure degradation has and will occur. Access to clean water and adequate sanitation will be compromised and the impact of environmental degradation and rapid population growth will be exacerbated by inadequate health infrastructures. ADF personnel involved in operations where serious infrastructure degradation has occurred will be at an increased risk of a range of environmental and disease threats.

Environmental changes over the next decade and the consequences for regional population health are likely to affect the ADF in a number of ways:

a. The reality of global interdependency subjects Australia to the repercussions of disorder from distant quarters, whilst conducting operations within Australia and overseas, ADF personnel will be exposed to increased risks of sustaining Disease Non-Battle Injuries (DNBI) primarily as a result of exposure to emerging and reemerging disease – some of these will be linked to environmental change.

b. Longer-term climate change is likely to alter the nature of the health threat. Issues such as food and water supply and quality may become prominent. As depletion of the ozone layer progresses, and cloud density and precipitation decrease, increases in skin cancer and ocular damage due to increased exposure to ultraviolet radiation have been predicted.

10. India Today October 31 1994/Chow J. "Health and International Security" *The Washington Quarterly* 19:2 pp. 63-77

c. Countries that are unable to sustain dedicated systems of health care required to maintain a stable health population (due to political, economic, social instability) is at a greater risk of suffering serious consequences as a result of environmental developments and sudden climatic changes.

d. The impact of climate on vector transmitted diseases could be significant to Australia where it there would be a considerable burden placed on the Australian health infrastructure.

TAKE VIGOROUS ACTION IN THE CHALLENGE OF GREENHOUSE EFFECT

Speech by the Delegate from People's Liberation Army, China

Ladies and Gentlemen,

As the Chinese People's Liberation Army (PLA) representatives engaged in environmental protection, we feel very honored to attend this conference. And we are very glad to get together with friends on such an occasion. I'll now give a brief introduction about our actions in the face of the challenge of greenhouse effect.

The climate disaster has become more serious because of a large number greenhouse gas emission since industrial revolution. This leads to international attention like other environmental issues. During the Environment and Development Conference of the United Nations in June 1992, key leaders signed the *United Nations Framework Convention on Climate Change* (UNFCCC). And the convention went into effect regularly in March 1994. There are various reasons for the global climate change, but the primary reason is the emission large amounts of greenhouse gases (e.g. carbon dioxide, etc.) The large amounts of gases come from the developed countries over consuming the fossil fuel over a long period of time. The UNFCCC provides that, on the one hand the developed countries must reduce the emission of greenhouse gases, and on the other hand, they should carry out commitments to supply the developing countries with funds and technologies in order to strengthen the developing countries' ability to deal with the climate change.

China is a developing country, whose discharge amount of carbon dioxide per capita is very low. It is 0.64 tons-carbon in 1995, which is less than 60 percent of the global discharge amount per capita and only about one fifth of that of the main developed countries. According to the UNFCCC rule, the developing countries are not required to reduce emission. However, the Chinese government has always attached great importance to environmental protection and considered it as a basic national policy. China pays attention to the global environmental issues and undertakes the obligations actively which should be suited to its ability and position.

In order to protect the environment of mankind, China has firmly carried out the sustainable development strategy beneficial to the climate protection during the development of the national economy. We have taken a series of measures to fulfill the situation with great efforts that the economic development and the climate protection should coordinate and promote each other, and have made great contributions in protecting the global climate.

The Chinese PLA is an important force not only for peacekeeping, but also for peace building and ecological environment protection. Facing the challenge that the global climate becomes warmer because of the greenhouse effect, the Chinese PLA, in spite of its limited military expenditure and limited technologies, has tried its best for more than 20 years to make contributions to reduce the emission of greenhouse gases and create more conditions to absorb greenhouse gases. Positive actions taken are as follows:

(1) To strengthen the environment protection education and enhance environmental consciousness of the population. To increase the knowledge of environmental protection including that of the greenhouse effect, is one of the main contents of the environmental protection education of the Chinese PLA. Every year, units adopt various forms to carry on environmental education and enhance the consciousness of the population. This facilitates the continuous development of environmental protection.

(2) Formulate the environmental legislation and protect the climate according to law. The Chinese PLA firmly carries out the basic national policy of environmental protection and abide by a series of environmental legislation's including the energy legislation published by the Government. At the same time, the regulations for climate protection have clearly been defined by the Routine Service Regulations, the Environmental Protection Regulations, and the Afforestation Regulations of the Chinese PLA. In order to reduce the industrial pollution from the factories, the Chinese PLA has formulated some Environmental Protection Management Measures for its factories and enterprises. The establishment and improvement of the rules and regulations for environmental protection of the Chinese PLA ensure the climate protection work to be in progress efficiently and steadily.

(3) Improve energy structure and reduce energy consumption. The Chinese PLA pays great attention to energy-saving. The military regions, arms and services of Chinese PLA have set up the energy-saving technical guiding groups or offices, organizing and directing the troop units to carry on the energy-saving and fuel pollutant reduction activities. From 1991 to 1995, the Chinese PLA has accomplished the central heating of more than 6 million square meters, reduced more than 1500 coal burning boilers and 750 thousand tons of coal. The heating system of hundreds of dining rooms and 100 thousand military households have changed from burning the coal to burning the coal gas or natural gas. At some places where conditions permit, the troop units make use of the favorable factors, such as surplus energy, geothermal energy, wind power and solar energy, to reduce the coal consumption more than 390 thousand tons. Just in 1997, the whole army spread more than 700 thousand energy-saving implements of various kinds and saved about 300 thousand tons of coal and more than 30 million kilowatt-hour electricity. With the above-mentioned measures adopted, a great deal of carbon dioxide emission has been reduced.

(4) Attach great importance to tree-planting for afforestation and protecting forest-vegetation. Since the beginning of the nineteen eighties, the Chinese PLA began to afforest and plant flowers and grasses year after year. The number of trees planted adds up to 199 million in the camping ground. The afforestation area is about 140 thousand hectares in military land. This makes the military-controlled forest area more than 270 thousand hectares. At the same time, the Chinese PLA takes an active part in the national-priority afforestation projects, such as the Three-North Shelter Forest, the shelter forest of middle and upper reaches of Yang-zi River, coastal shelter forest, and so on. And the stationed troop units will take part in the tree-planting in the towns and countryside nearby. We support the local community to plant trees totalling 237 million. The air force helps to afforest about 5 million hectares by aerial sowing. The troop units stationed in the forested areas join the fire-fighters in putting out the many forest fires. Great contributions are made by the PLA in the protection of the valuable national forest resources. On the basis of calculation, the PLA's achievements of afforestation and forest protection make the new increasing absorption capacity of carbon dioxide approximately 5 million tons per day.

The Chinese PLA will, as always, firmly deal with the challenge of climate change. We welcome the environmental exchange and cooperation with foreign armed forces, we will try to do more to slow down the climate warming process. It is indisputable that the Chinese PLA has limited ability to deal with the climate change, especially due to the large financial input. Compared with environmental technologies and equipment of the developed countries and their armed forces, the Chinese PLA still has a long way to go. In the face of the challenge of greenhouse effect, “our ability falls short of our wishes”, as a Chinese proverb goes.

We are at the age of [this] century’s alternation. We live in the same celestial body and we would like to share the blue sky. For the sake of our common future, let’s try our best efforts to protect the living space of mankind.

DISCUSSION

The global climate change workshop was attended by individuals representing a range of countries, including several states which are among the most likely to suffer the negative effects of climate change. The participants agreed that global warming presents a major, long-term environmental threat to regional stability and security. It was suggested that the significance of the threat represented by the impact of climate change is comparable to other more traditional security concerns. Measures undertaken at both the level of mitigation and response, the nature being both proactive and reactive, are required to deal with the problems associated with climate change.

Environmental Issues and Challenges

1. Economic and social insecurity

The workshop participants emphasized the impact of climate change on socio-economic factors. The major security threats presented by climate change arise from its potential to undermine economic and societal security, often in regions which are already environmentally and economically vulnerable. These areas include not only small island states, but also mainland countries whose populations are heavily concentrated in coastal areas. Economic welfare, particularly in developing countries, is often closely tied to sectors such as tourism, agriculture and fisheries, which are susceptible to the effects of climate change, such as sea level rise and changing weather patterns and climate zones.

For example, tourism and tourist-related infrastructure are usually concentrated in coastal areas, which may be inundated by a rising sea or damaged by typhoons, cyclones and other extreme weather phenomena which are expected to increase as a result of global warming. Loss of income from tourism may be only one example of a broader flight of foreign investment from areas whose economic and social stability is perceived to be under threat in the longer term. The representative from the Maldives illustrated the severity of this problem; investments in tourism have already been lost following the flooding of hotels at sea level.

Changes in climate zones and seasonal weather patterns will affect the viability of current forms of agriculture. This may be particularly deleterious in areas which are reliant on few crop varieties, which may not adapt well to such weather changes, and where alternative crops are not readily transplantable. Examples may include the effect of the current El Nino phenomenon on Papua New Guinea's sweet potato crops, upon which it relies for the survival of the local population, and Kiribati, where soil quality is already very poor. Agriculture may also be increasingly threatened by the changing impact of pests as a result of climate change. Desertification and the inundation of coastal crops and inland waterways might exacerbate these effects.

Changing ocean current temperatures and currents are likely to affect the location and migratory patterns of fish stocks, which are a major source of protein in the region, as well as being crucial to the economic vitality of many regional countries. This is likely to compound the existing effects of overfishing.

Sea level rise and changing weather patterns will exacerbate the effects of population pressures on freshwater availability, for example when freshwater aquifers are contaminated by seawater particularly in small island countries.

Global warming may be characterised as presenting a threat to human security to the extent that it affects individual and community health and well-being.

2. Changing strategic relativities

Workshop participants suggested that climate change has a political dimension, thereby affecting strategic relativities in the region. For example states which have suffered the socio-economic effects suggested above may be more vulnerable to third party intervention or exploitation. Further, sea level rise may have a significant impact on the baselines from which Exclusive Economic Zones (EEZ) and territorial seas are measured, adding a new element of instability to existing tensions between states over competing maritime boundaries and access to maritime resources. In some cases small island countries may disappear entirely or to the extent that the viability of the nation is seriously threatened.

3. Increased frequency of extreme events in weather patterns

Participants made reference to predictions that one of the impacts of global warming will be an increase in the frequency and intensity of extreme weather events such as cyclones, typhoons, droughts and floods. These impacts may be compounded by the prolonged El Nino phenomenon the effects of which have recently been experienced in the pacific region. These events will be particularly catastrophic in areas where the results are either unusual or unprecedented, and where prediction and response infrastructure is weak or non-existent. The challenge of planning and preparing for them is increased by the complexities and difficulties associated with prediction at a global and regional level.

4. Environmental refugees and mass movements of population

A likely security impact of climate change in the next century will be the voluntary and involuntary movements of people, both within states and across state borders. The economic, social, and biophysical effects of climate change may prompt these migrations, which in various ways result in the reduction or loss of livelihood or opportunity. This may occur as a result of natural disasters in the short-term, or from the cumulative environmental impact of climate change in the longer term. The local effects of climate change may exacerbate existing social and political tensions, which may be another causal factor in population movement. In addition, mass population movements may contribute to competition for scarce resources within countries and for inter-state tensions where refugees cross borders.

The participant from the Marshall Islands pointed out that young island inhabitants are progressively leaving due to the risk of storm surges. As a result of people progressively leaving, these islands are likely to be left with an increasingly ageing population; this “brain drain” is likely to have a negative social and economic impact on this and other areas.

5. The challenge of preventing climate change

The need to address the problems of climate change at its source is equally important to responding to the effects of climate change once they have occurred. However, it was also recognised that due to the cumulative nature of climate change and the time-lag effect, action undertaken in the present will not prevent the security effects

of climate change from manifesting themselves, particularly in vulnerable countries.

Opportunities for Defence Cooperation

The participants in the Global Climate Change workshop recommended an enhanced leadership role for defence forces in some form of regional arrangement. Those representing small islands in the Asia Pacific region overwhelmingly favoured gaining the benefit of larger states' experience through information sharing and capacity building. Specifically, it is recommended that contingency planning for the management of climate change-related disasters be supported by experienced defence forces.

1. Regional arrangements

The suggestion of developing regional partnerships is closely linked with the sharing of capabilities and the exchange of information. This type of arrangement has many possibilities that may assist in offsetting the negative effects of climate change.

The group also agreed that defence departments should be encouraged to participate on multilateral scientific groups such as the *Intergovernmental Panel on Climate Change* (IPCC), where abatement issues are addressed. Defence cooperation should be encouraged through this type of representation.

Similarly, developed countries in general, and their defence departments in particular, should encourage the participation of developing countries at these forums through financial support. The reasoning was that developed countries are large energy consumers themselves, and in many cases possess a higher degree of expertise in environmental matters than in developing countries.

2. Capacity building

Information exchange, technical assistance, and assistance in the development of response strategies may be subsumed under the topic of capacity building. The consensus among workshop participants was that the most effective way to deal both proactively and reactively with the negative impacts of climate change is to help those nations which lack the capacity to help themselves.

This could be achieved through such activities as the involvement of defence forces in training local volunteers for disaster relief operations.

Defence forces with clear environmental management systems could assist those which lack similar experience in developing capabilities for the abatement of their own greenhouse gas emissions. Information on what defence forces can do to reduce their energy consumption and improve climate change mitigation practices could be shared and exchanged through the Internet.

3. Contingency planning

Another important factor in capacity building is contingency planning for disaster situations. It is recommended that these activities take place at the bilateral, trilateral, or regional level. An arrangement which facilitates the sharing of information gained from defence cooperation-related experience, particularly in the sense of “lessons learned”, could be beneficial.

Contingency planning should involve preparing for “worst case” scenarios. This requires an identification of areas that are particularly vulnerable. This could involve the development of a map of high risk areas. Relevant, quantifiable data in terms of meteorological information and satellite imaging toward predicting the effects of for example, climate change, fish stocks, and vegetation patterns would be a requirement for the success of contingency planning. Defence departments may be able to use their own resources to fill the information gap. While the data for this purpose could come from the defence agency, action should be taken at a national level.

Defence may similarly not perform the role of the lead agency but may be able to provide support to non-governmental organizations, contractors and others who are assisting the government in its contingency planning activities.

4. Regional coordination

Contingency plans and exercises which deal with potential hot spots should be coordinated on a regional basis. Specifically, experienced countries such as Australia, Canada and the United States should coordinate plans to deal with vulnerable countries and areas in the region.

The distinctive roles of and areas for cooperation among local governments, defence forces, and non-governmental organizations (NGOs) should be established prior to a disaster or complex emergency. Solutions require the development of partnerships, whether bilateral, multilateral, such as military to military, military to NGO where capacities and capabilities may be shared and enhanced throughout the region.

5. Preventive defence

The projected impact of climate change (such as the effects of sea level rise on baselines) should be incorporated into existing systems of risk assessment.

Flashpoints should be identified ahead of time through meteorological information, satellite imaging and other early warning measures, and where possible, these problem areas should be addressed proactively. The participants believed that all things being equal, it is less costly to deal with problems in a preventive manner prior to resorting to costly military intervention after the fact.

Experienced countries should advise regional partners on taking measures which will effectively prevent them from having to exercise their more traditional conflict-related roles.

CHAPTER V

PLENARY SESSION III – FISHERIES AND MARINE PROTECTION

This topic will address land and water quality management in the catchment, reef and inshore waters. It will focus on those issues that affect the quality of water, which in turn have a significant impact on conservation of fish stocks.

For example, coral reefs are linked to other habitats such as mangroves and seagrass meadows not only by geography but more importantly, these three distinct habitats provide shelter and food to many of the same species that often migrate between these habitats as they grow and feed. Mangroves and seagrass habitats are nursery grounds for many of the fishes and invertebrates we see as adults on coral reefs. In addition, coral helps maintain natural landscapes for realistic military training, now and in the future.

Coastal and marine environments enhance quality of life and are important economic resources for fisheries, eco-tourism, potential resource of new medicines, and water sports recreation. Protecting these environments contributes to national security by helping to maintain these natural resources, especially fisheries, upon which a country may depend. Physically protecting shorelines from erosion and wave damage, or ocean dumping, or contaminated runoff from the shore is critical to protecting these areas. Construction of marine facilities not only has the potential to disrupt natural environmental processes such as water movement, deposition of silts and the transport of nutrients; but also, the ecosystem balance.

This session will include issues related to biodiversity; sustainable usage (swimming, fishing, boating, water supply, etc.) of coastal waters; and the effects of vessels transiting these areas and discharge of bilge and ballast water. There are a number of international treaties that are applicable to this topic, including MARPOL, which address the dumping of waste at sea.

Questions

- What are the national security implications of fisheries and marine protection?
- Does the military have a role in controlling over-fishing?
- What is that role? (i.e. policing waters, etc.)
- Does the military have a role in monitoring ocean dumping?
Or protecting coral reefs?
- Does the military have a role in monitoring or responding to ocean spills?
- What is the impact of technology (eg GPS and Fish Finders) on over-fishing?
- What can the military do to protect the marine environment?
- What can the military do to protect the marine environment during training exercises; construction and dredging operations; or waste (garbage and hazardous waste) management operations?

Introductory Remarks

Tony Downs, Director General Environment at Canada's Department of National Defence, welcomed the participants to the workshop's third plenary session on the topic of *Fisheries and Marine Protection*. Mr. Downs suggested that while only two speakers would be presenting papers on the topic during the session, their remarks would undoubtedly challenge the group to consider the importance of the issues that would be raised, particularly in terms of the South Pacific region.

Mr. Downs began his introductory remarks by stating that the issue of the health of the fisheries is important in all our economies. The protection of the marine environment from contamination from land and sea sources is truly an international concern since it impacts on the economies of so many nations. Such protection may include limits on catches to preserve the economic viability of certain or all species.

The Pacific Region has a variety of marine environments from coral reefs to mangrove swamps, and many of these habitats are linked to health and sustainability. Mr. Downs suggested that we probably still do not know all the mechanisms at play in these links.

Problems can arise from construction and operation of coastal facilities, over-fishing, ocean dumping of improper materials, direct pollution from ships, industries, runoff, and shoreline erosion, to name but a few. Militaries of the world can be a significant part of the problem and therefore can be a significant part of the solution. The military is engaged in activities that potentially cause all those problems; for this reason policies and operating procedures that minimize any impact that they may have should be put in place by defence departments. Once accomplished, regional militaries are in a position to demonstrate leadership by example and put their resources towards helping to prevent the aforementioned problems from occurring, or at least reduce their impact.

Armed Forces are also in position to do the will of their governments in monitoring the fishery and ultimately, enforcing national and international treaties and regulations concerning conservation.

Mr. Downs suggested questions to be explored during the workshop and after, whether individually, bilaterally or multilaterally, through defence co-operations and other avenues. These areas to be considered include the national security implications of fisheries and marine protection; the military's impact and role in reducing these adverse impacts while enhancing positive impacts; and the military's role in any of the potential problem areas.

Mr. Downs then turned to Canada, a country with an extensive coastline and an abiding interest in fisheries and in the protection of the marine environment. He explained that Canada's fisheries act is very strict and comprehensive in protecting the fish habitat from deleterious substances.

In particular, the Canadian Department of National Defence pays strict attention to waste discharges. Although the dumping of toxic waste is illegal, the ocean is still used as a sewage receiver in many communities. The Canadian Armed Forces work with communities to improve harbour and coastal water quality.

Mr. Downs pointed out that it is widely known that Canada has had to ban fishing of all species on its East Coast. He explained that the fish stocks became depleted due to overfishing as a result of new technology associated with factory ships and new nets, and an overly slow reaction to setting and enforcing new quotas. The ban has had a devastating impact on the economy of the East Coast. It has also had an impact on other countries' economies since they cannot fish within the 200-mile limit controlled by Canada. A major international incident occurred in connection with the ban when Canadian Fisheries vessels fired on and arrested a Spanish trawler for fishing illegally for turbot.

The Canadian position was supported by the fact that the Government had adopted legislation that set limits on the fishing of one of the few commercially viable species even outside its 200-Mile Limit in order to preserve the species. Spain's position was that Canada had committed an act of piracy. While the issue was a diplomatic one, there was a great deal of hostility, with naval posturing on both sides and demonstrations in both Canada and Spain as well as in other countries supporting each of the parties. The incident did force a re-negotiation of fishing quotas in the area in question and the resulting agreement included provisions for stronger

enforcement and better gear and catch verifications. The terms of the agreement should prevent the collapse of the turbot fishery off the Grand Banks. In addition, the incident hastened the negotiations on the 1995 Convention on Straddling and Highly Migratory Stocks.

More recently a disagreement arose between the United States and Canada over salmon fishing stock on Canada's West Coast near the Alaskan border. The size of the salmon stocks and catch limits for each nation became a very public bilateral issue. Canadian fisherman illegally blockaded an American coastal ferry to make their point. No military or police action was taken on that incident which resulted in further diplomatic criticism. Negotiations broke off several times. The military was involved indirectly at one point, in that a Canadian Provincial Premier threatened to cease US and Canadian naval torpedo testing in an area of provincial jurisdiction in order to put pressure on the US to sit at the bargaining table. Other forms of pressure, relating to other bilateral agreements and issues, were applied by both sides. There was a visible escalation of the dispute with time and emotion until the parties sat down to try to resolve the issue.

Mr. Downs concluded his remarks by suggesting that each participant has a deep interest in the topic and that the session's speakers would certainly shed more light on the subject.

REGIONAL SUPPORT FOR INTEGRATING ENVIRONMENT AND DEVELOPMENT OBJECTIVES AND IMPROVING SECURITY IN THE PACIFIC: AN EXAMPLE OF FISHERIES MANAGEMENT

Mr. Gerald Miles
South Pacific Regional Environmental Program

1. Introduction

This paper assumes that by deriving environmental benefits through improved management of natural resources, potential environmental threats to the security can be reduced. This is assumed true for external threats such as climate change as well as those generated in the region from over-exploitation of resources. As island governments in the region undertake public sector reforms and structural adjustment programmes as part of their efforts to promote employment and economic growth, it is very timely to consider what mechanisms exist for promoting the integration of sound environmental advice with macroeconomic decisions and thereby deriving benefits for regional security.

Ensuring environmentally sound management of resources in the Pacific has received increased attention in the last decade. There is also increasing recognition that, while development in the Pacific still follows a strong sector-based approach, competition for resources between sectors requires a more integrated or coordinated approach. Considerable discussion of these issues has been facilitated by existing regional institutions that provide an important framework for both capacity building and collective action. The most recent manifestation of this need to effectively integrate environmental and development objective across the different economic sectors is the development of a Strategic Action Program (SAP) for International Waters. It provides a framework for considering how development activities, including fisheries, affect oceanic coastal waters in the region. The SAP provides a useful analysis of the root causes of environmental degradation in Pacific waters, clearly links action in the region to global benefits and

highlights the security implications of poor environmental management.

This paper presents a summary of the SAP as an example of a useful integrating framework. The example of fisheries in the Pacific is used to demonstrate links between resource use, the environment and security issues as well as to highlight the role of existing regional mechanisms in managing the resource base. The following material has been selectively extracted from the Project Brief for the Implementation of the SAP and supporting reviews prepared for the South Pacific Regional Environment Programme (SPREP). Specific comments are presented in *italics*.

2. The Strategic action program¹

The Strategic Action Programme (SAP) for International Waters of the Pacific Islands Region was initiated and developed by the thirteen Pacific Island States participating in the work of the Global Environment Facility (GEF). It represents a pioneering effort by a group of small island developing states (SIDS) to integrate national and regional sustainable development priorities with shared global environmental concerns for protecting International Waters.

The SAP has built on considerable national and regional work related to International Waters.² A Regional Task Force (RTF) oversaw preparation of the SAP. It was composed of country representatives, members from regional organisations and the three GEF Implementing Agencies, two non-government and one private sector representative. National consultations that produced country reports and targeted project proposals, along with regional reviews provided the raw material for the SAP that was subsequently

-
1. The following text is drawn from SPREP/UNDP (1998) Project Brief for the Implementation of the SAP. UNDP. Unpublished.
 2. Reports of the National Consultations, the State of the Environment (SOE) Report or National Environmental Management Strategy (NEMS) for each country, the Action Plan for Managing the Environment of the South Pacific Region 1997-2000, the Draft Regional Strategy for Development Priorities of the Forum Island Countries, the Action Strategy for Nature Conservation in the South Pacific Region 1994-1998, the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, the Report to the United Nations Commission on Sustainable Development (UNCSD) on Activities to Implement the Barbados Programme of Action in the Pacific Region (1996) and the 1992 Report to the United Nations Conference on Environment and Development (UNCED) in The Pacific Way

endorsed by the Heads of Government of the South Pacific Forum at their twenty-eighth meeting in Rarotonga on 15-19 September 1997.

A. Defining International Waters

In terms of the GEF, International Waters include oceans, large marine ecosystems, enclosed or semi-enclosed seas and estuaries as well as rivers, lakes, groundwater systems, and wetlands with transboundary drainage basins or common borders. The water-related ecosystems and critical habitats associated with these waters are integral parts of the system. International Waters extend far inland and far out to sea. This is because the global hydrological cycle links watersheds, airsheds, estuaries, and coastal and marine waters through transboundary movement of water, pollutants and living resources.

This definition of International Waters fits precisely the reality of the Pacific Islands. Although separated by vast distances, these islands are linked and controlled by the vast marine environment. The land to sea ratio is generally so small that Pacific islands are wholly coastal in character. The importance of the health of International Waters to the islands cannot be overstated.

B. Transboundary Environmental Concerns

Work undertaken during the SAP process resulted in the identification of three priority transboundary concerns related to International Waters: Degradation of their quality; degradation of their associated critical habitats; and unsustainable use of their living and nonliving resources. These concerns are inextricably linked by their causes and by the cumulative, mutually exacerbating effects of these causes.

C. Imminent Threats

International Waters in the Pacific region are subject to a number of threats giving rise to transboundary concerns. The threats were examined from the perspective of critical species, their habitats, and living and non-living marine resources. Priority was given to those transboundary concerns that arise from the following imminent threats to the health of those waters. The priority concerns include:

1. Pollution of marine and freshwater (including groundwater) from land-based activities
2. Issues related to the long term sustainable use of marine and freshwater resources
3. Physical, ecological and hydrological modification of critical habitats
4. Unsustainable exploitation of living and nonliving resources, particularly, although not exclusively, the unsustainable and/or inefficient exploitation of coastal and ocean fishery resources.

Each imminent threat affects each transboundary concern. The linkages between the imminent threats to and the transboundary concerns for International Waters require integrated measures to address the concerns effectively.

D. Root Causes

The root causes were examined in their legal, institutional, socio-economic and environmental context. The ultimate root cause underlying the imminent threats has been identified as deficiencies in management. The factors contributing to the management root cause can be grouped into two linked subsets: a) governance and b) understanding. The governance subset is characterised by the need for mechanisms to integrate environmental concerns, development planning, and decision-making. The understanding subset is characterised by the need to achieve island-wide ecosystem awareness through improved education and participation. This island wide awareness and participation will help make possible the development and implementation of measures to protect International Waters.

E. Information Gaps

The SAP analysis revealed a set of information gaps relevant in particular to decision-makers (as opposed to researchers) who must address ultimate root causes and respond to imminent threats. Particularly important is the lack of strategic information presented in an appropriate manner to decision-makers, resource users, managers and communities to evaluate costs and benefits of, and to

decide among, alternative activities. Improving information input and exchange at the regional, national, and community levels is an objective of this SAP.

F. Proposed Actions

Actions to address the root causes of degradation of International Waters will be taken through regionally consistent, country-driven targeted actions that integrate development and environment needs. These actions are designed to encourage comprehensive, cross-sectoral, ecosystem-based approaches to mitigate and prevent imminent threats to International Waters. The SAP provides the regional framework within which actions are identified, developed and implemented. Targeted actions will be carried out in two complementary, linked consultative contexts: Integrated Coastal and Watershed Management (ICWM) and Oceanic Fisheries Management (OFM). Through the ICWM and OFM approaches, the SAP sets out a path for the transition of Pacific islands from sectoral to integrated management of International Waters as a whole, which is essential for their protection over the long term.

Management in these two contexts will necessarily include three other pressing concerns in sustainable development planning, namely: biodiversity, vulnerability to climate change and land degradation. These are GEF focal and cross-cutting areas, and the remaining three of the seven major issues identified in the Barbados Programme of Action for the Sustainable Development of SIDS as common to most islands. The other three major small island issues from the Barbados Programme have already been addressed above, and the seventh, tourism, can only be effectively dealt with in this type of framework for national sustainable development. The SAP also meets the objectives of the GEF operational programme entitled “Integrated Land and Water Multiple Focal Area,” to which International Waters projects addressing the needs and special conditions of small islands are assigned by GEF. Consequently, the SAP is expected to involve and build upon the complementary skills and experience available from organizations and groups active in our region.

The region receives much development assistance from a variety of donors for a wide range of projects. The SAP will be taken into

account in discussions with donors to plan and coordinate regional and national development assistance for International Waters in order to address imminent threats and their root causes more effectively. The SAP will facilitate the choice and design of high priority interventions, remove duplication, and ensure that projects do not work at cross-purposes. Funding from GEF *per se* can only support a small proportion of such interventions, hence the importance of the SAP to organize and leverage additional assistance in order to receive maximum benefit from available funds. The SAP is designed to comply with the requirements of GEF, but also, and perhaps more importantly, to be a framework for overall national and regional planning and assistance for the management of International Waters.

The SAP complies with the legal framework for regional cooperation and related obligations established by the regional Conventions, the UN Convention on Law of the Sea, the Convention on Biological Diversity, the Framework Convention on Climate Change and other international conventions within which the Pacific Island countries identify common issues and coordinate national approaches to address those issues. Application of ICWM and OFM approaches will facilitate further joint action between sectors nationally and between governments regionally. As experience with ICWM and OFM grows, this SAP will also evolve, reflecting the increased knowledge of and changing conditions in the environment of our islands. To ensure that the SAP remains a living, evolving and useful instrument for sustainable development, and to assess and apply lessons learned from its implementation, the SAP will be reviewed every five years.

G. Priorities for Action

All sustainable development issues related to International Waters in this SAP cannot be addressed at once. Therefore four high priority areas have been identified for immediate intervention: improved waste management, better water quality, sustainable fisheries and effective marine protected areas.

Targeted action within these activity areas is proposed in five categories: management, capacity-building, awareness/education, research/information for decision-making, and investment.

Institutional strengthening is included under management and capacity-building. The analytical framework within which proposals for assistance should be evaluated under the SAP is set out below.

Goal of the SAP: Integrated sustainable development and management of International Waters

Priority Concerns:	Degradation of water quality Degradation of associated critical habitats Unsustainable use of resources
Imminent Threats:	Pollution from land-based activities Modification of critical habitats Unsustainable exploitation of resources
Ultimate Root Causes:	Management deficiencies a) governance b) understanding
Solutions:	Integrated Coastal and Watershed Management Oceanic Fisheries Management
ICWM Activity Areas:	- improved waste management - better water quality - sustainable fisheries - effective marine protected areas
OFM Activity Areas:	- sustainable ocean fisheries - improved national and regional management capability - stock and by-catch monitoring and research - enhanced national and regional management links
Targeted actions:	- management/institutional strengthening - capacity-building - awareness/education - research/information for decision-making - investment

3. Fishery Management³ and Regional Security

Within the context of the SAP, therefore, fisheries is dealt with in terms of its role in both coastal and oceanic waters. While over-exploitation of inshore resources will effect the security of local communities and potentially whole islands, it is the exploitation of oceanic resources that perhaps presents the greatest potential for regional/international conflict.

A. Global context

World fisheries production, including marine and inland fisheries and aquaculture, currently averages about 100 million metric tonnes (mmt) per year. Fish is now the largest single source of animal protein in the world and the fastest-growing food commodity in international trade, providing direct and indirect employment to over 100 million people globally. World fisheries are currently suffering from global-scale over-fishing such that total marine fish catches, which grew from about 20 mmt in the 1930s to a high of 82.2 mmt in 1989, have now fallen back to about 78 mmt. These statistics mask the fact that many fisheries have undergone more serious declines. All but two of the world's fifteen major fishing areas have shown decreasing productivity and, in the most extreme cases, entire fisheries have disappeared. World marine capture fishery production is being maintained by the increased exploitation of those resources that are not yet overfished, and by the harvesting of newly discovered or previously unexploited stocks. Both these processes are subject to finite limits which will be reached in the near future, if they have not already.

B. Pacific context

Fisheries management in the Pacific Islands region encompasses a wide range of situations and issues, from customary systems of marine tenure practised by coastal communities, through national fishery development and governance, to the international management of the world's largest tuna fishery which crosses the

3. Unless where otherwise stated this text has been taken from Gary Preston (1997) Review of Fishery Management Issues and Regimes in the Pacific Islands Region. SPREP unpublished. **and Regional Security**

national jurisdictions of at least 21 resource-owning states, as well as extensive areas of high seas, and which involves harvesting by the fishing vessels of 26 different nations. Managing the use of these widely differing resources is implicitly linked to aspects of marine resource biology, economic conditions in the region and elsewhere, pre-existing patterns of fishery exploitation, and the requirements imposed by customary practices and other socio-cultural factors.

In addition to large international fisheries, many local or coastal fisheries of vital significance to domestic economies and food security are being threatened worldwide, not only directly by overexploitation or other aspects of poorly regulated harvesting, but also indirectly through the deleterious effects of pollution, habitat destruction through coastal development and poor watershed management. The Pacific Islands are no strangers to these phenomena, and the declining, sometimes overfished and frequently degraded coastal fisheries of the region are as much in need of protection and management as their counterparts in other regions of the world.

In an oceanic context, the tuna fishery of the Western Central Pacific Ocean (WCPO) is one of only two remaining major fisheries in the world still considered to be in healthy condition and amenable to increased exploitation. This fishery, and the large marine ecosystem on which it is based, is a global asset which requires the concerted attention and support of the international community if it is to be managed on a sustainable basis for the benefit of the present and future generations.

C. Economic value of living marine resources

The EEZs of Pacific island countries cover 30.5 million sq. km, compared with meagre land resources of about 550,000 sq. km., equivalent to about 1.8% of their maritime jurisdiction. Pacific island countries thus look toward fisheries as an important means to advance their economic development through the creation of jobs and the generation of exports and income. Although living marine resources support non-consumptive uses such as tourism to a certain extent, their most significant economic role by far is in providing the basis for commercial and subsistence fisheries.

Fisheries contribute to Pacific Island economies and their security in a number of important ways – food supply, employment and income, foreign exchange earnings, non-economic values such as cultural, religious and recreational values.

Although estimates vary widely, formal assessments indicate that the fisheries sector accounts for only a modest share of gross domestic product (GDP) in most countries of the region. However these estimates significantly underestimate the economic importance of the sector because they fail to account adequately for artisanal and subsistence production. Failure to appreciate the importance or extent of subsistence fisheries is paralleled by the fisheries development and management policies of many Pacific island governments, which continue to focus on the more visible but sometimes less economically or socially significant commercial fisheries.

D. Regionalism and regional organizations

There is a high degree of ‘regionalism’ among Pacific island States. This is supported by:

1. The fact that many countries share problems which justify a collaborative search for common solutions;
2. The small size and limited human and financial resources of most countries, which constrains their ability to address the wide range of development problems they face.

As a result, regional mechanisms and institutions have been developed to assist countries build capacity to better managed resources in the region. The existence of these institutions is often linked to regional agreements that also provide a framework for collective management/decision making concerning resource allocation as well as for resolving conflicts.

Cooperation among Pacific island countries in fisheries management is an especially striking feature of the region, to the point where it has been the subject of study by other geographical and economic groupings of countries (e.g. the Caribbean Community and the island states of the Indian Ocean) hoping to put in place improved regional arrangements of their own.

The high level of cooperation among Pacific island countries is fostered largely through various regional organizations, which have been established as a means of obtaining technical information, advice and support on a collective, cost-sharing basis. The three ROs with major involvement in living marine resource management matters are:

- **The Secretariat for the Pacific Community (SPC)** headquartered in Nouméa, New Caledonia. SPC is a multi-disciplinary technical assistance agency serving 22 Pacific Island countries and territories and which has a fisheries section with two major components. The Oceanic Fisheries Programme (OFP) is primarily concerned with scientific research on the region's tuna fisheries, while the Coastal Fisheries Programme (CFP) is involved in research, development and management of coastal fisheries;
- **The Forum Fisheries Agency (FFA)** headquartered in Honiara, Solomon Islands, is concerned primarily with economic and policy aspects of the offshore tuna fisheries in its 14 independent member Pacific island countries, as well as Australia and New Zealand. The FFA has achieved a high degree of success in the development of regional fishery management arrangements, to the point where the organization has several times been held up as a model that could be adopted in other regions of the world;
- **The South Pacific Regional Environment Programme (SPREP)** headquartered in Apia, Western Samoa. SPREP takes a lead role in coordinating regional approaches to environmental conservation and management, and has been active in promoting the concept of integrated coastal zone management in Pacific island countries. SPREP also provides technical assistance and support at the national level, particularly in regard to pollution and waste management issues.

There are also regional programmes which are relevant to the management of living marine resources at the University of the South Pacific (USP) and the South Pacific Applied Geoscience Commission (SOPAC), both located in Suva, Fiji. The former

undertakes research and higher education in regard to living marine resources, while the latter carries out bathymetric, geological and hydrological studies which provide valuable information on habitats and habitat change.

FFA continues to be the major vehicle through which multi-country fisheries management issues, particularly those pertaining to the regional tuna fishery, have been addressed to date. FFA provides technical and logistical support to its 14 Pacific island member states in areas relating to regional cooperation in tuna fishery development and management. The agency employs economists, lawyers and industry specialists as advisors and analysts, has promoted the use of sophisticated international telecommunications systems for monitoring purposes, and uses seconded Australian and New Zealand military personnel in connection with its surveillance work.

FFA is also directly involved in both regional and bilateral negotiations with distant water fishing nations, and has had an active role in the development of all the existing regional tuna management arrangements. The agency tends to take a pro-active role in these matters and has historically been a strong advocate of the right of Pacific island countries, as resource owners, to manage their fishery resources without distant water fishing nation involvement in the decision-making process.

E. Regional agreements

There have been and continue to be considerable efforts to develop regional-level arrangements for the management of the international fishery. Four main management instruments operate at the regional level:

- The Wellington Convention;
- The Regional Register of Fishing Vessels;
- Harmonised Minimum Terms and Conditions of Access;
- The Palau Arrangement.

Surveillance and enforcement is an adjunct to regional fisheries management. Three important recent and on-going regional initiatives in surveillance are currently in place or under development:

- The Niue Treaty;
- The Maritime Communications Network; and
- The Vessel Monitoring System.

Enforcement has been considerably enhanced by the regular surveillance flights throughout the region conducted by the Australian, New Zealand and French Air Forces. The Australian-funded regional patrol boat programme, under which Pacific Island Governments have acquired fishery patrol vessels and had police or military personnel trained in their use, has also contributed greatly to regional enforcement capacity.

International maritime boundary delimitation is also an aspect of regional cooperation with management implications.

4. Conclusions

The comprehensive framework provided by the SAP has identified that the threats to living marine resources, and therefore regional security, are related to over-exploitation and environmental degradation. Over-exploitation, principally of inshore fisheries, is exacerbated by destructive fishing methods, which include explosives and various types of toxic compounds such as traditional vegetable poisons, household bleach, cyanide and herbicides, and by inappropriate government incentives for coastal fisheries.

Concerning the management of oceanic fishery resources in the region, the best available information indicates that the tuna stocks of the wider Pacific region are not believed to be biologically overexploited at this time. However the market-led growth of the tuna fishing effort in the WCPO during the last few years may be a matter of concern. The decline of fisheries elsewhere, the growing demand for fish due to population growth and affluence, and the desire of developing nations to use rich fisheries as a basis for economic development all are contributing to increasing fishing

effort in the Pacific. The surfeit of extraordinarily mobile fishing vessels in the world oceans can transform uncrowded into crowded fisheries more quickly than fishery managers can react. Experience throughout the world shows that regardless of how healthy fish stocks may appear, they can rapidly become over-fished if an open access policy prevails or if regulation remains inefficient.

Pacific island countries nevertheless recognize the need for sustainable, environmentally sound harvest practices. The most prominent example was in 1991 when concerted action by regional countries was primarily responsible for the ban on the use of long drift-nets for tuna in the South Pacific. Recent decisions of the South Pacific Forum have repeatedly underlined the region's commitment to the development of a management regime for the international tuna fishery in the Pacific that provides for resource conservation and sustainable utilization in line with the provisions of the UN Convention on the Law of the Sea and the Code of Conduct for Responsible Fisheries. Regional countries have also assigned priority to research activity directed at these concerns, although so far financial constraints have meant that most research has remained confined to the main target species.

Efforts to ensure environmental benefits are derived from the management and utilization of resources in the region continue and the Strategic Action program for International Waters provides an important new framework for these efforts at a regional level. Resulting benefits for regional security are expected, however, they will be significantly influenced by external environmental threats to security such as climate change (discussed in other sessions of the workshop). As demonstrated by the example of fisheries, regional mechanisms and support to countries in the region are well developed and could provide a useful framework for ongoing assistance in linking environmental benefits and security.

FISHERIES AND MARINE PROTECTION – AN AUSTRALIAN RESPONSE

Lieutenant Commander J.P.M. Shevlin
Royal Australian Navy

Lieutenant Commander Shevlin is currently serving as Staff Officer 1 Naval Strategy in Navy Headquarters in Canberra, taking up his appointment in late November 1997. In this capacity he has been responsible for providing the Defence input into the development of an Australian Oceans Policy.

Introduction

LCdr Shevlin began his comments by expressing his pleasure in participating at the second Regional Asia-Pacific Defence Environmental Workshop. He explained that his professional association with matters environmental is only recently established but, like many of his generation, he possesses a natural interest in the environment.

As previously stated, there are particular challenges that must be addressed if environmental security is to be achieved. The challenges for fisheries and marine protection are, in some places, already quite acute. A case in point is that of the straddling fish stocks in the South Pacific. Australia shares the concerns of her regional neighbours and, in the Southern Ocean, is now having to confront the threat to its own fishing industry as illegal fishing vessels poach stocks of the Patagonian Toothfish from the waters surrounding Australia's sub-Antarctic territories of Heard and MacDonald Islands.

Fora such as the Regional Asia Pacific Defence Environmental Workshop will provide an opportunity to exchange ideas and encourage the sharing of experiences that, together, might help to identify solutions to these challenges.

Scope

Rather than focussing on any specific marine protection concerns of Australia, LCdr Shevlin explained that he would instead describe

Australia's management response to the Ocean Environment. He explained that he would first offer a brief description of Australia's circumstances and attempt to provide a feel for the enormous management task that is faced. The paper then explores what are, in his opinion, two key planks of Australia's response and, on this framework, detail the particular contribution the Australian Defence Force is able to make, and is already making, in support of their achievement.

Offering an 'insider's perspective', LCdr Shevlin suggested that the ADF track record of responsible environmental management is laudable. The Navy's main Fleet Base in Western Australia, HMAS STIRLING, occupies part of an otherwise uninhabited island just off the coast. Garden Island's native residents include a small rat-like kangaroo called a tamar which is unique to the island as well as a large colony of venomous black snakes. The Navy peacefully co-exists with both these species and its detailed environmental management plan for Garden Island has earned much deserved acclaim.

Closer to home in NSW and the ACT there is a remarkable coincidence between Defence-owned land and sites of special environmental and heritage value. Recently, Jervis Bay was declared a marine park by the Government of New South Wales. The bay's waters are almost tropical in their colour and the sand on the beaches is amongst the whitest you could find anywhere. It is a site of particular beauty that is largely unspoiled by industry and development. It has also been the home of the Royal Australian Navy College since 1913; it abuts the Fleet's main East Coast Exercise Area and Gunnery Range; and is the principle Fleet Anchorage.

In Canberra, the Naval Communications Station provides sanctuary to the endangered legless lizard and represents one of the few remaining sites of temperate grasslands in the region.

In short, LCdr Shevlin suggested that a Defence presence can be good for the environment

Australia's Circumstances

Under the 1982 United Nations Convention on the Law of the Sea (UNCLOS) which came into effect on 16 November 1994, Australia has claimed an Exclusive Economic Zone (EEZ) of 200 nautical

miles. This EEZ surrounds mainland Australia, Australia's offshore territories and Australia's Antarctic Territories. In all, Australia exercises sovereignty over a marine area in excess of 11 million square kilometres. Australia also has the right to claim areas over the legal continental shelf that extend beyond the 200 nautical mile limit, out to a maximum of 350 nautical miles. Nine such areas have been identified and represent a further 4 million square kilometres.

Sovereignty brings with it rights and responsibilities. Article 56 of UNCLOS provides 'sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources' of the EEZ. The right to explore and exploit is balanced by the responsibility to conserve and manage. Article 62 obliges Coastal States to 'promote the objective of optimum utilisation of the living resources of the EEZ.' It continues to state that, 'where the Coastal State does not have the capacity to harvest the entire allowable catch, it shall, through agreements or other arrangements, give other States access to the surplus of the allowable catch.'

Australia recognises that it has only a finite ability to explore the oceans and to harvest their resources. The country is therefore obliged to allow others to access these resources but must regulate this access in such a way as to ensure ecological sustainability as well as the long-term economic viability of industries. Getting the balance right demands fine judgement that must be informed by hard scientific fact and data. This requires continuing research and study as we recognise that our understanding of the oceans and the effects of human use and exploitation is very limited.

The situation in Australia has been further complicated by the overlap of Commonwealth/State and local government jurisdictions and the strength of particular sectoral interests. It is an undesirable situation. It encourages lines of demarcation; it leads to unintended loop-holes; and it promotes an insular, introspective view.

In the longer-term, it is also unsustainable, a fact now recognised by Government, Business, Industry and the Community at large. Change is now underway and a more holistic approach is now being pursued. Fundamental to this new approach is the understanding that the oceans need to be protected and their use carefully managed and, where necessary, be regulated. There are two key elements to the Australian solution.

Australia's Solutions

A National Representative System of Marine Protected Areas

The first plank of the Australian solution is the creation of a National Representative System of Marine Protected Areas. This is a vital precursor to responsible management, allowing future decisions to be based on scientific data and an appreciation of the diversity of the marine ecology and an understanding of the inter-dependencies between the different bio-regions and marine life that inhabit Australia's coastal and marine environments. Australia has one of the largest EEZs in the world which is diverse in both its geographic spread and its physical and biological diversity. It borders the EEZs of five neighbouring nations and includes an almost complete range of oceanic regimes from the tropical to the antarctic.

In 1992, an increasing awareness of the vulnerability of the coasts and oceans to degradation prompted initial work on the development of the Interim Marine and Coastal Regionalisation for Australia (IMCRA). This was a collaborative effort between Commonwealth, State and Northern Territory marine management and research agencies and focussed on the development of a range of bio-geographical projects in the States and the Northern Territory. In 1994, the work was extended to include regionalisation projects for Commonwealth waters.

IMCRA identifies regions with biological and physical features distinct from those elsewhere in Australia. These bio-regions are mapped on two scales: at a continental level comprising a few, large bio-regions; and at a regional or meso-scale representing some 60 bio-regions. These regions provide the basis for planning the National Representative System for Marine Protected Areas. They will help to identify gaps where ecosystems or habitats within bio-regions are not adequately protected and will assist decision-makers in setting priorities to fill these gaps. The continental scale maps allow regional plans to be viewed in a larger, national context.

The National Representative System will encourage the development of nationally consistent procedures to identify and select potential sites for Marine Protected Areas and will establish common principles for biodiversity conservation and management. It seeks to make scientific data accessible to all users and to deliver

greater transparency and openness to the oceans management process. In military-speak, it represents an important confidence building measure.

Australia's Oceans Policy

The second plank is the development of Australia's Oceans Policy. This policy seeks to draw together in a single document the full range of Government, Business, Industry and Community interests as they relate to our use and exploitation of the oceans. It hopes to provide an over-arching policy framework for oceans management and to accommodate sectoral and cross-sectoral interests to ensure the ecologically sustainable development of Australia's oceans.

Not surprisingly, its gestation has occasionally been difficult and it has demanded a mixture of patience and persistence. Nevertheless, recognition of the value of such a document—a statement of Australia's collective intentions for its marine environment—has served as a beacon of light during sometimes stormy and tempestuous debate.

Work on Australia's Oceans Policy began in 1996. The development process has deliberately involved many individuals and organisations with the objective of ensuring an informed and involved constituency with a shared sense of ownership for the finished product. As a representative participant of this consultative process, I believe this objective has been largely met.

The Commonwealth Government is expected to release a comprehensive Issues Paper for public consideration later this week. Cabinet consideration of the policy is scheduled for August-September and the formal release of Australia's Oceans Policy has been flagged as the centrepiece of Australia's response to the International Year of the Oceans.

The Australian Oceans Policy Issues Paper to be released later this week describes a vision of 'Healthy, Productive Oceans, with Benefits for all Australians, Now and in the Future'. This recognises the range of sectoral and cross-sectoral interests and also gives prominence to the notion of 'inter-generational equity'—our obligation to safeguard the marine environment in the interests of our

children and their children, on whose behalf we exercise temporary custodial responsibility for the oceans.

The policy sets three broad directions. Firstly, to foster greater understanding of the oceans and the marine environment. Secondly, to encourage the sympathetic, multiple and sustainable use of the oceans for the benefit of all Australians. And, thirdly, to care for and preserve the ecological diversity of Australia's marine environment.

The second portion of LCdr Shevlin's presentation focussed on the Australian Defence Force (ADF) contribution to the achievement of the aforementioned objectives.

The Defence Contribution

Australia's interests are inextricably linked to the oceans for trade, resources, fishing, shipping, tourism, industry and recreation. The Defence Mission is 'to promote the security of Australia and to protect its people and its interests' and, not surprisingly therefore, the Australian Defence Force has an important role to play in Australia's marine environment.

The ADF's foremost responsibility is to safeguard Australia's territory and to protect Australia's sovereign rights. Flowing from this is a complementary responsibility to secure and maintain the rights of Government, Industry and Business to explore and exploit the oceans, their resources and the seabed. The ADF provides the Government with a mix of personnel, equipment and skills uniquely placed to deliver the capability to perform these roles.

Defence Tasks

The Oceans Policy Issues Paper includes discrete sections on Defence and Surveillance and Enforcement. Therein, Defence tasks are nominated as Maritime Surveillance and Response, Fisheries Law Enforcement, Preparedness and Contingency Planning, Search and Rescue, and Aid to the Civil Community.

The last two are more appropriately addressed in the context of the subsequent session on Environmental Disaster Response. Accordingly, I do not intend to discuss them further now. It is sufficient simply to acknowledge them as important Defence tasks.

Preparedness and Contingency Planning is about maintaining operational readiness and standards of performance. It is very much our daily business and the levels of activity serve as a reminder of our resolve to safeguard Australia's interests. The tasks of Maritime Surveillance and Response and Fisheries Law Enforcement are more focussed demonstrations of Australia's commitment and resolve.

The Navy annually contributes 1800 patrol days to maritime surveillance tasks, especially across Australia's northern maritime approaches. The Air Force provides a further 250 hours of Maritime Patrol Aircraft aerial surveillance. These activities are undertaken as part of a coordinated surveillance program managed by Coastwatch and also involving Customs, Immigration, Quarantine and Fisheries agencies. The arrangements are based on the principles of partnership and shared responsibility and attest to Australia's resolve to respond forthrightly to all EEZ incursions.

Fisheries Law Enforcement activities are performed by Defence units although they are not a core Defence role. In the north, the Navy's patrol boats do much of the work. In the Southern Ocean, the task is performed by the Australian Fisheries Management Authority, with the assistance of ADF units. Since September 1997, two frigates have completed patrols of Australia's sub-Antarctic EEZ arresting three unlicensed vessels fishing illegally in Australian waters.

Defence Services

Beyond the contributions to protecting Australia's sovereign and territorial interests the ADF also makes a significant contribution to the scientific understanding of Australia's marine environment. The RAN Hydrographic Service is Australia's national charting authority and is responsible for managing and distributing hydrographic information to enable safe navigation and to satisfy international obligations for navigational safety. The Service publishes, maintains and distributes official nautical charts and other related publications and is developing the capacity to provide new and improved services such as digital charts.

The Australian Oceanographic Data Centre (AODC) is another Defence-owned organisation with a significant interest in the marine environment. It manages the national archive of oceanographic data

and is the national coordinator of Australia's contribution to the International Oceanographic Commission's International Oceanographic Data and Information Exchange program. It also provides marine data management support to other inter-governmental and scientific programs including the Global Ocean Observing System and the Global Temperature and Salinity Profile Program. In so doing, it too makes an important contribution to our understanding of Australia's ocean environment.

However, it must be appreciated that the Defence contribution comes with a price tag. The aforementioned tasks and services cannot be provided without some return; a fact that acknowledges the collaborative, partnership approach that underpins Australia's management response to the marine environment. That said, the price is not considered excessive. The ADF requires freedom of operations; the ability to go where he needs to, when it needs to, without restriction. It also requires unconstrained access to accurate and up-to-date hydrographic, oceanographic, meteorological and navigation information. And, finally, the ADF needs the support of Australian Industry if it is to maintain the essential knowledge edge. Arguably, the Defence contribution represents real value for money.

Conclusion

Australia recognises its rights and responsibilities to effectively manage its marine jurisdictional areas and to use the ocean's resources in a responsible and sustainable manner. Equally, the obligation to explore the marine environment and to further our collective understanding of it are acknowledged, particularly in the context of Australia's further claims on the Continental Shelf out to 350 nautical miles.

Scientific research is fundamental to this process and provides the means to inform our management of the oceans and to ensure their ecological sustainability. Australia's Oceans Policy and the National Representative System of Marine Protected Areas provide frameworks for improved management practices and the means to address sectoral and cross-sectoral interests.

The ADF has an important part to play. By safeguarding Australia's territory, by protecting Australia's sovereign rights and by progressing agreed programs of hydrographic and oceanographic

survey and research, the Defence Force makes an essential and enduring contribution to the protection and security of the oceans and marine environment.

LCdr Shevlin concluded by suggesting that while Australia's particular circumstances may differ from those confronting other countries, the differences are peripheral. The substantive issues are universal; he submitted that Australia's management response to the challenges of Fisheries and Marine Protection offers a useful blueprint that could have wider application.

DISCUSSION

Environmental Issues and Challenges

The fisheries of the South Pacific are of vital economic importance, not only to the South Pacific island states, but also to the rapidly growing nations of East Asia. As countries which previously welcomed foreign fishing vessels begin to restrict access and quotas to these countries, these fleets are moving increasingly into the South Pacific as a relatively unexploited source of supply. It has been described as East Asia's rice bowl for the 21st century.

1. Overfishing

The common denominator among the participants to the workshop on Fisheries and Marine Protection is that the fisheries of the countries of the region are of vital economic importance to their economies. All were in agreement in terms of the fact that overfishing threatens the sustainability of the resource and consequently the economic vitality of these nations, as well as food security for East Asia. The decline in fishing stocks in other fisheries is generating an increased interest in the relatively unexploited South Pacific fisheries.

2. Illegal fishing

Illegal fishing is perhaps the most immediate challenge to regional security and stability in the area of fisheries, providing a clearly identifiable role for defence forces and possibly international defence cooperation. Illegal fishing is likely to increase due to the decline in other distant fishing stocks. Small island nations have a limited capacity to uphold national laws without assistance.

Illegal fishing activities have the potential to generate international tensions as vessels are seen to flout the laws of Pacific Island nations, and undermine the goals of international fishing conventions such as the *Convention for the Conservation of Antarctic Marine Living Resources* (CCAMLR) or the *Convention for the Conservation of Southern Bluefin Tuna* (CCSBT). Despite stringent penalties on those who are apprehended for illegal fishing, law enforcement disincentives are currently inadequate to deter many illegal fishing vessels due to the immense areas to be monitored and the consequent improbability of detection.

3. Pollution

Another area which the workshop participants noted as being of major concern is pollution. Coastal and marine pollution threaten both the sustainability of the region's fisheries and the tourism industry which are two crucial contributors to the countries' economies. Habitat destruction, oil discharges, litter and waste dumping all have disastrous impacts. The two major contributors to the problem are land-based sources and shipping. As with the problem of illegal fishing, the monitoring and law enforcement capacities of the island nations are currently inadequate to reverse these trends.

4. Over-dependence on fisheries as an economic base

The absence of other national resources combined with the underdevelopment of the industrial and service sectors of island countries has contributed to an over-dependence on fishing resources and revenue from the sale of fishing licenses.

The economic impact of the decline of regional fish stocks would be less significant if the economies of the region were more diverse.

5. Monitoring

The participants agreed that monitoring is a requirement for mitigating the negative impact of several issues associated with the health of the fisheries and marine environment. The group agreed on four key areas where monitoring is needed;

- a) identify illegal fishing activity of licensed vessels
- b) identify illegal fishing by unlicensed vessels
- c) quantify fish stock levels, changes in migration routes and congregation areas
- d) measure water quality, sea temperatures, pollution levels

Despite the recognized need for monitoring on the issues listed above, Pacific Island countries currently do not have the capacity to monitor the changes in levels of the marine-living resources upon which they depend for economic survival.

Opportunities for Defence Cooperation

Once the principal environmental issues and challenges had been identified, the participants suggested a compatible range of possible opportunities for defence cooperation. These are not proposed as whole solutions to problems, rather they are particular defence contributions that could potentially reduce or contain a larger problem. They represent a defence element that should be considered in the context of a wider national solution.

Despite their immense size, the South Pacific fisheries are beginning to follow a global trend whereby the world fish catch has decreased since 1990. As a result of this resource competition there has been an increase in the number of clashes and incidents in East Asia's seas caused by foreign fishing vessels illegally encroaching into EEZ and territorial waters.

EEZ incidents have sometimes taken the form of armed intervention by regional navies seeking to defend the activities of national fleets or to prevent perceived territorial violations by foreign fishing vessels. If regional navies begin to take a more interventional approach towards fishing activities in the South Pacific, it will clearly be desirable to establish guidelines for cooperation in order to forestall the kinds of low level military conflict which have already broken out in East Asian waters.

1. Overfishing

Overfishing is seen as the fundamental problem facing the long-term viability of the South Pacific fishing industry. Defence Forces can help to address this problem by:

- Raising the issue in the forum of the **Western Pacific Naval Symposium** (WPNS) suggesting it is an area in which cooperative defence activities might help to reduce the problem. The WPNS forum seeks to encourage practical assistance and the adoption of common practices or approaches to shared problems.
- Providing an increased **Maritime Surveillance** and **Aerial Surveillance** capability to the regional countries to assist in monitoring vessels and fishing activity; to identify possible

Exclusive Economic Zone (EEZ) incursions; and to demonstrate the practical resolve of the South Pacific countries to enforce their sovereign and territorial rights. Provision of this type of support would be provided at the request of recipient countries and in accordance with bilateral and/or multilateral agreements.

- Providing **Satellite Surveillance**, possibly through access to existing military satellites, to extend the surveillance capability of regional countries. This would offer the prospect of targeting specific areas, thereby increasing the efficiency and effectiveness of limited patrol assets. Satellite surveillance also provides a means of managing marine pollution, particularly in terms of tracking oil spills.
- Fostering an **indigenous surveillance and enforcement capability**. This could be encouraged through Defence Cooperation Program initiatives such as Australia's Pacific Patrol Boat project whereby Australia has provided South Pacific countries with 21 patrol boats, as well as the essential follow-on logistics, technical and operational support.

1. Illegal Fishing

While states have some control over the level of legal fishing undertaken within their EEZs, illegal fishing presents as a particular problem. Those who participate in illegal fishing activities are generally opportunistic and are motivated by potential financial reward. Illegal fishing is therefore best tackled in a way that jeopardises the rewards and makes the activity less viable. Defence Forces can contribute to this by:

- Providing assistance in establishing **Communication Systems** that facilitate the flow of information and **Intelligence** between regional countries on the presence and activities of possible illegal fishing vessels.
- Promoting **awareness** of the problems and dangers of illegal fishing. This is a two track activity with both an internal and external audience. Firstly, there is a need to promote an awareness of the immediate financial costs and longer-term

impacts of allowing illegal fishing to go unchecked. Secondly, potential illegal fishermen should be made aware of the penalties attached to illegal fishing while advertising the commitment and resolve of regional countries to act firmly and cooperatively to stop illegal fishing.

- Becoming engaged as observers to discussions and negotiations between the *Forum Fisheries Agency* and countries involved in Distant Waters Fishing. This notion of a **Defence Presence** could be reinforced further by increasing the number of defence units in the South Pacific during the peak fishing season. Such a presence would not need to be ongoing and need not be the responsibility of only one or two countries. Pacific Island countries might collaborate on a bilateral or multilateral basis. Additionally, the Trilateral Nations, New Zealand and France could coordinate regional exercise programs to coincide with the migratory path of straddling fish stocks. Alternatively, regional countries might consider extending the scope of existing or future bilateral agreements to allow signatory countries to undertake some constabulary and enforcement tasks.
- Providing **training** for local Defence and law enforcement services in the techniques of boarding and apprehension and the management and coordination of surveillance, monitoring and communications systems and networks.
- Directing Defence Force **research and development** capabilities towards the development and production of a low cost vessel monitoring system appropriate for the region.

1. Pollution

Pollution control is a global issue and, by and large, Defence Forces cannot do a lot themselves to reduce the problem. To the maximum extent possible, International Conventions on Marine Pollution will be observed and national laws adhered to. Although opportunities to be more pro-active are limited Defence Forces might consider:

- Providing **free access to scientific data**, such as that of the Australian Oceanographic Data Centre (AODC), to facilitate the measuring and monitoring of changes to the marine environment as a pollution indicator. The AODC has data management responsibilities for an area extending from 20° East to 150° West and 40° North to 80° South.
- Providing **practical pollution control assistance** under the auspices of established Military Aid and Defence Cooperation Programs. Examples might be army engineering assistance to manage the run-off from land-based industries or the treatment and disposal of effluent in remote communities.
- Promoting an **awareness** of and **education** on the adverse consequences of pollution and the alternative practices and processes that could be adopted. Education programs could form part of Defence Cooperation Program activities or could be undertaken as an adjunct to operational deployments and exercises by Navy, Army and Air Force units/personnel.
- **Waiving the warship exemption to the 1978 London Protocol on Marine Pollution.** With some limited qualifications, this should have little practical effect on the day-to-day operations of Defence Forces but would send a powerful message of resolve and environmental awareness to other ocean users. Indeed, such an undertaking could conceivably provide a means for controlling access to the region in a similar fashion to the declaration of the South Pacific Nuclear Free Zone.

1. Economic Dependence

Many of the Pacific Island countries are almost wholly dependent upon fishing and tourism for their economic well-being. The protection of the fishing industry and the marine environment is essential to these nations. A range of Defence activities aimed at aiding their protection has already been addressed. However, this almost total economic dependence on one resource is a particular strategic vulnerability. There is therefore a need to diversify the economic base of these nations. Defence Forces cannot do a great

deal to solve this concern; nevertheless wherever possible efforts should be made to:

- **Reprovision and resupply** visiting Defence Forces from the island communities—where they have the capacity to fulfill demand
- **Use local contractors and service providers**, in preference to external agents

1. Monitoring

Much remains to be known about what is actually occurring in the marine environment. There is a lot of anecdotal evidence that may provide some useful insight but hard scientific data is essential to inform decision-makers and to pinpoint critical factors. Monitoring of the marine environment, fishing activities and fishing stocks themselves is required to develop a useful database of information. Defence Forces can contribute to this activity. A number of possible initiatives have already been discussed above under the topic of *Illegal Fishing*, most notably the ideas of Communications Systems and Intelligence and Defence Presence. Other opportunities for Defence cooperation might include:

- **Research and development** directed towards tracking migratory fish stocks, possibly along the lines of adapting acoustic and sonar technologies.
- **Scientific data collection** directed towards monitoring oceanographic trends such as changing ocean currents, water temperatures and temperature gradients. The Australian Oceanographic Data Centre and similar agencies might play an important part in this activity.

CHAPTER VI

PLENARY SESSION IV – INFORMATION AND TECHNOLOGY EXCHANGE

Web surfers can log on anywhere and connect to any other location in the world. Information is global and our economies are based on the power of information. Information can no longer be easily controlled and networking has facilitated free markets and free trade. The amount of information available in the public domain continues to rise and already there may be too much information available to actually use.

It is therefore important not only to establish a reliable method for information exchange, but also, for filtering this information for both content and quality. This session explores the types and structure of information exchanges; safeguards to ensure that only the desired information is exchanged; and procedures to avoid duplication of effort.

Questions

- What is the state of information technology?
- What data bases are out there?
- What are my information and technology needs?
- How do I deal with the information glut?
- How do I find the reliable information and avoid inferior information?
- What are other militaries doing?
- What can I contribute?
- How can we share lessons learned and success stories?

- Information I do **not** need?
- What are the security implications of using Internet (the internet is not ready for exchange of secure information or operational data)?

Introductory Remarks

Mr. Warren Meekins of the United States moderated the session on *Information and Technology Exchange*.

Mr. Meekins explained the objective of the fourth plenary session, which was to provide background to the participants on Information and Technology Exchange, with emphasis on establishing a reliable mechanism for information exchange, developing a proposal for the type and style of an exchange, and ensuring that only the desired information is forwarded.

Mr. Meekins noted that the topics of the session's two speakers complemented one another. The first would address information exchange needs and information uses. The other would explain the information system used within the United States Department of Defense (DOD). Mr. Meekins noted that the DOD system already has a site established to support these regional workshops.

Mr. Meekins explained that the Internet is a widely used medium for information exchange. The use and accessibility of the Internet is growing exponentially. Problems such as communications and security experience improvements each year. Mr. Meekins noted that in his area of expertise, applications are being produced that use the web to process reporting data up and down the chain of command and provide analytical graphs and charts from databases over the Internet.

Mr. Meekins challenged the participants to consider a number of questions throughout the session's presentations;

- What databases and information sources do you use regularly?
- What are your information needs?
- What concerns do you have with internet security?
- What recent events or decisions have you encountered where you would have liked to have had more or better information?

DENIX: THE TOOL KIT FOR SUCCESS AND PARTNERING

**Ms. Jackie Hux
United States**

Jacquelin Hux is the president of TEAM Consulting, located in the Washington, DC area. In addition to running her own company, Ms. Hux supports the DENIX information system for the US DOD Environmental Security program.

During her presentation, Ms. Hux addressed the DENIX system; the role DENIX plays in supporting Environmental Security professionals world-wide; the capabilities and uses of DENIX and the broadening of information sources becoming available through DENIX.

The Defense Environmental Network and Information Exchange or “DENIX”, is the World Wide Web standard system for all Department of Defense (DOD) Environmental Security Professionals. This system facilitates exchange of information and ideas between all DOD Environmental Security professionals world-wide and promotes free exchange of information with people outside the Department, such as other Federal and State government organizations, Native Americans, international organizations and the public at large. The system has many capabilities that facilitate communication and conducting business operations as well as a great depth in current events, news and information.

DENIX serves as a centralized platform for the dissemination of policy and guidance, access to information sources and transmission of data up and down the command chain. DOD’s environmental policy emanates from the Office of the Deputy Under Secretary of Defense for Environmental Security (DUSD(ES)). This office maintains a hands-on interest in the development of DENIX and other systems supporting environmental programs within DOD. DUSD(ES) serves as the primary functional proponent for DENIX, supplemented by tri-service representatives.

DENIX provides access to vast repositories of information. Annually, DENIX is utilized by more than 4,000 DOD personnel, who are involved with environmental programs from the installation level up to the policy-making level of the DUSD(ES) Office. These users login to the system for timely access to information on:

- Air
- Cleanup/Installation Restoration
- Compliance
- Conservation and Natural/Cultural Resource
- Environmental Planning
- Explosive Safety
- Hazardous Substance Management
- International Activities
- ISO 14000
- Land
- Native American Peoples
- Noise
- Pest Management
- Pollution Prevention
- Safety/Occupational Health/Fire
- Toxic Substances
- Water

The depth and richness of the information in these topic areas makes DENIX an essential tool for the environmental professional at

all levels. The following features provide DENIX users with a wide range of methods for accessing information:

- The *calendar of environmental events* is a calendar which can be interactively updated by the user community and can be used as a planning tool for scheduling meetings, conferences, workshops and training events.
- Links to other environmental Web sites - numerous federal, state, and public sites can be directly accessed through hypertext links.
- *Central subscriptions to environmental news, regulations, and technology* - updated proprietary subscriptions to journals such as the BNA's "Daily Environmental Report", the weekly "Inside EPA", and the "Defense Environmental Alert".
- *Online access to current federal and state regulations* – full text of state laws and regulations which are searchable by key words.
- *Enhanced search engine* – the improved search engine on DENIX has links to 34 carefully selected sites which keeps user queries focused within the applicable environmental domain.
- *Ongoing discussion forums* – a special area posted throughout the life-cycle of a project or work group to aid in communications relating to the project.
- *Chat room* – Real time discussions among environmental professionals.
- *Upload/download features* – many systems enable file downloads only. By providing two way capability, reporting is facilitated both up and down command channels.

There are four unique menu areas on DENIX: DOD, Public, State and International. Eligible DOD environmental professionals wishing to obtain a login to the restricted DENIX DOD area may do so online at: www.denix.osd.mil. DUSD(ES) strongly encourages

members of the contracting community to access DENIX. There are some restrictions for contractor eligibility to access the DOD menu. The contractor must be currently supporting a DOD environmental contract, and contractors will be blocked from viewing the daily and weekly online environmental journal subscriptions. The State and International menu areas require registration. This form is also available at the URL shown above. There are no limitations to the Public menu of DENIX.

The system facilitates DOD outreach to other federal, state and international organizations. For instance, a joint partnership between DOD and the Environmental Council of the States (ECOS) resulted in a new menu item dedicated to the special issues impacting the states. DENIX supported early NATO committee efforts to exchange information on environmental cooperative agreements among the NATO community. A new initiative provides a dedicated DENIX menu area for American Indians, Alaska Natives, and Native Hawaiians environmental programs

The DENIX International menu serves as a platform to facilitate work in various cooperative arrangements where DOD is working with other organizations or countries. For example, the US-Swedish Defense Environmental Cooperative Agreement between the Department of Defense of the United States of America and the Armed Forces of the Kingdom of Sweden for Cooperation on Environmental Protection in Defense Matters uses the DENIX International menu. Other related initiatives which, like the US-Swedish initiative, use DENIX as a communications medium and feature special program related menu area items on the system:

- US/Canada/Australia Trilateral Forum
- Arctic Military Environmental Cooperative Agreement (AMEC)
- Environmental Cooperation in the Baltic States
- Department of State Environmental Hubs program

DENIX is also used to provide users with information on the development and implementation of innovative environmental technologies. A page on Remedy Selection/Remediation

Technology provides over twenty Application Analysis Reports on site specific case studies of cleanup technologies that have been implemented at DOD and Department of Energy installations. These case studies document site specific examples of the performance, cost, regulatory issues, and lessons learned in implementing an innovative technology. Links to other federal agencies and private sector Web sites are also available to exchange cost and performance data in this same format.

As DENIX continues to improve, it is experiencing a rapid growth rate. The ultimate goal of the cooperating organizations is to promote a scenario where DENIX becomes a knowledge station for all DOD environmental security professionals. With DENIX as the entry point they will be able to accomplish most of their research, reporting, and communications requirements from a single point of entry.

In summary, DENIX is a dynamic system. Its origins are in the tri-services bulletin board systems, its present is a compilation of environmental tools, information and data, and its future will be shaped by the needs of environmental professionals and evolving environmental requirements as set by policy and legislation.

DISCUSSION

Information technology is a rapidly growing field where new advances are made on a daily basis. Given the delicate nature of information itself, it is important to question how information is on the one hand, to be shared and disseminated and on the other, protected.

The potential impact of information sharing and exchange on developing countries which are deficient in new technologies, particularly in terms of early warning and prediction, is tremendous. Information sharing is the basis for capacity building, and a requirement for cooperation at every level.

Environmental Challenges to Regional Security

1. The nature of information (the “why”)

Among the key challenges related to the issue of information and technology exchange is determining which information is needed, and the time that is available for the process of information gathering. Other challenges raised by workshop participants were: improving regional and global information sharing analysis, the subpoena of information related to early warning, how information-sharing can assist in planning and response, and the ability to predict critical information.

2. Technology delivery (the “what”)

The processes of information sharing and exchange require some degree of interoperability. In other words, one challenge is related to compatibility of systems between sender and receiver. Other issues which threaten the benefits of information exchange are the supporting infrastructure and the standardisation of data into formats. The group concluded that the format of information must be universally understood in order to be useful.

3. The purpose and management of information (the “how”)

This problem is directly related to information delivery. One of the greatest challenges to making full use of the potential benefits of information sharing involves the education and training of the individuals and groups who require the information. One suggestion

was the establishment of a central information and coordination centre; resolving the logistics of this proposal is a challenge in itself.

4. Information tailoring (the “who”)

The group identified this last challenge as being the most critical. Specifically, the information that is exchanged must be useable and available at the right level.

Key people requiring the information must be identified. The group suggested that in some cases there are cultural biases against accepting the information that is provided, a potential problem which may also result from traditional inputs or perceptions.

A related challenge involves ensuring that the information is user-driven and outcome focussed. A similar problem is connected to ensuring that the user contributes to the process, and perhaps more importantly, that the user is confident of both the credibility of the information and its usefulness.

Opportunities for Defence Cooperation

The group identified and discussed four opportunities for defence co-operation, and felt strongly that these types of co-operation could be very beneficial and could potentially be implemented as a result of the workshop.

1. Identify the central point of contact in countries and regional organizations (both governmental and non-governmental) for information sharing

The workshop participants suggested that identifying key people in all relevant governmental and non-governmental agencies, organizations and groups, would foster civilian and military communication while allowing for centralized control of the information and decentralized implementation of the actions undertaken as a result. Clear lines of communication would be established, breaking down communication barriers.

2. Participate and sponsor interest-focussed conferences/workshops

Those attending the workshop explained that this topic was categorized as an opportunity for cooperation because its realization would allow defence establishments to participate or sponsor forums

which are oriented to specific areas of interest. Defence involvement within specific expert areas would allow defence expertise and capability to be seen, well-publicized, and employed. A further benefit would be the identification of specific factors in problem areas. There is also a high potential for resolving technical issues. The primary examples of specific interest areas discussed by the group were: disaster response, meteorology, quarantine, land management, and humanitarian assistance.

3. Hold regional conferences on regional issues

Another opportunity for defence cooperation identified by the participants was convening meetings on topics which could foster reasonable co-operative efforts. This opportunity could take advantage of established organizations, using them as an umbrella and framework. The participants referred more specifically to ASEAN, the South West Pacific Forum, the Trilateral Forum, APEC and others. In addition, the group agreed that there should similarly be conferences related to organizations already outside that framework.

4. Use information technology to hold discussions, plan meetings and share information

The fourth opportunity for defence cooperation as identified by the workshop participants as being the easiest to implement. It involves using information technology to hold discussions, plan meetings and share information. Its implementation would allow multimedia access and input on a broad range of defence issues, thereby facilitating input from people who have a contribution to make from outside the main focus group. The use of an Internet-based work site would foster communication over an unlimited geographical area and a broad base of issues. The web site would enable all interested parties to participate in a dialogue, contribute to and gain information from a variety of documents, issues and events, and possibly engage in real time discussions over the Internet chat.

The web site would allow interaction among groups of many sizes, ranging from small groups to the entire public.

CHAPTER VII

PLENARY SESSION V – NON-INDIGENOUS INVASIVE SPECIES MANAGEMENT

This session will provide background to participants on the impact Non-Indigenous Invasive Species (NIIS) have on the economic productivity and ecological integrity of lands and waters and how they can threaten a nation's security. Not all non-indigenous species cause harm. However, non-indigenous species are reducing the economic productivity and the ecological integrity of lands and waters. The rate of introduction of such species has risen markedly in the last century as world travel has increased and modes of transportation have proliferated. The problem is global, and no place on earth is immune to threats.

The focus of this session is on the identification of NIIS; exploration of the potential sources and means of probable transport of NIIS; and the prediction of the likely recipients of NIIS. The keys to ensure NIIS do not become established are the knowledge of identified and potential threat species and conscientious vigilance. These are the critical elements to an effective NIIS management program in today's highly mobile and fast moving world economy.

Simple commerce and trade, as well as unknowing tourists are potential sources for NIIS problems. However, military exercise planners must also be vigilant and assess the risk of transporting invasive plants and animals between countries where their forces may be in transit, exercising or even operating (eg UN Peace-keeping). In larger countries there will also be a similar problem between internal regions.

NIIS can pose a huge threat to agriculture and ecosystems. Preventive measures can be simple, effective and easy to employ prior to deployment or re-deployment. If NIIS are accidentally transported from one nation to another, NIIS management techniques may have to be instituted to control or eliminate unwanted invaders. Military officials must work closely with their national resource management agencies to develop NIIS risk assessment strategies,

prevention measures, and methods of response to any detected NIIS-related problems to protect their economies and ecosystems.

Questions

- What are the national security implications of NIIS?
- What are the regional economic threats of NIIS?
- What is the military's role in controlling NIIS nationally? Regionally?
- What are the military's unique capabilities that can be brought to bear on NIIS control?
- How can the military control NIIS on lands they manage?
- How can the military control NIIS during exercises or deployments outside land they manage?

Introductory Remarks

Colonel Don Driggers, Director, Defense Pest Management at the Office of the Under Secretary of Defense (Environmental Security) moderated the Workshop's fifth plenary session. Col Driggers introduced the session by suggesting that Non-Indigenous Invasive Species (NIIS) Management is becoming more and more of a problem, particularly as awareness and concern about ecology increases.

Col Driggers explained that the session would provide a background to participants on the impact of non-indigenous invasive species. In particular, how NIIS impact upon economic productivity and the ecological integrity of lands and waters, and how they can threaten national security.

Col Driggers pointed out that not all non-indigenous species cause harm. However non-indigenous species are reducing the economic productivity and the ecological integrity of our lands and water. The rate of introduction of each species has risen remarkably in the last century as world travellers increased and modes of transportation have proliferated. The problem is global; no place on earth is immune from the threat.

Col Driggers explained that the focus of the plenary session is only an identification of the non-invasive species, exploration of potential sources, and means of probable transport of the non-invasive species, and the prediction of the likely recipients.

The key to ensuring that NIIS do not become established is the ability to identify potentially threatening species, and conscientious of vigilance. These are the critical elements to an effective NIIS management program in today's highly mobile and fast moving world economy. Commerce and trade as well as tourists and business travellers are potential sources for these problems. Military exercises planners must be vigilant and assess the risk of transporting invasive plants and animals; countries where their forces transit, exercise or operate are susceptible. In larger countries, such as Australia, there is also a similar problem of internal regions being populated by invasive species.

These animal and plant species poses a significant threat to agriculture and ecosystems. Preventive measures can be simple,

effective and easy to employ prior to the deployment or redeployment. If NIIS are accidentally transported from one country to another, NIIS management techniques may have to be instituted to control or eliminate unwanted invaders. Col Driggers related that part of the session on Non-Indigenous Invasive Species would deal with some of the problems which arise if preventive measures to keep unwanted species from invading, have not been undertaken. He noted that it would become apparent that prevention is the best strategy. Prevention also minimises the ecological impact and also the significant economic resources that have to be expended to cope with problems associated with NIIS after the fact.

IMPACT OF NON-INDIGENOUS INVASIVE ANIMAL SPECIES

**Mr. Gary Oldenberg
Wildlife Services,
United States Department of Agriculture**

Gary Oldenberg is currently the State Director responsible for Vertebrate Pest Management in Washington, Hawaii, Alaska and the Pacific Islands, most notably including Guam.

Mission and Program

Mr. Oldenberg explained that the role of the program that he is involved in is to provide a service for the resolution of vertebrate pest control problems in the most environmentally acceptable way.

Within Animal Plant Health Inspection Service there is Plant Protection Quarantine which deals with plant problems and diseases. There are also Veterinary Services which deals with the transmission of animal born diseases.

Agency Program – How it Operates

Mr. Oldenberg explained that the program operates on the basis of requests received from an individual or agency who has a vertebrate pest problem. The initial response is by initial consultation. Information is then provided to the individual or agency making the request as to how they might solve the problem themselves. The alternative is to go into a cooperative agreement where the program looks at the situation, gets its technicians involved and signs a cooperative agreement with that agency or individual, which is basically a funding document. Those employed by the program then go ahead and resolve the problem. Although a federal agency, they do not work on appropriating monies. Rather, whomever receives this service pays for that service.

Mr. Oldenberg explained that his presentation would offer some examples in each of the areas with which he is acquainted with. Each example notes the species' location, the damage that has been caused

by those species as they were transported to these locations, and the methods of resolution that have been put into effect, either through technical assistance or Wildlife Services operational program.

Alaska

The *Arctic Fox* was only indigenous in northern areas; it was introduced to the Aleutian Chain of Alaska by fur growers that wanted to harvest it. Obviously it was a non-indigenous species in that area.

A cooperative effort with US Fish and Wildlife Services was undertaken to clear the islands of the fox. There are hundreds of them in the Aleutian Islands.

They are endangering the Tufted Auklet, one of the ground nesting birds, puffins and the Aleutian Canada Goose which is a threatened species in the Aleutian Chain at this point in time.

One of the methods used to clear the islands of the Arctic Fox is the use of the sodium cyanide capsule, called M-44, which is basically a mechanism to inject cyanide into the mouth of the Arctic Fox as it is feeding. It is a lethal control mechanism. Other methods include the use of steel jawed traps, and snares, which are basically all lethal control as well.

Washington State

One of our prime introduced species in Washington State is the *European Starling*, brought over to the United States in late 1800s, because some Europeans felt lonely without the starling. When they moved to the US they thought the starling ought to come along. Damage to Washington State from starlings is in the hundreds of thousands of dollars each year to:

- *sweet cherries*: Washington is the number one producer of sweet cherries in the United States
- *apples*: Red and Golden Delicious Apples; the damage caused by starlings often makes the products totally unsaleable

- *power/buildings*: Starlings often flock on power installations; through their excrement they cause very serious damage to metals and other building structures
- *cattle feed*: Starlings sometimes fill livestock feed lots, eating the feed that is meant for livestock
- *Viral enteritus*: Excrement is a problem in other ways; one will see piles of excrement around bunkers where they feed. There is a problem of disease transmission involved with livestock populations in these areas. This is one of the major problems with the introduced Starling.

DRC-1339 is used for starling control, which is a bait for baiting within the feed product. Large numbers of starlings are killed with these baiting operations.

In the orchard situations where starlings cause damage, the converted Australian Crow Trap is used. Between these two methods, anywhere between 250 to 750 thousand birds a year are taken out of Washington State. The total population nationwide is considered to be between 50 and 70 million Starlings in the United States.

Guam

A major invasive species there is the *Brown Tree Snake*. One of the impacts of the Brown Tree Snake on Guam is that nine of the eleven bird species in Guam are now extinct. Power outages are also fairly common in Guam due to the snake.

Guam has been threatened with embargoes on cargo being shipped through Guam because there is a chance of the snake getting involved.

Some of the methods being used are temporary barriers. They have been used on some military exercises.

Other methods include trapping, which is considered in more depth in a paper below by Mike Pitzler. Dogs and night fence line searches are employed to keep the snake on Guam from transiting to other locations.

Hawaii

Hawaii probably has some of the more prolific invasive species, to mention a couple, there is the *cattle egret*, which was brought intentionally, supposedly to reduce insect problems for cattle. They frequent airports because they are attracted by insects and rodents and other things as their food. Any bird species drawn into jet engines are very much a problem. One year and a half ago up in Anchorage, Alaska, an AWACS plane hit Canada Geese and was lost. Total losses from that particular bird-strike were a 200 million dollar aircraft and 24 lives.

Among the techniques to rid the islands of them are scaring them off with audio sound devices, such as shooting cracker shells. Shooting is used as well. Habitat management is one of the techniques that is used to try and prevent situations which attract these egrets.

Feral pigs are pigs that went wild from the introduction of domestic animals. They root around and are quite a serious problem to the native plant communities in Hawaii. They are damaging to some of the commercial crops such as pineapple.

Fences have been used to a great extent to try to keep them out; at times big panel traps have been used. And there is the use of dogs and firearms as well.

Midway Island

Mr. Oldenberg noted that his program worked on Midway, Kure Island and the Rose Atoll in American Samoa toward eliminating rats. Three rats, *Polynesian*, *Norway* and the *Black Rat* are all problems.

Specifically, one of the major rat problems is that they eat birds' nests and destroy their eggs. They similarly eat turtle eggs, which is of particular concern on Rose Atoll in American Samoa.

Basically baits are being used; the conventional trap which are being run at nights. There is also the use of the live trap.

There is also the *mongoose*, an invasive species in Hawaii. Mongoose are predatory on the nests of the nene, a ground nesting

bird. With the mongoose, live traps are being used particularly with the US Fish and Wildlife Service refuges, and the state agency there, to reduce some of their populations.

“THE BROWN TREE SNAKE PROGRAM IN GUAM”

**Dr. Mike Pitzler
Wildlife Services,
United States Department of Agriculture**

Dr. Pitzler presented the workshop participants with a case study of the impact of the brown tree snake impact on Guam. He also considered efforts to remediate the problem and prevent the spread of the snake outside of Guam.

Guam is located close to the Marianas island chain. It is a seven hour flight from the Hawaiian Islands and about 3 hours to Japan. The Washington State office, which supervises the brown tree snake program, is located about 6,800 miles from Guam.

Located in the tropics the warm, humid climate makes for dense vegetation growth to which this animal is well suited.

The *Brown Tree Snake* originates from Papua New Guinea, the Solomon Islands and parts of Australia. The size class ranges from 35.5 centimeters after 100 to 120 day's incubation to lengths in excess of 3 meters.

The earliest reported snake sighting on record occurred near Apra Harbour during the early 1950s, shortly after the war. Both nocturnal and arboreal, over a period of 25 years, the snake spread island wide with little notice. Current population estimates indicate that there are some 30 to 40 snakes per hectare occupying Guam's 550 square kilometers of land surface. Because the snake occupies virtually every niche of Guam, it was just a matter of time before it dispersed from Guam to other neighboring areas even as far as Hawaii, the continental United States, Northern Marianas Islands, Okinawa, Diego Garcia, to include other Pacific Basin Islands.

The island of Guam has been ravaged by the snake including impacts to birds and lizards, poultry, livestock, electrical power and human health and safety. Nine of the 11 forest birds can no longer be found on the island of Guam. In fact five of the those that disappeared were found nowhere else in the world.

The island's only remaining bat out of three original species, the Marianas Fruit Bat or Fanihi, has been listed as endangered because of the snake. Lizards, including several species of gecko, and skinks have been severely impacted.

Pets have also been impacted. The Brown Tree Snake actually will attack prey much larger than it can possibly swallow. There have even been puppies and some small goats that have been killed by this species. Guam's small poultry industry has also been impacted by this snake.

In the last ten years, some 1200 power outages were caused by snakes climbing on transmission lines, primarily in the search for food, which includes nesting birds.

In terms of impacts to human health and safety; the snake enters homes and can attack infants. Biting has resulted in swelling and other side effects such as fever and respiratory related complications; as many as ten cases per year are reported.

The Brown tree Snake is unlike a truly viperous front fanged snake. It is actually a rear-fanged animal. A pair of small, grooved teeth are located in the upper jaw at the rear of its mouth. Glands containing a mild venom above these grooved teeth become activated only when chewing its prey.

When an adult is bitten they pull away preventing the venom from reaching the wound but the snake's sharp teeth leave puncture marks.

Other than man, the Brown Tree Snake has no predators on Guam, with the exception of the occasional electrocution or a set of rubber tyres.

In 1993 under a contract with the Government of Guam and the US Department of Defense, Wildlife Services initiated a program with the objective of preventing the inadvertent dispersal of the Brown Tree Snake through Guam's transportation network. Currently there are 27 employees on Guam and three others operate from a shop facility located in Washington State. They provide support in the form of supplies and materials.

All high risk ports of exit have been targeted to include Won Pan International Airport, Harmon Industrial Center, which contains 17 cargo processing warehouses, Anderson Air Force Base, Commer-

cial Port and COMNAVMAR which is actually the naval facility. Limited in resources, the dynamic state of cargo movement on Guam necessitated the classification of cargo into high risk and low risk. 'High risk' being cargo that would have the greatest chance of harbouring a snake for export.

Several assumptions were made by Wildlife Services with regard to the transportation of cargo. First, the probability of Brown Tree Snakes surviving in cargo while in transit decreases as the transit time increases. Recent data now suggests that the snakes' survivability while in transit greatly depends on their location within that cargo.

Secondly the potential for survivorship, colonisation and the ensuing adverse ecological impacts is greater in an island ecosystem similar to Guam. Cargo that originates in areas with high snake densities is high risk.

The probability of visually detecting brown tree snakes in complex cargo is lower than in cargo with few potential hiding places. Brown Tree Snakes are more likely to be detected within cargo when the contents are each packed and handled individually.

Brown Tree Snakes are less likely to be detected if the cargo is delivered to the port area and lowered with minimal disturbance directly onto the vessel or aircraft by crane or forklift. Brown Tree Snakes in cargo are less likely to be detected by K9 inspections if the inspection occurs after the cargo has been crated or containerised.

To prevent snakes from entering identified high risk cargo, Wildlife Services implemented an integrated control program which today still consists of trapping, fenceline search, use of temporary barriers, public relations and pre-base removal.

- *Trapping:* in excess of 1500 Brown Tree Snakes are in place at or near high risk ports of exit. A one way door on either end of the trap allows easy access for the snake. For maximum coverage, traps are spaced at 20 metres apart along forested plots and on fence lines which surround all ports of exit. A centre chamber containing a single live mouse is inaccessible to the snake. Traps are serviced up to twice each week. A parafinised grain block, which Wildlife Services manufactures, is the food source and a large baking sized potato provides an adequate water supply.

- *Fence Line Search*: after dark it is common to find large numbers of Brown Tree Snakes climbing on fence lines where they frequent the upper portion of the fence. It is presumed that they either use it as a migratory corridor and/or as a feeding area where it locates its prey. High candle power flood lights easily illuminate the snake on the fence which can then be promptly removed. All accessible sections of fence lines surrounding ports of exit are searched a minimum of twice each evening.
- *Snake Detector Dogs*: Currently Wildlife Services has 14 Jack Russell Terriers on the island. The breed was selected because they are extremely aggressive in nature. They are agile which comes in handy when inspecting cargo in tight places. The canines are used specifically at export cargo facilities, some of which include cargo staging warehouses, surface cargo and vessel, aircraft and various military cargoes.

Approximately 10 per cent of all cargo that goes through the commercial port (which operates 24 hours, seven days a week) is what we call “break-bulk” cargo. This is cargo that is too large to be containerised. Generally it consists of construction equipment that comes from jungle areas and is considered extremely high risk for snake export.

Household goods are inspected on a regular basis. Personal owned vehicles (POV) are inspected daily from the the island’s commercial port. Ammunition stored at and shipped from the naval installation is also inspected regularly.

- *Temporary Snake Barriers*: During all large scale military exercises, Wildlife Service is tasked with providing 100 per cent, 24 hour inspection of all outgoing cargo. These types of exercise sometimes last up to three weeks. A temporary snake barrier acting as a cargo containment area is an integral part of the control effort. The one shown here was installed by Wildlife Services during Exercise TANDEM THRUST 97. It measured about 140 metres by 80 metres. The one installed was a double barrier. It was designed to prevent snakes from entering the containment area and preventing snakes from

escaping the containment area if a snake was inadvertently brought in by vehicle.

- *Prey Based Control:* Wildlife Services remove all feral pigeons with traps or air rifles and rats. Removal of prey base species from high risk ports of exit reduces the attraction to the snake in that area.
- *Public Relations:* In its continuing endeavour to seek assistance from warehouse managers, handlers of cargo and the general public, Wildlife Services has produced several training aids, including videos, information posters, wallet-sized cards, and more recently, a Brown Tree Snake fact sheet, all of which clearly show the identifying characteristics of a Brown Tree Snake and whom to contact when one is discovered.

Wildlife Services interact with the local and national media on a regular basis.

Brown Tree Snake control workshops are regularly conducted where tens of thousands of people over the last four years, ranging from school age to adults, interact with Wildlife Services employees.

In concluding, Dr. Pitzler added that in addition to regularly scheduled duties, employees of Wildlife Services also spend a lot of time assisting its research arm, the National Wildlife Research Centre, currently on Guam, to develop additional Brown Tree Snake control tools including repellents, irritants and inanimate bait attractants, toxicant development and delivery systems, K9 efficacy, and trapping strategies and their efficacy. All this to prevent the inadvertent spread of the Brown Tree Snake to other areas.

CONTROL OF NON-INDIGENOUS INVASIVE VERTEBRATE SPECIES

**Mr. James Murphy
Wildlife Services,
United States Department of Agriculture**

The most isolated chain of islands in the Pacific Ocean, the Hawaiian Islands comprise the United States' 50th and newest state. Stretching over almost 2,000 mile of ocean, the islands' range in geological age from sunken islands and atolls through the high islands that are so familiar, and even islands that have not yet risen from the ocean floor. Born of volcanic origin, these barren inhospitable rocks became home to a few species that chanced to arrive there. Over the millennium, these few species evolved into a myriad number of new species. Evolving in isolation, free of predators, many of them lost their defensive mechanisms, leaving them vulnerable to later perdition by invasive species brought in by man.

The first invasion began almost a millennium and a half ago when the first Polynesians discovered Hawaii. With them they brought the basics needed to establish their culture in a new land; dogs, pigs, chickens and a wide range of agricultural crops. With them either intentionally or as a stowaway came the Polynesian rat (*Rattus exulans*). A millennium later, Captain Cooke sailed into the islands and with him, and the others to follow came a long list of invasive species that would forever change the composition of these unique islands. With them, they brought more rodent species, the roof rat, the Norway rat and the house mouse. Ungulates, such as pigs, goats, sheep and cattle were released into the wild to provide a food supply for mariners transiting the islands. Afforded protection by agreements with the ruling chiefs of the day, these ungulates increased in numbers and wreaked havoc on the environment. As time went by, many new species of birds, plants and animals were intentionally introduced to supposedly improve these unique islands, and to rectify some of the damage done by previous introductions. With these intentional introductions were many unintentional introductions.

Consequently, Hawaii has the dubious honour of being called the endangered species capital of the world. Representing two tenths of one percent of the nation's mass, three fourths of the nation's extinct species were once found in Hawaii. Currently, more than a third of the plants and birds found on the nation's endangered species list come from Hawaii. A total of 273 threatened and endangered species are currently at risk.

Many of these endangered species and their unique environments are found on lands under the control of the Department of Defence. Environmental departments and natural resource managers across the state are working to identify and protect these treasures entrusted to them and still accomplish the mission of their respective branches. In a cooperative effort, the U.S. Department of Agriculture's Wildlife Services Program has been working closely with all branches of the Service to protect and preserve the environment.

The mission of Wildlife Services is to provide Federal leadership in managing problems caused by wildlife. Realising that wildlife is an important public resource, the program uses an Integrated Pest Management strategy to resolve conflicts between man and wildlife. Control strategies may include the application of one or more control techniques, and consideration is first given to non-lethal methods. Consideration is given to environmental impacts, the cost effectiveness of control methods and social and legal concerns. Assistance to governmental agencies can be in the form of technical assistance or direct control activities. Direct control programs are cooperatively funded by the agency requesting the service. Control activity is restricted to vertebrate pest problems.

Currently, on several military installations, Wildlife Services is providing predator control at wetland refuges to enhance the survival of endangered water birds. Through the use of cage traps, leg-hold snares and shooting, predators such as feral cats, dogs, mongooses, rats and even cattle egrets are removed from refuges where they prey on eggs, chicks and adult birds.

Feral ungulates are also being controlled on a number of military installations. Feral cattle that trample and graze on native plant species are being trapped and removed when possible. One area where such work is being done is a naval magazine where there are considerations that have to be dealt with such as restrictions on the

types of weapons used, as well as on the use of radios and other communications equipment. Failure to comply with these restrictions may set off a bunker of ordinance.

Feral pigs are being controlled on numerous bases where they not only represent a threat to the environment, but also to personnel safety. Often well-intentioned individuals start out by feeding piglets that soon become accustomed to handouts. In a short time, they grow up to be large rowdy and pushy animals that often will not retreat unless they get a handout. Most feral pig control work is done using leg snares, which are checked daily when deployed. Captured pigs are routinely euthanized on the spot. Concerns over the various diseases they may carry, such as pseudorabies and brucellosis, makes it unrealistic to move them to game management areas. Blood samples are routinely drawn from euthanized animals and submitted to the State Division of Animal Industry so that the prevalence of such diseases can be monitored. Additionally, in more remote areas of some bases, trained dogs are used to catch pigs.

Feral goats are currently being controlled on several military firing ranges. Left alone, their numbers rapidly increase and they have considerable impact on steep areas, which they frequent. After grazing these areas to the ground, tropical rains saturate the soil, often washing out entire hillsides. While the Army is installing ungulate proof fences along their borders, Wildlife Services is controlling their numbers by controlled shooting.

All of these ungulate control activities involve considerable coordination, diplomacy and a margin of risk. Frequently, the control areas are adjacent to ranches that are raising the animals that are being controlled. In fact, in some instances, control areas are adjacent to game management areas run by the State; we are out to remove the same animals that state personnel are promoting for public hunting. In most situations, fences are few if any, and usually in poor repair. In almost all cases, the feral ungulates are in rugged terrain. In a few instances, they are in active live fire ranges where unexploded ordinance is not uncommon. In order to operate in these areas Wildlife Services personnel must undergo Unexploded Ordinance Recognition Training, wear flak jackets and helmets, and in some instances have to be escorted by installation explosive ordinance personnel. All of these things make the job both exciting and challenging; but escalate operational costs.

Twelve hundred miles to the northwest of Honolulu, Wildlife Services has been assisting the U.S. Navy in eradicating rats from the Midway Naval Air Station. This base was scheduled for closure under the Base Realignment and Closure Act and was handed over to the Department of Interior's Fish and Wildlife Service to be converted into a National Wildlife Refuge. During the frenzied activity of World War II when thousands of ships were moving millions of tons of cargo, rats were introduced into the atoll's islands. Within a few years their numbers increased rapidly and they caused the extinction of several species of birds there. Within a decade, colonial seabird colonies were decimated with some species being eradicated from the islands. Efforts by the Navy to control these rats were unsuccessful as they focused primarily on the public health issue and they concentrated their efforts primarily in areas inhabited by personnel.

Over 50 years, millions of dollars were spent, but the rat problem was still unresolved. It is generally thought that eradication on all but the smallest of the islands was impossible. However, recent rodent eradication successes by Wildlife Services personnel on Rose Atoll in American Samoa and on Kure Atoll, just 80 km from Midway, where the Coast Guard decommissioned it Loran Station, gave renewed hope that it could also be done on Midway. Utilising 50-meter grid squares places across each island, pesticide bait stations baited cage traps were placed across the entire island, except for runway and roads. Grid squares were maintained on a daily basis until eradication was achieved. Approximately 16,000 roof rats were removed from the 140 hectare Eastern Island in 90 days utilising a Wildlife Services supervisor and four installation employees. In another control operation, a similar number of rats were removed from the 480 hectare Sand Island in just 120 days using a Wildlife Services supervisor supported by 10 base employees.

Today, we are faced with an even more ominous threat to the environment. The threat is the possible introduction of the brown tree snake into Hawaii. The ecological devastation and impact on Guam is well documented. To date, there has been seven snake sightings in Hawaii. Wildlife Services personnel are working cooperatively with other state and federal agencies to prevent the snake from entering and becoming established in Hawaii. State and military personnel are inspecting cargo and craft arriving from Guam. Cargo handlers and

military police are being trained on how to respond if a snake is sighted. Wildlife Services has all the necessary equipment in place and are trained and ready to respond to any suspect sightings on Department of Defence installations in Hawaii.

Although Wildlife Services personnel are prepared to respond and assist in any contingency, it must be emphasised that the education and training of personnel involved in high-risk areas, such as cargo handlers and crews of aircraft and vessels, as well as the public in general, are keys to the rapid identification of any introduced snakes or other invasive animal species. Finally, since prevention relies on a comprehensive program, which simultaneously addresses the source, possible routes of entry, and the recipient, the main line of defence still resides at the identified primary source, Guam. Without the conscientious work being done there, Wildlife Services' job in Hawaii would be next to impossible.

IMPACT OF NON-INDIGENOUS INVASIVE PLANT SPECIES

Mr. Craig Walton
Australian Quarantine and Inspection Service,
Australia

Introduction

The impact of non-indigenous invasive plants is a global issues, it is increasing and it is significant in its economic and social costs.

Mr. Walton presented his paper as a representative of the Plant Quarantine Policy Branch of the Australian Quarantine and Inspection Service (AQIS) to discuss actions that AQIS is taking to prevent the introduction of new plant invaders into Australia. Mr. Walton's work is also funded under the Australian National Weed Strategy (NWS) which is a national project to prevent the introduction of new plants and control the weeds already in Australia.

The scale of problem caused by non-indigenous invasive plants is becoming increasingly recognised. The Secretary of the Interior of the United States, Bruce Babbitt, only recently described invasive plants as the second most important threat to native species in the United States behind habitat destruction. The awareness of these plants is currently high in Australia, New Zealand and South Africa and is growing in Hawaii and other parts of the US, but is still not recognised in many countries represented here today.

In the context of this workshop invasive plants will be a major and growing issue for many departments of defence because they will need to increasingly manage the impact of these organisms on the land they control and need to be aware of the potential they may contribute to the spread by niche creation and the deliberate or accidental spread of invasive plants into other areas.

Mr. Walton introduced his topic with a short slide show and then went on to discuss the impacts, method of introduction, identification and some control strategies.

Topic Species

Kochia – *Kochia scoparia* var *scoparia* (*Bassia scoparia*) – Kochia is a variable tumbleweed herb which was deliberately introduced from the United States in 1992 as a forage plant for saline soils for land reclamation. It has since spread dramatically.

- 1) Extensive stand of plants on saline areas
- 2) One plant can spread many seeds and cover a large area while rolling away

This species is a problem in countries of origin, Argentina, Afghanistan; it may also be a seed contaminant.

Kudzu is a species in the United States. Imported for land stabilisation, it has become an invader.

Mimosa or **giant sensitive plant** (*Mimosa pigra*) – A leguminous shrub which grows up to 6m, with a prickly to 7 mm. It originates from Tropical America. It is an example of a specimen plant which was introduced as a display species into botanical gardens in late 1800's. It was only a problem in the Darwin area until the 1950's, now the flood-plain of 800 km is covered. Spread by man overgrazing, niche creation, water buffaloes and water dispersed.

1. Adelaide River has 30 000 hectares

Found now in Thailand, Costa Rica, Zambia, South Africa and Florida.

Other specimen plants which went on to become weeds include **Water hyacinth** (*Eichhornia crassipes*) and many **Broom** species (*Genista* spp.).

Chromolaena odorata, many common names **Siam weed**, **Christmas bush**, **trifid weed**. Native to neotropical Americas now a problem in many tropical and subtropical areas. Contaminant:

1. Dense stand on Tully River in Queensland
2. Teak plantation – Lombok Indonesia

Maybe the most insidious and hard to control weeds. These weeds are naturally very invasive. Other examples are many agricultural weeds, **Ambrosia** spp. and grass species.

Impacts

Non-indigenous invasive plants may not only have very severe visible impacts but many other impacts as well.

One example is the *Chromolaena odorata*. Growing to 20 metres and creating a dense tangled mass, this plant reduces productivity of timber and tropical crops and smothers native species. It makes movement on land and possibly on water impossible. Because it taste-reduces pasture productivity, it may cause death of some stock. The plant also affects the taste of meat. It is a host for a pest grasshopper in west Africa which has extended its range due to the spread of the plant. The only impact it does not have is a direct affect to human health. Ragweeds on the other hand may cause people to have to move due to sensitivity to the pollen.

Means of introduction

One important topic raised during the workshop is the issue of how plants enter and where they come from. Research in Australia (Groves 1997), in common with other international studies shows that contrary to popular belief most non-indigenous plants are not introduced accidentally or as contaminants. Rather this study showed that of the 290 species newly naturalised into Australia in the last 25 years, over 65 per cent were imported for use in the garden, amenity planting market. 7 per cent were imported for use in agriculture and the other known species or 2 per cent were only known to have entered as contaminants.

The list of methods of introduction is quite long. Although the proportion of contaminants was only 2% they and the 20% unknown may make up a large group of economically important weeds.

Again *Chromolaena odorata* is an example. It entered Australia as a contaminant in pasture seed from Argentina. It was introduced into India as a botanical specimen in the late 19th century. Its spread into Burma, Thailand and Malaysia is directly related to the movement of people, machinery and materials during World War II. Its movement to west Africa has also been linked to soldiers returning from combat in India after WW II.

Some other severe weeds have been introduced into Australia during WW II by trucks and other machinery; **parthenium weed** (*Parthenium hysterophorus*) and **perennial ragweed** (*Ambrosia psilostachya*) and in ballast sand **Alligator weed** (*Alternanthera philoxeroides*).

Equisetum ramosissimum has recently been reported to have spread to Papua New Guinea from Irian Jaya by the movement of bulldozers from one mine to another without effective washdown.

Origins of non-indigenous invasive plants

Given that many of the problem non-indigenous invasive plant species are introduced is it possible to predict from where they will arise. Unfortunately this may not be so easy. In the same report Groves 1997 reported that newly naturalised species were from all over the planet. This reflects more the large number of ecosystems and climate types in Australia.

Waterhouse 1997 determined that of the 55 major weeds of the west and south pacific 60 per cent came from tropical America. Of the rest, an equal number were from either Asia or Africa (21%) mostly also from tropical areas. In the Cape of South Africa 47 per cent of the weeds are of Australian origin and on the east coast of the USA a large percentage of ornamental weeds come from China or east Asia.

Managing the problem

Quarantine in Australia is considered a continuum which involves pre-border, border and post-border actions activities. These principles can also be used to prevent new non-indigenous invasive plants.

The first step is to evaluate the risk.

In AQIS we now assess the risk of new plants to be weeds by using a weed risk assessment system. This system is combined with using a permitted list (a white list of plants allowed) and all plants not yet assessed are classed as prohibited (or black) until assessment, or as a result of the assessment.

If plants are to be planted in a new area under defence control the question should be asked if they have been invasive in similar areas or

if other native species could be used. This could be for amenity plantings and gardens on bases for example.

Education may also be an effective pre-invasion tool. Staff should be made aware of the risk and cost of introduction. This may reduce the desire to deliberately introduce new plants, rather people may use native plants. Also, good education will help in the control of other methods of introductions such as accidental spread.

Legislation and or regulations will be needed to strengthen the controls on introduction or accidental spread.

Barrier controls need to be put in place. The major controls for defence forces would be in the minimisation of accidental plant movement, although deliberate introductions may be an issue within bases. As mentioned, machinery, vehicles, personnel all pose risks of introduction. These all require techniques to minimise accidental seed or plant material spread. Seeds may be found in: mud stuck on wheels, caught in crevices of used equipment or attached to clothes and many other personal items.

Managing lands under control will be an effective tool for minimising niche creation which may allow potential invaders to establish themselves.

The final issue is the need to put in place measures to control plants once they establish. This requires the development of an incursion plan (what will be done if a problem is found, who, where, how, how much, do we bother), surveys (checking what is present to determine if there is a problem) and then control strategies (response to the discovery of a new non-indigenous invasive plant).

NON-INDIGENOUS INVASIVE SPECIES PREVENTION METHODS AND TRAINING AREA PROGRAM

Mr. Bob Woods
Department of National Defence,
Canada

INTRODUCTION

Mr. Woods presented a paper on the issue of non-indigenous invasive species in Canada and how the Canadian Department of National Defence (DND) deals with this issue. Mr. Woods explained that he would first provide some general comments concerning non-indigenous invasive species, then touch on DND's role in dealing with the prevention of their introduction into Canada by the military. He explained that he would conclude his presentation by outlining a specific example at Canadian Forces Base Shilo where DND is dealing with such a problem species on its training areas.

Mr. Woods began by providing a brief look at Canada and its geographical location. Canada is the second largest nation in the world with a total surface area of 997 million hectares. It is sparsely populated for its size, with over 80% of its 30 million people within 160 kms of its southern border. Canada is a country of northern temperate climate that has very cold winters and warm summers. This temperature regime represents a significant barrier to species arriving from other countries, especially from tropical environments, as most species are unable to adapt to Canada's cold winter temperatures, which regularly reach minus 30 degrees Celsius. That is not to say that there have been no problems with non-indigenous invasive species, but the problems have in general not been as severe as has been experienced as in other countries, for example as Australia.

At present, Canada's battle with non-indigenous invasive species is experienced in one of two ways: one, the prevention of the arrival of potential non-indigenous invasive species, and second fighting those species that are already established here. Non-indigenous invasive species as has been explained throughout the workshop,

refers to those species that have arrived by direct means of human activity from elsewhere, and have moved into a habitat and successfully and aggressively reproduced such that it has displaced a portion or all of the original components of the natural community or agricultural field.

During the early days of European settlement, Canada and North America saw a significant number of non-indigenous invasive species. These species arrived in many forms: as contaminants in seed crops, forage for animals, horticultural material, an intentional agricultural crop, and as a contaminant in the ballasts of ships. Most often these species arrived on the shores of eastern North America and slowly or quickly move across the continent by means of inland rivers or with the movement of prospective farmers into the interior of the continent. A quick look at the distribution of the plant: purple loosestrife demonstrates this point.

Why do we worry about these species in Canada? The main reasons are:

- they can and do have a significant negative impact on agricultural or forestry production;
- they cause impacts on infrastructure;
- they may displace native species, especially endangered species;
- they disrupt natural ecological conditions

It should be noted that most non-indigenous species are not invasive and do not create problems as they exist in some harmony with the natural environment.

The role of Canada's Military in Preventing the Introduction of Non-Indigenous Invasive Species

The main Canadian military role in this battle is the prevention of the importation by the military of non-indigenous species into Canada that could become a problem. Other lesser roles are the eradication of the problem species on Canadian land, and the prevention of the spread of these species within the country. The

focus will now be shifted to consider how Canada's military deals with the prevention of the importation of potential invasive species.

Canada's armed forces train throughout the world for potential combat role. Our armed forces also play a significant United Nations peacekeeping activity around the world, and the redeployment of these troops has a significant potential to provide entry for unwanted species. These undesirable species can arrive by three means: ship, airplane or vehicles and equipment.

Ships

The need for DND to address the issue of preventing the arrival of potential non-indigenous invasive species from coming into Canada by ship is demonstrated dramatically with the arrival of the zebra mussel into our Great Lakes. These mussels are a shared problem with Canada and the United States as on the eastern border, as the two countries share a common water system that forms part of our border. Thus the invasion of zebra mussels into Canada means the invasion of zebra mussels in the US. A native of the Black Sea region in southern Russia, the zebra mussel was discovered in Canada in Lake St. Clair in 1988, where it was introduced via expelled ballast from cargo ships from Europe. So invasive is this species, that well over 300 facilities now spend close to \$100 million dollars in monitoring and attempting control of it. Zebra mussels, in common Canada-US waters have found an environment with no natural enemies to control them, and without this, the one-half million eggs laid by a female in a year cause their population to grow in a logarithmic rate. Their densities have been recorded at up to 1 million individuals per square meter. They affix themselves to pipes and anything else by means of threads – up to 600 per individual – which are virtually impossible to dislodge when attached to a substrate; they are unbelievable. They block water intake pipes so successfully; that they have forced the closing of water treatment plants and have also threatened the closure of nuclear generating facilities.

To ensure that our naval ships do not create this type of problem, the Canadian Navy has adopted the International Marine Organizations Guidelines for "Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens From Ship's Ballast Water And Sediment Discharges". To do this the Navy amended its

“Shipboard Waste Management Policy” for all ships and submarines. These basic measures to be taken are:

- ballasting and deballasting must occur outside of territorial waters greater than 200meters of depth;
- should ballasting and deballasting be required in other areas, permission must be obtained from the appropriate formation commanders; and
- In extreme cases, when ballasting or deballasting has occurred without permission, it must be reported to the formation commander as soon as possible.

As the International Maritime Organization’s guidelines do not apply to internal waters, the Canadian navy has worked with Canadian Coast Guard to follow the Coast Guard’s: “Voluntary Guidelines For The Control Of Ballast Water Discharges From Ships Proceeding To the St. Lawrence River and Great Lakes”. These Guidelines were developed in cooperation with the United States Coast Guard.

At present, there are no effective control methods for zebra mussels except for physical removal of the individuals. This however is an expensive and only a stop gap method that does not deal with the need for proper control of this mighty pest.

Airplanes

As aircraft move throughout the world, they have become the modern day vessels that transport potential non-indigenous invasive species from everywhere. One can go around the world in hours, and carry along unforeseen passengers. It is known that commercial carriers do bring pests; for instance, individuals working in airports are found to have developed malaria although they have never been near a location of potential infection. The disease escapes from aircraft, and strikes those working nearby. Studies have shown that a minimum of 10 per cent of commercial aircraft coming from countries of concern carry pests, and that the number can reach 100 per cent.

To prevent Canadian Air Force planes from being carriers of these potential pests, in 1995 the Canadian Forces Air Command implemented Order 55-28 entitled: "Aircraft Disinfestation Responsibilities and Procedures", for all international Air Command flights. This order places the responsibility for implementing these procedures on Canadian Forces preventative medicine technicians, aircrew and maintenance staff for the inspection of passengers, baggage and cargo.

Vehicles and Equipment

All military vehicles and equipment are required to be disinfected before entering Canada. This includes items of personal use by the military and their families. At present, DND does have a directive that although direct, is lacking in details and description as to the method that should be undertaken to carry out this requirement.

The current standard for prevention of returning with pests requires that military vehicles and equipment be steam washed under pressure to ensure that they are free of soil. This same requirement holds for private vehicles. Our present orders only focus on the external washing of our returning equipment. This of course does not address the non-soil living organisms that may be transported. The existing order does in fact do little to face the fact that some Canadian Forces equipment cannot be wash, for instance electronic and computer equipment so commonly used today.

The federal department of Agriculture is the responsible agency for quarantine regulations for the country. They can, usually on inspection at the port of entry, require further disinfestation at the entry sites in Canada. This can be an expensive process that can see equipment held in quarantine for varying length of time. If Agriculture Canada feels that individuals or even the Department of National Defence is trying to avoid this process, they can be subject to fines and in extreme measures, jail sentences.

After the issuance of the new aircraft disinfestation orders had been prepared in 1995, the need became apparent for revised or new regulations for military equipment. So this spring DND has begun the process of developing new orders for ensuring that our equipment and vehicles being redeployed are able to meet the current standards required by the regulators. This will include the use of cleaning

methods: physical removal of potential pests; spraying and fumigation; and the materials, equipment and procedures to carryout this cleaning. At present DND is developing a working draft with the input from all commands and services involved and also have included Agriculture Canada in assisting us develop these orders. It is expected that these orders will be “on the street” by the end of this year.

Case Study: Biological Control – Canadian Forces Base Shilo

Canadian Forces Base Shilo sits in the heart of Canada, and provides a training area for German Army Tank training, a Canadian artillery school and general mechanized training. This 40,000 hectare property contains 34,000 hectares of land leased from the provincial government. As part of the terms of the lease, DND is required to have an active program to suppress the weed: leafy spurge, a non-indigenous invasive species that is a major weed species in the agricultural sector. Leafy spurge has been reported to cost the Canadian agricultural sector in the range of \$10-20 million dollars per year. So it is important that Defence ensures that it plays its part in both ensuring that it is not responsible for further spread of the weed and to control the spread on our own training area.

Leafy spurge is a plant with bright attractive yellow flowers from Western Europe and temperate Asia, which first appeared in North America in the early 1800’s. It is believed to have arrived in the ballast from ships arriving from Europe. From its arrival, it moved steadily across the continent.

Leafy spurge truly deserves the label “noxious weed”. It reaches a height of 1 meter, but that is only the tip of the problem, as its roots extend nearly three meters deep and resist being physically removed from the soil. Spurge has invaded agricultural land and virtually takes over completely and can compose over 75 per cent of the vegetative cover. When leafy spurge invades an area, it chokes out native vegetation; creates erosion problems as spurge has little ability to bind soil; and reduces biodiversity, as few native species that depend native vegetation, are able to utilize spurge for food or shelter, especially rare species.

Our initial approach to control the weed was one of chemical herbicides. Unfortunately, spurge resists herbicides for several

reasons, first herbicides affect only the above ground stem, and has little or no impact on the roots and the next year, shoots arise from the extensive roots system. Also, spurge is able to produce a tremendous number of seed that remain viable in the soil for up to eight years, thus creating a significant seed bank for continuous supply of new recruits.

Aside from being ineffective, herbicide spraying is also expensive, as treatment has to be repeated annually. In the late 1980s, the Base, in concert with researchers from the federal Department of Agriculture, and a consortium of agencies from Canada and the United States began a program to assist in the development of a biological control solution to the problem. It was hoped that a biological control solution to the spurge problem would be more effective than a chemical one.

Biological control involves the introduction of a species, plant, animal or even a disease, to reduce the growth or ability of a species. Most bio control agents have been found in native habitats of the invasive species, where alone or in combination with other species or conditions they held the species in check. The situation in their native habitats are opposite to what invasive species face in their new habitats – that is there are no control agents and their growth goes unchecked.

For biological agent to be effective, it must:

1. Be able to do damage to the target species.
2. It must work only on the target species.
3. Be able to successfully reproduce itself.
4. Be somewhat resistant to native predators.
5. Must not develop into a problem themselves.

Biological control agents when they work often have the possibility to provide good long-term control, without causing the type of down stream problems of most herbicides.

Canada has a good record of successfully introducing biological control agents for the agriculture and forestry sectors, with none of the agents causing problems.

The first step in developing a bio control agent requires the identification of a native control species, and then testing to see if they meet the five criteria listed above. This is a time consuming processing. After several years through field trials, two species of flea beetles that seemed to be effective were discovered. These beetles are pests of the spurge from its native habitat in Western Europe, where the spurge is not a problem. These beetles are extremely small, 3-5mm in length. They feed on both the shoots and roots of the spurge, decreasing the vigor of the plant significantly. Over the course of several years, the spurge declines and its place is taken by native species. The level of spurge has dropped significantly from the previous photo. There are at present approximately 220 biocontrol sites on base. These sites are generally small in size, that is 100m in diameter. Our present program involves site visits to these sites to ensure that the flea beetle population is surviving, and if it is doing well, a small portion of them will be harvested to begin a new site no more than a couple of hundred meters away from the original site. We move only a short distance from the site because the beetles seem to be very temperature sensitive and moving a kilometer or two leads to problems, as it seems that the flea beetles are at their northern limit due to temperature.

One concern in maintaining a biological control program is that there remains enough material present so that the flea beetle do not totally eliminate the spurge, which would cause the flea beetle population to be lost. If this happens, and if the spurge returned, from the buried seeds, there would be no flea beetles to fight them. The goal is for them to be successful but not too successful.

The beetles are continuing to slowly, but without ecological damage, reduce the presence of leafy spurge at CFB Silo.

Conclusion

Mr. Woods concluded by saying that DND's general approach to non-indigenous invasive species on Canadian Forces training lands is such that:

- DND does not attempt to control species that are so widespread that their efforts are unlikely to make an impact.

- The cost of control is likely to be significant, and must be cost effective.
- If such species are present, but seem to be doing no significant ecological damage, it will generally be left alone

DND takes its responsibility seriously for the prevention of the introduction of non-indigenous invasive species into Canada. On Canadian Forces training areas, the Department's stewardship efforts can also include the control of these species.

NON-INDIGENOUS INVASIVE SPECIES – BALLAST WATER

**Ms. Katherine Colgan
Australian Quarantine and Inspection Service**

Background

Over recent decades, there has been increasing concern at the potential and actual impact on Australia's coastal marine environment of exotic marine pests and other harmful organisms translocated from overseas ports and between Australian ports in ships' ballast water.

It has been estimated that over 200 introduced marine species have been detected in Australian coastal waters to date, and that there is statistically approximately one new introduction every 20 weeks.

Global shipping moves some 80 per cent of the world's commodities. In Australia's case, it is close to 98 per cent, and is a transport mode that is essential to Australia's trade, both internationally and domestically. Each year around 150 million tonnes of ships' ballast water are discharged into Australia's 64 international ports by 10,000 vessels from some 600 overseas ports. In addition, approximately 30 million tonnes of ballast water is moved by domestic shipping each year from one Australian port to another. Most ballast water is brought into Australia from the northern Pacific area, with the greatest volume usually being in bulk carriers.

Not all introductions have harmful consequences for the marine environment, but a significant proportion do. In Australia's case these include, but are not confined to, the Northern Pacific Seastar (*Asterias amurensis*) discovered in the Derwent Estuary, Hobart in the early 1980s and now numbering about 28 million, and the Giant European Fan Worm (*Sabella spallanzanii*) now present in many southern Australian ports. Both are having a significant impact on marine biodiversity, habitat and the food chain for wild fisheries and aquaculture. Other harmful species present in Australia include toxic dinoflagellates which have the potential to cause Paralytic Shellfish

Poisoning in humans, and which are known to result in human deaths on a frequent basis; mainly in underdeveloped countries.

Unlike other major pollutants of our oceans like oil, sewage and garbage which can be eventually cleaned up, a marine pest once established is almost impossible to eradicate and can have serious and permanent consequences for the marine environment, marine productivity and public health.

Known Impacts of Non-Indigenous Marine Invasive Species on Economic Productivity in Australia and Overseas

Australia has a relatively pristine marine environment and has a number of significant marine reserves including the Great Barrier Reef. Our Fisheries and Aquaculture industry are worth almost \$2 billion both domestically and in export income. There have already been significant impacts on the Australian marine environment from the introduction of non-indigenous marine organisms.

Non-indigenous marine organisms that have already come to Australia include:

- The Northern Pacific Seastar
- Japanese Kelp
- The European Green Crab
- The European Giant Fanworm
- Toxic Dinoflagellates

The following examples of non-indigenous marine introductions, taken from both overseas and Australia experiences, highlight the impacts of these species on the environment, fisheries and aquaculture, and public health.

Mneopsis leidyi – Comb Jelly Fish

It has been clearly shown that the Comb Jelly Fish has had a significant effect on the anchovy, sprat and mackerel fisheries of the Black Sea. This animal was introduced into the Black Sea in the

1980's and quickly became a very successful marine invader. It is believed that the Comb Jelly Fish feeds on the eggs of the anchovy, sprat and mackerel. All three fisheries have suffered a significant decline in numbers since the introduction of the species and in particular the anchovy fishery which has been virtually eliminated.

Zebra Mussel

The zebra mussel is a freshwater mollusc from Europe that was introduced into the North American Great Lakes through ballast water discharge. This mussel has now become the single most common species in the Great Lakes encrusting other species including the freshwater crayfish and endangered native clams and also fouling ships hulls. It has been estimated that it costs US\$ 20 million per year just to control this species and that total costs will reach \$500 million by the year 2000. Its presence in such large numbers is driving native North American species to extinction.

Asterias amurensis – The Northern Pacific Seastar

Asterias amurensis was introduced into Tasmania in the 1980's. It has mainly been confined to the Derwent river near Hobart. The most recent estimate of the population of seastars in the Derwent is approximately 28 million. The species is a voracious feeder on shellfish, a threat to fish species and is suspected of being a major factor in the threatened extinction of the Tasmanian Spotted Handfish. It is estimated that mature *Asterias* can spawn 20 million eggs and live for five years. It has had, and continues to have, a significant adverse effect on both the marine environment and Tasmanian fisheries.

Earlier this year a significant number of *Asterias* were found in Port Philip Bay in Victoria at a mussel farm. This outbreak is of great concern both nationally and internationally. Within Australia there is concern regarding the further spread of this species and internationally this could effect shipping movements between New Zealand and Australia. New Zealand has already banned ships from Hobart entering their ports during the *Asterias* spawning season in an attempt to prevent its introduction into New Zealand.

Toxic Dinoflagellates

Different species of toxic dinoflagellates have been found in the temperate waters of Southern Australia. These organisms can cause Red Tides and pose a significant threat to shellfish industries as they become part of the seafood chain. These organisms are responsible for the disease Paralytic Shellfish Poisoning which can cause death in humans. Dinoflagellate cysts are often transported both in ballast water and in the sediment found in ballast water tanks.

Action undertaken by AQIS to address the problem

Australian Ballast Water Management Guidelines

In response to our concern regarding the uncontrolled introduction of ballast water into the marine environment, Australia was the first country in the world to develop and implement voluntary ballast water management guidelines for international shipping.

These guidelines, which were introduced in 1990, are at this stage voluntary guidelines (the Australian Ballast Water Management Guidelines) for international shipping visiting Australia. The Guidelines outline appropriate ballast management procedures designed to minimise the risk of unwanted marine organisms, such as;

Non discharge of ballast water: ships are advised that the most effective means of preventing the introduction of unwanted aquatic organisms and pathogens from ships' ballast waters and sediments is to avoid, wherever possible, the discharge of ballast water.

Ballast Uptake: ships are advised that only clean ballast water should be taken on board and the uptake of sediment with the ballast water should be minimised. In addition, where practicable, ships are advised that they should avoid taking on ballast:

- In shallow water areas;
- In the vicinity of dredging operations; or
- In an area which is known to have an outbreak of diseases such as cholera, or where a phytoplankton bloom is occurring.

Exchange at Sea: ships are advised that a full exchange of ballast water in deep ocean waters or open seas currently offers a highly effective means of limiting the probability that coastal and estuarine species will be translocated in ballast water. Where it is not possible to carry out an “at sea” exchange of ballast, a “flow-through” exchange may be an acceptable alternative, providing there has been a “flow through” of at least three tanks volumes of water.

Control of Ballast Sediment: ships are advised that in no circumstances should sediment resulting from tank or hold cleaning or stripping be disposed of in Australian waters.

The Australian Ballast Water Management Strategy

At a national Ballast Water Symposium convened by AQIS in 1994 to address the need for a strategic national approach to ballast water issues, it was agreed that a national ballast water management strategy should be developed by AQIS in consultation with a broad range of key stakeholders. Subsequently an Australian Ballast Water Management Strategy was finalised and adopted by the Government in April 1996. In line with the Strategy, the Minister for Primary Industries and Energy appointed the Australian Ballast Water Management Advisory Council (ABWMAC) to advise the Government on implementation of the Strategy

The Strategy is a framework for the management of ballast water issues, and includes a number of key elements such as the development of an effective risk assessment tool for the management of ballast water, an integrated research and development program, and the introduction of ballast water management controls for coastal shipping.

The Australian Ballast Water Management Advisory Council

The Australian Ballast Water Management Advisory Council (ABWMAC) plays a key role in the management of ballast water matters in Australia. The Council comprises all of the key stakeholders in ballast water issues, including fishing and aquaculture industries, shipping, port authorities, environment interests and State and Commonwealth government agencies.

The Council is administered by AQIS and is chaired by Dr. Meryl Williams, an eminent marine biologist and Director-General of the International Centre for Living Aquatic Resources Management Inc (ICLARM).

The role of ABWMAC is to advise the Commonwealth Minister for Primary Industries and Energy and AQIS on ballast water management issues, including

- development of effective management policies to minimise the risk of translocation from overseas ports and between Australian ports of introduced marine pests and disease organisms in ships' ballast water and on ships' hulls;
- implementation of a research and development program; and
- liaison and work with the International Maritime Organization (IMO) Marine Environment Protection Committee (MEPC) to develop an Annex to MARPOL (the UN International Convention for the Prevention of Pollution from Ships).

ABWMAC meets two to three times a year in port cities around Australia and in Canberra. It has an agreed Work Plan which is focused on implementing the Australian Ballast Water Management Strategy.

At its first meeting in July 1996, the Australian Ballast Water Management Advisory Council appointed two advisory working groups: the Research Advisory Group (RAG) comprising scientific and technical experts, and the Coastal Voyage Ballast Water Management Guidelines Group (the Coastal Group) comprising representatives from each State and shipping and ports representatives.

The Council also endorsed a Strategic Ballast Water Research and Development Program developed by the Research Advisory Group.

The Council and its advisory group, has proved to be a most effective forum for discussion of the broad ranging issues surrounding invasive species and ballast water, and has contributed significantly to bringing the issue to greater prominence,

implementing a range of risk minimisation arrangements and bringing the matter to international attention.

The Strategic Ballast Water Research and Development Program

The Strategic Ballast Water Research and Development Program has been developed and is being managed by ABWMAC on advice from its Research Advisory Group and in conjunction with AQIS. AQIS provides administrative support for the implementation of the Research Program which has been costed at approximately \$1 million per year over four or more years

- implementation of the Program commenced in 1996/97.

The outcomes of the Strategic Ballast Water Research Program are central to the development of effective ballast water management practices. A key project of the Program at present is the development of a risk assessment based Decision Support System (DSS) as an effective ballast water management tool for AQIS and other relevant government agencies and port authorities.

The DSS will provide a sophisticated risk assessment tool for application to each vessel voyage, and will allow authorities to more effectively manage ballast water discharges from international and coastal vessels. It will be the first of its kind in the world and has already created a lot of international attention. Exchange verification testing and a maritime awareness program strategy are key components of the DSS approach.

The Research Program was first in beginning to examine the issue of hull and sea-chest fouling as a vector for harmful marine pests.

The Program has been funded in 1996/97 by the international shipping industry and the Australia Maritime Safety Authority (AMSA); prior to that being largely funded by the Government. On 3 March 1997 the Prime Minister announced a further \$1 million to fund the Research Program in 1997/98 from the Government's Coasts and Clean Seas Initiative.

In addition, and in recognition of the urgent need for further research, recently ABWMAC agreed unanimously to the introduction of a levy on shipping to collect a further \$2 million for

implementation of the Program in 1998/99 and 1999/2000. Subsequently, the Australian Chamber of Shipping (ACOS), the Australian Shipowners' Association (ASA), the Minerals Council of Australia (MCA), the Association of Australian Ports and Marine Authorities (AAPMA), AMSA and AQIS (all Members of ABWMA) formed a working group and developed criteria for the application of the levy. Levy legislation is now before the Parliament, and has been debated in both the House of Representatives and the Senate. It is expected that the legislation will receive Royal Assent before the end of June 1998.

International Ballast Water Management

Largely at the instigation of Australia in 1991 the UN International Maritime Organization (IMO) introduced voluntary international guidelines for world shipping, the International Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ships' Ballast Water and Sediment Discharges. These guidelines were revised in November 1997 and now contain instructions for shipping and port states.

Australia has more recently taken a leading role in the international arena through the International Maritime Organisation (IMO) to progress work on the development of mandatory international regulatory arrangements through a ballast water Annex to MARPOL (the international Convention for the Prevention of Pollution from Ships). Australia chairs the IMO Marine Environment Protection Committee (MEPC) Working Group on Ballast Water, and in November 1997 the IMO Assembly adopted a resolution calling on governments to introduce new ballast water management guidelines as a matter of urgency. Australia will introduce these new guidelines and improved ballast water management arrangements from 1 April 1998. The IMO Resolution also sets a target date of the year 2000 for adoption of mandatory international regulatory arrangements through a ballast water Annex to MARPOL and work towards this objective is well underway.

What can the Military do?

The Navy are already assisting in this matter by voluntarily adopting the Australian Ballast Water Management Guidelines.

Other areas where the Military could assist is in becoming more aware of the possibility of non-indigenous marine introductions and during standard diving operations noticing any unfamiliar species and informing either AQIS or the Centre for Research on Introduced Marine Pests.

Another possible role for the Military would be to provide assistance in the case of rapid response action should a pest be discovered and the decision made to attempt to eradicate it from an area.

Port surveys are also being carried out around Australia on an ongoing basis and additional diving personnel could be used to assist in these surveys.

Conclusion

The management of the impacts of ballast water on the Australian marine environment benefits a number of groups which include the community as a whole who are generally concerned with the protection of the marine environment and more particularly those groups involved with aquaculture, fisheries, tourism and shipping.

It is internationally recognised that Australia leads the world in its management of ballast water issues and it is critical that Australia maintains its involvement, through AQIS, with the IMO to ensure the introduction in Australia of mandatory provisions for international shipping with the achievement of a Ballast Water Annex to MARPOL in the year 2000.

Australia's approach to Management

Australia is currently focussed on strengthening its ballast water management arrangements. This includes:

- the further development of a vessel tracking system
- the development of a risk based decision support system
- mandatory reporting arrangements for ballast water
- mandatory access to ballast water sampling points on vessels

- development of ballast water sampling methods
- training for AQIS field staff
- a comprehensive Maritime Industry Awareness Program

Australia's approach to Research and Development

Knowledge, both in Australia and internationally, with respect to scientific and technological issues regarding ballast water management is currently not well advanced. However in Australia research, which is recognised as being foremost in the world, is being accumulated more quickly than in the past, now that a national institutional framework is in place for addressing the issue. The ultimate solution, or 'magic bullet', to the ballast water problem is not likely to be available for some time.

However, whilst the long term objectives of the ABWMAC Strategic Ballast Water Research and Development Program are to find a solution to the ballast water problem, *ie*: a method of killing harmful organisms in ships' ballast water, the short term objectives are to enhance scientific and technological knowledge to allow more effective ballast water management controls. This will be achieved with the introduction at ports around Australia of a risk-assessment based Decision Support System, improved ballast water sampling and analysis techniques, and verification of ships' compliance with Australian ballast water requirements.

An effective system of notification and agreed protocols for eradication are also important in controlling the introduction and spread of harmful marine organisms in Australian coastal waters.

Australia's Approach in a Global Context

Australia's approach has been and will continue to be consistent with IMO/MEPC's stated views on this matter, and it will continue its active representation on MEPC. Australia will seek to:

- (i) Ensure that the International Guidelines.
 - (a) Remain safe, practical, cost effective and environmentally acceptable

- (b) Are adopted as quickly and widely as possible
- (c) Are flexible so that they can be modified as quickly as possible in light of emerging technical and scientific developments
- (ii) Work towards the earliest possible translation of the IMO Guidelines into an Annex to the International Convention for the Prevention of Pollution from Ships, (MARPOL) 73/78
- (iii) Secure greater international cooperation and sharing of research findings between nations.
- (iv) Encourage the development guidelines for the design and construction of ships for ballast exchange at sea.
- (v) Support the adoption of an approved ballast water management plan by each ship.

In summary the focus of this session has been the impact of Non-Indigenous Invasive Species on economic productivity, ecological integrity of land and water and the threat they pose to national security. Marine invasive species introduced by ballast water and hull fouling have the potential to have a significant impact in all of these areas. There are already many examples in Australia of the impact of introduced marine species on both economic productivity and the marine environment. There is the potential for introduced marine pests to have an impact on national security in the area of public health for example the possible introduction of cholera via ballast water and an outbreak of Paralytic Shellfish Poisoning via shellfish.

ROLE OF A US ARMY EXCHANGE OFFICER WITH THE AUSTRALIAN DEFENCE FORCE

**Major David Jones
United States of America**

The purpose of the Army exchange program is to promote defence cooperation and understanding between allies. As a US Army officer serving as the staff officer grade two preventive medicine with the Defence Health Service Branch of the Australian Defence Force (ADF), Maj Jones is interested in environmental issues as they impact on human health.

The impact of the environment on human health can be direct, such as exposure to environmental contaminants caused by pollution of air, soil, or water, or less direct.

Before discussing what the ADF is doing to prevent the spread of non-indigenous invasive species (NIIS), Maj Jones mentioned a couple of recent issues that the ADF has dealt with regarding environmental impacts on human health. The Defence Health Service Branch of the ADF was involved in assessing health impacts from forest fires in Indonesia which impacted on air quality in Malaysia where ADF personnel are located. Policy regarding precautionary measures, evacuation, and redeployment was developed. Recent drought conditions in Micronesia and Malaysia caused concerns regarding water quality and potential health impacts to ADF personnel, which required an assessment of the health threat and appropriate recommendations for how to avoid illness.

How the ADF gets involved in control of NIIS

Military aircraft, ships, and equipment are frequently deployed outside the borders of Australia. As such they are a potential means for introducing NIIS into Australia or to introduce NIIS into other countries.

From a quarantine perspective, the Defence Health Service Branch is concerned about the transmission of diseases and

introduction of insects, animals, foodstuffs, soil, seeds, *etc.*, which could adversely affect human health and the Australian ecosystem.

The Defence Health Service Branch seeks to avoid this transfer of NIIS through compliance with the Australian Quarantine Act and quarantine laws of other countries. The ADF has a regulation covering quarantine, which deals with control of NIIS.

The Air Force and Navy have developed a good working relationship with the Australian Quarantine and Inspection (AQIS). In the absence of AQIS inspectors, Air Force and Navy environmental health personnel are the nominated quarantine officers for the implementation of the Quarantine Act at Naval establishments and Air Force bases.

NIIS control procedures used by the ADF include the following:

- Proper disposal of food and galley wastes from ships.
- Complying with requirements for prohibited food items.
- Issuing deratting certificates.
- Cleansing of vehicles and equipment to ensure they are free of soil.
- Disinsection of aircraft.
- Implementing a comprehensive vector control program at Air Force bases.
- Managing ship's ballast water in compliance with appropriate protocols.
- Requiring foreign military ships and aircraft to comply with AQIS requirements.

Through these means, the ADF seeks to minimise the transport of NIIS as a result of military activities.

**THE IMPACT ON HUMAN HEALTH OF
NON-INDIGENOUS SPECIES
A CASE STUDY – FERAL PIGS AND
JAPANESE ENCEPHALITIS**

**Ms. Pam Frost
Strategic Health Intelligence, Department of Defence,
Australia**

In 1996, the Australian Bureau of Resource Sciences identified several problems associated with feral pigs, “Feral pigs cause problems for farmers because they eat crops, pasture and lambs. Conservation authorities are concerned that feral pigs, through selective feeding, trampling and rooting could have negative impacts on a range of native plants and animals, including invertebrates. Quarantine authorities need to manage the risk that feral pigs could be involved in exotic disease outbreaks, such as foot-and-mouth disease or swine fever, should such diseases enter Australia.¹” As of 1998, a new threat, that of the introduction of Japanese encephalitis (JE), with feral pigs as an amplifying host, has been added. The potential economic, political and military impact that the establishment of this disease in Australia could have, both for regional security and for the Australian Defence Force, needs to be considered.

When the military forces assigned to the First Fleet arriving in Sydney in 1788 supervised the unloading of the ancestors of today’s feral pigs, they were unwitting accomplices in the possible establishment, two hundred years later, of JE on mainland Australia. Domestic pigs were brought to Australia with the first white settlement. Pigs were both imported and translocated to other settlements over the next century and feral populations soon established. Feral pigs are now widely distributed and abundant in Queensland, the Northern Territory, New South Wales and the Australian Capital Territory. There are isolated populations in Western Australia, South Australia and Victoria.²

1. Choquenot, D., McIlroy, J. and Korn, T., (1996) *Managing Vertebrate Pests: Feral Pigs* Bureau of Resources Sciences, Australian Government Printing Service, Canberra, p. iii

2. *Ibid*, p. iii

The distribution of feral pigs is directly related to the location of inland rivers and their associated floodplains. Juvenile mortality is close to 100% during drought, but feral pigs can increase their population at 80-110% per annum, depending on the area and seasonal conditions.³ The wetlands and swamps of western and south western Cape York where large numbers of wild pigs share the same habitat as ardeid waterbirds and mosquitoes provide an ideal environment for JE to become established, as the virus exists in a zoonotic cycle between mosquitoes and/or water birds and pigs, which are the major vertebrate hosts for maintenance, amplification and virus spread.

JE is largely a rural and peri-urban disease. There is potential for the virus to spread from the north to the south-east of Australia through wild pig-mosquito transmission cycles. Such movement could be exacerbated in the future by global warming because of the predicted increased frequency and intensity of rainfall events, providing additional environmental conditions and sites conducive to virus transmission cycles.

It had been generally accepted that JE activity was defined by the Wallace Line, a hypothetical line based on geographical and biological differences between the oriental and Australasian regions, extending from between Bali and Lombok Islands north through the Strait of Malasar between Kalimantan and Sulawesi. A second hypothetical line, Weber's Line, extends from between Timor and Australia north through the Moluccan Sea east of Sulawesi. The area between these lines is known as Wallacea, and JE is the major flavivirus north and west of this area. Murray Valley encephalitis is the major flavivirus to the south and east. Within the Wallacea area, little reliable information is available.

The propensity for JE virus to spread and colonise new areas has seen its geographic range expand significantly over the past three decades. This is due largely to increased deforestation and land management change to irrigated agricultural production, resulting in expanded vector habitats.⁴ The major vector for JE transmission in

3. *Ibid*, p. iii

4. Mackenzie, J., (1997) *Japanese encephalitis: an emerging disease in the Australasian region, and its potential risk to Australia* (unpublished paper)

Australia is the species *Culex annulirostris*,⁵ which, excluding Tasmania, is found throughout the country.

Mosquito-borne viruses are different to all other viruses in that they infect two very different kinds of organisms, mosquitoes and vertebrates. Mosquitoes act as “vectors” in order to transmit the virus between vertebrate “hosts”, but to enable this cycle to be successful, the virus must be able to grow in the cells of both mosquitoes and vertebrates. The vertebrate hosts may be animals or birds, with humans usually being incidental, ‘dead-end’ hosts rather than primary hosts. The transmission cycle must always alternate between the mosquito vector and the vertebrate host; that is, transmission cannot occur from vertebrate host to vertebrate host directly, but only through a mosquito bite. This alternation between mosquito and vertebrate will obviously be profoundly affected by a large number of external factors, especially environmental and climatic conditions.

The external factors which affect the mosquito vector include the importance of water for mosquito breeding, be it rainfall, flooding, irrigation, high tides, or even drought (as rivers and streams stop flowing and become reservoirs of mosquito larvae); the importance of temperature so that the mosquito can hatch and develop, but also so that the virus can grow in the mosquito (the mosquito has no temperature control mechanism – its temperature is that of the external environment); the importance of humidity so that the mosquito can survive without desiccation; and the necessity of ‘cover’ so that the mosquito can rest safely during the heat of the day. Some factors also affect the vertebrate host; thus there must be sufficient new, non-immune susceptibles, which have not been previously infected, to enter the transmission cycle, and they must be attractive to the mosquito as providers of blood meals.⁶

A person infected with JE can have signs and symptoms ranging from mild fever to meningitis. The virus can appear as a flu-like illness with headache, fever, gastrointestinal symptoms, confusion and other behavioural disturbances. In 1 in about every 200 cases, the

5. Hanna, J., Ritchie, S., Phillips, D., Shield, J., Bailey, M., Mackenzie, J., Poidinger, M., McCall, B., and Mills, P. (1996) “An outbreak of Japanese encephalitis in the Torres Strait, Australia, 1995” in *The Medical Journal of Australia*, Vol. 165, No. 5, 2 September 1996

6. Mackenzie, J., (1998) *Mosquito-borne viral diseases and human behavior: a recipe for disaster?* (paper presented at Horizons-in-Science Forum, February 1998)

illness progresses to inflammation of the brain, with more than half those cases ending in permanent disability or death. The case fatality rate is 25%, with 30% of cases having psychiatric sequelae. There is currently no effective drug treatment for the disease once it sets in – it can only run its course.⁷

The first line of defence against JE is to take personal protective measures against mosquitoes. There is a vaccine available, however the vaccine is not 100% effective. The vaccine is an injected vaccine, and three doses are required for the development of protective antibody levels in vaccinees who are not continually exposed to the virus from birth.

Adverse reactions to the vaccine include, commonly, local swelling, redness and tenderness and 10% of recipients are reported to have systemic adverse reactions such as fever, headache, malaise, rash, dizziness, myalgia, nausea and vomiting. Adverse events include hypotension, collapse, shock and respiratory distress, even death.

The vaccine is not 100% effective. To be at its most effective, the recommended vaccine schedule is over a period of 38 days, with doses given on day 0, day 7 and day 28, with a 10 day waiting period after the last dose to enable an adequate buildup of the immune response and as a precaution against delayed adverse reactions. Three-yearly booster doses are recommended.

In 1995, JE appeared in the Torres Strait of northern Australia for the first time, appearing to have jumped 3000 kilometres from the nearest known focus of activity in Bali, and caused three cases of clinical disease with two deaths.⁸

It was subsequently found that it has become endemic in Western Province of Papua New Guinea (PNG), probably since at least 1989, and the first three human cases there were observed in the latter part of 1997 and early 1998, one of which was fatal.

7. National Health and Medical Research Council, (1997) *The Australian Immunisation Procedures Handbook, Sixth Edition*, Australian Government Printing Service, Canberra

8. Mackenzie, J., Poldinger, M., Phillips, D., Johansen, C., Hall, R., Hanna, J., Ritchie, S., Shield, J., Graham, R., (1997) "Emergence of Japanese encephalitis virus in the Australasian region" in Saluzzo, J. and Dodet, B. (eds) *Factors in the Emergence of Arbovirus Diseases*, Elsevier, Paris, pp. 191-201

More recently, JE virus re-appeared in the Torres Strait in February-March 1998 with a clinical case in a child from Badu Island, and with widespread activity in domestic pigs on at least six islands in the northern and central Torres Strait. Then in March 1998, the first human case from mainland Australia was recognised in a fisherman from the Mitchell River area (near Kowanyama) of Cape York, and shortly after, seropositive sentinel pigs were reported from near Bamaga. Both recent human cases from Badu and from the Mitchell River area were relatively mild, and the patients have recovered.

Although the human case and the pig seroconversions from Cape York tend to suggest that JE virus may have entered Australia, it is unknown whether the virus has become established. Several important factors have still to be ascertained, including the susceptibility of the wild pigs to the virus compared to domestic pigs, particularly their potential to act as amplifier hosts, and the role of other flaviviruses in competition for vertebrate hosts.

What does this scenario have to do with regional security and the Defence Forces? Common concerns in regional engagement with the potential to cause tension between countries are trade, resource protection and economic growth. These issues are all directly or indirectly affected by the possible establishment of JE in Australia.

Firstly, there are potential economic impacts of the establishment of JE in Australia. Although there have been no specific studies in this area, the examples below illustrate some possibilities.

If JE did become established, Australia could experience difficulty in its animal export trade. Under international agreements Australia is obliged to report the confirmation of diseases such as JE in animals to the Office International des Epizooties in Paris. (The seroconversion of pigs in Cape York was reported in April.) Although the region in which seroconversion was found is localised, the potential consequences to our export trade are enormous.

There could also be major repercussions for tourism. One of the attractions of travel to Australia is that tourists do not require vaccinations. If JE becomes established in the north of Australia, it is possible that tourists may have to consider JE vaccination, and therefore look elsewhere in the region to spend tourist dollars.

The cost of vaccine for humans living in the high risk areas would also create a financial burden on our health system. In 1995, 9,000 people were vaccinated in the Torres Strait. At an approximate cost of \$195 (\$US126) per vaccination course, this limited vaccination program would have involved expenditure of \$ 1,755,000 (\$US1,113,400) for vaccine alone. Additionally, the lead time for procurement of large quantities of vaccine could be considerable because of its complicated production process. Twelve months is the estimated time frame for supply of extraordinary quantities of vaccine.⁹

Similarly, the cost of immunisation of domestic animals (especially pigs) could have severe financial repercussions.

Attempts to reduce mosquito populations by spraying and other methods of mosquito control have potential effects on other insect and animal species in the region. Environmental impact assessments with respect to mosquito numbers and/or breeding sites and potential vertebrate host numbers are essential to determine the likely consequences of changes in land use, notably for urban, mining, and water impoundment developments, as well as changes in agricultural practices.

The establishment of JE on mainland Australia also has potential political impacts, some of which are suggested below.

Given our large live animal export market, there are possible effects on our relations with trading partners if we or they felt that conditions placed on export/import were too restrictive or too loose.

If mass vaccination campaigns caused a run on vaccine supplies, there is potential for disruption to regular supplies to other countries, creating tension.

Although not really an issue in this case, diplomatic relations between countries could be affected if a specific country is suspected of having contributed to the problem, for example if there was a direct link established between changes in land practices, or incursions of people bringing infected animals.

9. Commonwealth Serum Laboratories

Apart from the flow-on of the political and economic impacts on their role as protectors of the national interest, there are direct impacts on military forces as well.

For example, the 38 day time-lag needed to ensure maximum efficacy of the JE vaccine could cause delays in deployment on operations and exercises, or cause rescheduling or resiting of exercises programs.

Combined exercises planned to take place in affected areas may also require rescheduling or resiting, or other participants may require vaccination.

Additionally, the cost of the vaccine as detailed for the general community would have a similar cost for the military, diverting scarce funding resources from other areas. Using the same price of \$A195 per person, the cost of vaccinating the Australian Defence Forces of 50, 000 would be \$A9.75 million!

Management of feral pigs on exercise/training areas and management of mosquito populations would also be an issue.

Having canvassed some of the negative impacts of the possible establishment of JE, in what positive ways can the military forces contribute to the national interest on this issue?

Military organisations can contribute to national surveillance systems, for example preventive medicine or environmental health assets carrying out mosquito survey tasks and pooling data with national bodies, as has recently been done by the Royal Australian Air Force at the Scherger Bare Base near Weipa, Cape York.

By researching and testing best control techniques, repellents and barriers, military organisations can not only provide protection for their own personnel, but contribute to information available to the general community. For example, the Army Malaria Institute has carried out research work on identification of improved anti-vector agents/methods.

In addition to carrying out eradication programs related to military activities, military resources could be used in community vector eradication programs.

Military forces have an obligation to ensure that disease vectors and host animals do not enter or leave the country aboard military transport or with military personnel. While feral pigs as stowaways would be difficult to overlook, mosquitoes can and have transported exotic diseases, such as 'airport malaria'.

The question of whether JE could become established in northern Australia and the consequences of that are of considerable concern to Australia. The suitable vertebrate hosts, both ardeid waterbirds and wild pigs are readily available and intermingle with mosquitoes in coastal wetlands and swamps. There are both political and economic repercussions both in the general community and to the Defence Forces. However, forewarned is forearmed, and there is time to ameliorate the major effects of this emerging disease within Australia. This example, however, illustrates the unpredictable consequences of the introduction of non-indigenous species and the importance of maintaining vigilance in preventing such introduction to new regions.

GLOSSARY

arbovirus	<i>any of a group of viruses which are transmitted to man by various mosquitoes and ticks; those transmitted by ticks are often considered in a separate category</i>
ardeid	<i>relating to herons; a family of wading birds in the order Ciconuformes</i>
flavivirus	<i>subcatechory of togavirus, which is subgroup of arboviruses</i>
host	<i>a person or living animal including birds and arthropods that affords subsistence or lodgment to an infectious agent under natural conditions</i>
seroconversion	<i>the development of anti-bodies in response to infection or administration of a vaccine</i>
vector	<i>an insect or living carrier that transports an infectious agent from an infected individual or its wastes to a susceptible individual or its food or immediate surroundings</i>
zoonosis	<i>an infection or infectious disease transmissible under natural conditions from vertebrate animals to man</i>

DISCUSSION

Environmental Challenges that Threaten Regional Security

It was generally acknowledged that all of the environmental challenges covered in the group discussion had an economic impact. The impact was discussed by the participants and then grouped into four broad fields.

1. Commerce

The workshop participants identified commerce as a broad area comprising the sub-sets of trade and tourism. Commerce will be adversely affected by non-indigenous invasive species (NIIS) as a result of a decreased demand for products which are perceived as bringing with them the risk of NIIS. In addition, the aggregate output of the products may be reduced by NIIS behavior or competition.

The level of tourism may similarly decrease as areas are despoiled by NIIS and become less attractive to potential visitors. For example, tourists might be discouraged from visiting a particular area if they are required to be vaccinated against such vector borne diseases as malaria or Japanese encephalitis.

2. Domestic production

This second general area includes agriculture, aquaculture and fisheries, which might suffer as NIIS provide direct competition for resources and elements necessary for production, such as fertile land areas, food and water. Agriculture may also be affected due to a reduction or degradation of land, decreased in usefulness through the invasive or predatory behaviour of NIIS.

3. Environmental impact

A significant environmental impact will result from the process of ecological disruption. Natural habitats will be degraded by non-indigenous species where they alter environments through their invasive behavior. The NIIS will come into contact with indigenous species and their supplies of food and water. As the NIIS are more adaptable or successful they will either destroy indigenous species as prey, or indirectly reduce their numbers through competition. The outcome of this process is a reduction in the number of indigenous species, possibly to threatened levels or extinction, and finally a

reduction in biodiversity. This process will degrade the overall environment.

4. The social impact

The group subsumed political issues under the broad category of social impact. The social impact includes effects on public health, such as the requirement for immunization and other medical treatment costs from various infectious diseases that might be contracted from NIIS. The participants also identified the detrimental effect on quality of life as an important negative social impact, particularly in a disease-laden area.

The political impact may include the international isolation of the country by other countries and the resulting disconnection of the country from the normal operation of the international system. Not only might there be an isolation of the country from other members of the international community, but possibly the isolation of districts of people within a country.

The political repercussions also account for a negative impact on defence forces. The military impact involves the loss of the use of training areas, resulting in the loss of training opportunities. This is likely to result in a reduction of the readiness of the local military forces, consequently degrading national security.

Another impact for defence forces which is directly related to the loss of land use is the depletion of resources associated with efforts to restore the area. Imparting opportunity costs as one has to spend money for control activities or reclamation. The costs associated with control activities or reclamation may diminish the military's ability to purchase new equipment, develop new areas, and so forth.

Opportunities for Defence Cooperation

As with the challenges to security, the participants identified possible areas for defence cooperation within four broad categories.

In general, the group believed that although the opportunity for cooperation was limited, emergency response operations are particularly likely to feature the defence force.

1. Duty of care

Overall, defence forces have a 'duty of care' in maintaining and preserving the environment locally, regionally and globally. International defence forces should cooperate in the area of environmental management. This is particularly the case when defence forces use a foreign area; defence forces should treat the environment as they would treat their own national territory. This expectation should be reciprocal among regional or global partners and allies.

All exercises and operations must involve the responsible use of the environment, particularly in terms of moving equipment and personnel to and from exercise and training areas. The environment should be taken into consideration in the scope of the mission to the greatest possible extent. This may include responsibility in the areas of quarantine, environmental standards and restoration activities.

2. Information exchange

Information must be exchanged among defence forces, civilian agencies and non-governmental organisations. This information exchange can be achieved through the use of the Internet, through training and exchanges, and during meetings, councils and expert forums. These meetings could address specific regional problems or issues which are of global concern. Training activities and exchanges may be done on a country-wide and regional basis.

The identification of central points of contact for locating and generating information was strongly supported. Related to this point was the establishment of a network for the dissemination of information. This exchange could benefit specific countries, and the region in general. Surveillance is another area in which information can be exchanged and consolidated. The information with respect to NIIS could incorporate, for example, the identification of diseases; predictive mechanisms can be enhanced through the identification of trends.

3. Emergency response

Emergency response frequently includes defence capabilities, often toward assisting in logistics and the transportation of the assets in support of other agencies during crises. They may also serve as a direct defence response to the NIIS.

The participants saw the need for detailed contingency planning prior to a crisis. The goal of the operation should be immediate control of the NIIS. One example of emergency response is the provision of health support.

4. Research and development

Work in the field of research and development presents an opportunity for defence cooperation. Coordination among regional defence forces will enable them to maximize their combined capabilities for the regional control of NIIS. Regional forums could address the relevant issues through workshops. Priorities in research and recommendations could be devised once the regional issues and problems have been identified.

CHAPTER VIII

PLENARY SESSION VI – ENVIRONMENTAL DISASTER RESPONSE

There is a range of disasters (fires, floods, earthquakes, volcanoes, typhoons, and tsunami) which regularly cause significant damage throughout the region. For example, 1997 and 1998 brought everything from forest fires in Indonesia, typhoons in Japan, torrential rains in East Africa, drought in Australia, a typhoon on Guam, unusually powerful hurricanes in the Pacific and tropical cyclones in the Central Pacific, to record storms pounding the western coast of the United States, and a freak ice storm in southern Canada. These events have caused loss of life, major flooding, loss of property, loss of natural resources (wildlife and fish habitat), increased disease in some cases; and polluted air and water.

This topic will explore the military's role in responding to these disasters.

Questions

- How should the military respond to such disasters? Is regional cooperation possible?
- How should the roles and responsibilities of the military and non-military forces be delineated?
- Who should be in charge?
- How to ensure effective command and control during the response?
- What are the militaries' unique capabilities that could be used in response?
- What are the national security implications of responding to a disaster?

- Does the military have a role in planning disaster response activities nationally? Regionally?

Introductory Remarks

Mr. Rod McKinnon, *Director Policy Planning and Coordination, Emergency Management Australia* moderated the Workshop's final plenary session on the topic of *Environmental Disaster Response*.

Mr. McKinnon explained that the topic would emphasize the role of the military in disaster response. Mr. McKinnon clearly demonstrated the significance of the topic by reminding the participants of the myriad of disasters which have taken place throughout the last year around the world and in the Asia Pacific region in particular. Many of these disasters have caused considerable damage, loss of life, and general disruption to the communities which have experience them.

Mr. McKinnon suggested that disaster response is clearly an area of concern, to the extent that the Asian Regional Forum, which consists of about twenty countries around the world, and a number of key NGOs, has formed an inter-sessional meeting to look at disaster relief, specifically looking at cooperation between countries and their militaries in disaster relief. It has met twice thus far, in Wellington, New Zealand in February 1997 and in Bangkok in February 1998. Mr. McKinnon noted that the meetings highlighted the diversity in approach among the countries, and he himself admits that he came away from the Bangkok meeting thinking that, "we really were not going anywhere". Mr. McKinnon suggested that perhaps the very forum he was addressing would have some thoughts on improving cooperation during disaster response operations.

Australia's Emergency Management Arrangement and the Role of the Military

The Hazard

Australia's physical geography makes it vulnerable to a wide range of natural disasters. Additionally, as a resource rich, technologically advanced country there is potential for man-made

disasters to occur. Nevertheless, Australia is fortunate in that while disasters cause considerable damage, they have not to date resulted in the deaths of large numbers of people. Disasters faced by Australia include earthquake, bushfire, tropical cyclones, flood, severe storm, landslide, tsunami, exotic animal disease and hazardous material, transport and industrial accidents.

Australian Arrangements

Australia's emergency management philosophy is based on self-help at the local level particularly in the early stages of a disaster. This philosophy also relies on a partnership between all levels of government. State and Territory Governments have prime responsibility for the protection of life and property within their jurisdiction. This is achieved through legislation, State/Territory Emergency Management Committees, well established and practised emergency management/disaster plans, and emergency service organisations such as police, fire, ambulance, State/Territory emergency services and other non-government and volunteer organisations.

The Federal Government provides guidance and support which includes the provision of assistance on request from a State or Territory. This assistance can only be requested by one authorised officer in each State and Territory. It must be approved by the Minister for Defence, acting as the Commonwealth Disaster Coordinator, and is then coordinated by Emergency Management Australia (EMA). Assistance can be provided by any Federal agency including the Australian Defence Force (ADF).

Role of the Australian Defence Force

The ADF does not have a mandated role to provide disaster relief. It is not trained in specific disaster related skills, equipment is not procured with disasters in mind and indeed, it may not be available when required due to other higher priorities. Nevertheless, it is a valuable resource in supporting State/Territory agencies during disaster. Assistance could be provided in the form of air and surface transport, communications, personnel, general stores and equipment, health services and engineer equipment.

Assistance can be provide by a local commander without reference to higher authority for the immediate saving of life or property. However, more extensive assistance requires the approval of the Minister for Defence and must be requested by the authorised officer through EMA. ADF elements provided in support of a State/Territory retain their own command structure but support the civilian disaster controller.

Overseas Assistance

Requests for overseas disaster assistance are processed through diplomatic channels to the Australian Agency for International Development (AusAID). If AusAID agrees to a request, assistance is coordinated by EMA and can be provided by any federal agency or NGO. If the ADF is tasked, the command and control principles are the same as for dealing with disasters in Australia.

DO MILITARY FORCES HAVE A ROLE TO PLAY IN DISASTER RELIEF

**Captain (N) B.R. 'Bear' Brown
Canadian Forces Adviser, The Canadian High Commission,
Australia**

Do Military Forces have a Role to Play in Disaster Relief?

Capt Brown introduced his presentation by answering this somewhat rhetorical question with a categorical “yes”. He explained that over the next few minutes he would like to show why – by illustrating some developments that have occurred worldwide and in particular, through some experiences of the Canadian Forces. Capt Brown added that he hoped it would become clear that the military has the wherewithal to respond in many situations but also, and this is important, it cannot do it alone.

Participation in disaster relief and humanitarian operations is not a new task for the Canadian Forces (CF). The CF have had standing tasks to provide engineer support to hurricane relief in the Caribbean for decades. As well, the Canadian Forces have provided medical facilities to the Kurish refugee camps in Iran/Iraq in 1991 and CF personnel played an important role in the aftermath of hurricanes in Florida in 1992. The Canadian Forces also participated in the international response to the Rwandan Crisis in 1994. At home, the CF has provided relief from floods and forest fires for many years. Later, the Canadian Forces' recent flood and ice storm operations will be considered in some detail.

In fact the 1994 Defence white paper identifies disaster relief as one of the specific tasks for the Canadian Forces.

This tasking allowed the forces to focus some of its planning effort on disaster relief and the initial effort was in the area of international response where the CF developed Oplan Griffon, which will be discussed in more detail shortly.

In the case of domestic humanitarian emergencies, each land force area in Canada is responsible for reacting to emergencies within

their own boundaries. Following approval of a provincial request for assistance the area response team deploys as quickly as possible. If the scope of the emergency exceeds the capability of the affected area, the commander may request the support of other areas, commands and national units. It goes without saying that the Canadian Forces work very closely with Emergency Preparedness Canada (EPC) in these types of situations. EPC has a vital role to play in any response to a national disaster.

This role for the military is not something that only Canada has identified. Most militaries have a capability to respond and plans in place to cater to a wide range of disasters for example one of the intercessional groups of the ASEAN regional forum has as its sole focus the role of militaries in disaster relief. This group includes all of the ASEAN countries as well as many other pacific players. Capt Brown confirmed that having himself attended a couple of their sessions, it is clear that many countries have plans in place and others are developing plans and the capabilities to make a contribution in this area. Indeed, talk of regional support plans is well underway.

Similarly, the United States Military has recently completed Exercise Emerald Express 98 which was co-hosted by CINCPAC (Commander-in-Chief Pacific) and CINCCENT (Commander-in-Chief US Central Command). It was a very large symposium held at Camp Pendleton in California and the purpose of the symposium was to understand the challenge of humanitarian assistance and disaster relief.

It seems clear that militaries do have a role to play but why are militaries useful, what do we bring to the table.

Looking at past deployments and contemplating those of the future the military's strengths are:

- A strong command and control system with sufficient well trained, well structured and responsive people.
- Good communications and ADP systems for both internal and external purposes.
- Good surveillance and intelligence (Zaire example)

- Expertise in disaster specific areas – medicine, fresh water, logistics delivery.
- Rapid mobility including the ability to get to remote sites.

These are all key as, in conducting the staff estimate for international humanitarian emergencies, a number of recurrent considerations were revealed.

First, in order to be of any utility, a response has to arrive and begin rendering aid before the effects of a crisis, for example an epidemic due to man-made or natural disaster, have come to a head. Generally this critical time period is one week and the needs are usually potable water, medical supplies and services, communications and limited engineering support.

Second, because of this critical time period, an international response would undoubtedly have to be moved by air due to the need for speed.

Third, mechanisms had to be developed to facilitate rapid, well-informed decisions by government to mitigate international crises. To that end, several initiatives were taken including the establishment of a standing working group including the Department of Foreign Affairs and International Trade (DFAIT), the Department of National Defence (DND), the Canadian International Development Agency (CIDA) and other aid agencies, development of protocols between different government departments for the handling of humanitarian requests, provision of a draft agreement between Canada and a potential host nation to speed up this critical process.

An attempt has been made to this point to show that militaries do have a role to play and a bit of the how and why but, are the armed forces experts in this field. Here the answer is a categorical – No. Any planning for these scenarios must include input from NGO and aid agencies as they are the experts and the ones who will be there for the long run. Military support is best brought to bear at the front end to establish stability so that the experts can take over. Similarly, on the national front, planning must include EPC or like organisations from the affected country.

Breaking down the barriers between the military and these other agencies is critical. In the Canadian experience, as the CF developed OP Griffon, the international aid plan, NGO and aid teams were brought in from the outset. When Canada commanded the multi-national force in Zaire, the commander's key advisory team included NGO and Aid Agency representation. This need for a combined approach is being organised by others as well and again one can refer to Exercise Emerald Express 98 which included participation by the US Department of State, the military, the United Nations, NGO's and private volunteer organisations. Representatives from over 25 nations participated.

International Response

The Canadian Forces Humanitarian Rapid Response commitment is imbedded in the Disaster Assistance Response Team or DART. It is on 48 hours notice to move from the time of a government decision to respond. The equipment is prepositioned at CFB Trenton, the home of airlift command and the troops are provided, on annual rotation, by one of the army areas. Training exercises are held on the handover of responsibility for the tasking and include a complete setup of a camp and the verification of inventory.

The DART's mission is to provide humanitarian assistance for a period not exceeding 40 days. This will be done in collaboration with the host nation, the UN, NGO's and International Agencies. Mission endstate is achieved when other national or international agencies are in place, when the disaster's effects have been mitigated or when other of humanitarian follow-up options have been deployed.

The DART structure is based on modules which can be plugged or unplugged based on the humanitarian need of the day. These modules include a headquarters element, a medical platoon (40 personnel to handle up to 500 outpatients per day), a composite engineering troop (fresh water, mine awareness, minor structural tasks) and a logistics platoon. The DART has been designed to deploy a permissive area but does also include a security infantry platoon to deal with thieves and looters and other unorganised criminals. This platoon also provides a ready source of trained labour for general duties associated with rescue and refugee situations.

On receipt of a request for humanitarian aid, all of the relevant factors will be considered and National Defence will make a recommendation to DFAIT as to whether the DART is a viable option. Once approved, the advance party will deploy within twelve hours and the main body 36 hours after that. Liaison with NGO's and the aid agencies will be heightened to determine the long term plan so that the DART can redeploy within 40 days.

The military planning for the DART was challenging but the CF now has a very potent capability. But, it is important to reiterate, it cannot work on its own. The establishment of direct and lasting contacts with other government departments, the United Nations Department of Humanitarian Affairs and High Commission for Refugees, NGO's and International Aid Agencies such as CARE Canada, the Canadian Red Cross and the Canadian Council of International Co-operation has been crucial. From discussions since his own arrival in Australia, Capt Brown pointed out that similar talks have taken place between Defence and AUSAID.

National Disasters

Capt Brown then turned to national disasters, natural or man-made, that simply swamp the ability of local authorities – municipal or provincial. As stated earlier, military forces represent a ready pool of innovative, flexible and reliable manpower and specialised equipment which can quickly step down and deal with some of the worst that mother nature can dish out.

Capt Brown suggested that he should preface what he was about to say with the observation that he is becoming a bit leery about the adjectival phase “of the century.” It has been linked to a series of natural disasters:

First, the flooding of the Quebec Saguenay Region in the “Storm of the Century” which drenched the watershed of the Saguenay River with over two hundred millimeters of rain in a weekend;

Secondly; to the “Flood of the Century” in the Manitoba Red River Valley that threatened to overwhelm the floodway and dikes around Winnipeg one year ago; and

Lastly; just this past January, in the “Ice Storm of the Century” that plunged over four million people in eastern Ontario, the cities of

Montreal and Ottawa and the eastern township region of Quebec into cold darkness.

Each of these events was marked by the request for military assistance to local authorities. After exhausting all other avenues, disaster relief is the responsibility of one or more of the land force areas.

Over the years there has been a continual employment of limited numbers of military personnel to assist in searches for missing persons, emergency air evacuation of remote communities threatened by forest fire, personnel to act as fire fighters and shelter for personnel trapped by snow storms. Historically, Canadian forces involvement has seldom exceeded the readily available resources of units maintained on standby in each area. As a matter of routine, each land force area maintains one battalion as a standby force with one sub-unit tasked to be available within four hours. As a relatively localised occurrence, the Saguenay Flooding was managed from within the local resources of the Quebec Area.

Op Assistance

Big disasters present a different situation. The 1997 Spring Flood of the Red River south of Winnipeg, Manitoba, a city of 600,000 people, necessitated the deployment of some 8,500 members of the Canadian Forces from 21 April to 31 May to assist local authorities in the worst flooding in over 150 years. Major flooding occurred from as far south as Fargo in North Dakota to Winnipeg in the north with the Canadian portion of the “Red Sea” representing approximately one third of the flood plain. By way of comparison, imagine a new lake 100km wide, stretching from Sydney to Goulbourn or similarly, stretching from London, England west over half the distance to Bristol. This was a challenge.

Aside from the expected activities of filling sand bags, manning emergency shelters and assisting in the evacuation of several communities, one of the major military activities was helping extend a dike by 34km to prevent the flood from making an end run around the existing dike. This work which would normally take 2-3 months was completed in 6 days.

Capt Brown then turned to consider some of the lessons learned from this deployment. As early as February 97 there were several indicators of the probability of massive flooding in southern Manitoba and initial direction was given to Land Force Western Area (LFWA) to commence contingency planning.

It was not until mid-April however, when the extent of the devastation in the US was apparent, that provincial authorities came to appreciate that they would need Canadian Forces support. In essence, the land force commander was restrained from making effective preparations in consultation with provincial authorities.

There were similar problems within the Canadian Forces as there was minimal joint planning between LFWA and the Airforce and Navy. As a consequence, although an initial contingency plan was developed by Land Force, it was carried out in isolation and there was minimal planning with other agencies involved. Even though EPC is part of Defence, working relationships at the Federal and provincial levels had not been developed to the point that things worked as well as they should have. Action has been taken to redress these issues and significant progress has been made.

Of greater concern was the realisation that not all the players had a good understanding of the different classes of assistance that National Defence can provide to civil authorities. In this instance, all the players interpreted the approval of the request for assistance from the province of Manitoba as an open-ended support package. This included low level material and personnel assistance to the Federal and Municipal police forces. In the initial stages Canadian Forces personnel were supporting limited police enforcement operations without legal authority. This was subsequently corrected through application by the provincial Minister of Justice to the Solicitor General of Canada but Military personnel should not have been put in an illegal position. The whole issue of classes of support to civil authorities has been resolved through the publication of a new guidance document on the subject.

Lastly was the concern that the National Defence Operations Centre (NDOC) was not properly configured or staffed to deal with this type of emergency. Action has been taken to correct deficiencies in this area through the provisions of better links with other

government departments and an enhanced working relationship with EPC.

It was not long before there was an opportunity to determine whether these corrective actions would work.

Op Recuperation

The ice storm of January 1998 resulted in the largest deployment of Canadian Forces personnel on operations since the end of the Korean War. Just four short months ago, mother nature unleashed her full fury on Eastern Canada when a warm, moist southerly flow courtesy of El Nino (yes, it can be blamed for everything), collided with a northerly flow of arctic air (the norm for Canadian winters). The result was a week-long series of ice storms that paralysed eastern Ontario, the entire city of Montreal, the Monteregie region of Quebec and parts of the Atlantic Maritimes. The scale of the disaster was beyond the worst case scenarios of hydro officials, in fact, the overall result was the wholesale destruction of the regional power grid.

A few statistics will serve to illustrate the point: In Quebec, roughly 3,525,000 people were without power in the dead of Canadian Winter. In Eastern Ontario, an additional 600,000 people were similarly affected. Essentially, El Nino turned off the power to a city of four million people in temperatures of minus 20 degrees Celsius and kept it off, in some areas, for over a month. Hundreds of major transmission towers had collapsed and thousands of kilometres of line were down.

There were large scale disruptions in telephone service as thousands of telephone poles had snapped under the weight of ice laden wires. In many places ice on power and telephone lines was 9 cm thick which caused excessive loads in crosswinds for which supporting towers were not designed. In Eastern Ontario alone, hydro had to replace 11,447 hydro poles, 84,482 insulators, 2,151 transformers and rewire 2,804 km of cable – enough to reach from Ottawa to Miami for those of us from North America and for our hosts, from Melbourne to Perth.

Sector Quebec was the lead land force area and the Commander's foresight in correctly assessing the massive scope of the problem led him to get all his available resources on the move and pre-positioned

well before the local authorities came to grips with the magnitude of the damage and the problem. It was quickly identified that the challenge was beyond the capability of Sector Quebec and local authorities and a brigade from Land Force Western Area was deployed in support. Ontario Area was providing the troops to Bosnia and so was only able to provide limited support.

At the peak of the recuperation almost 15,800 personnel were deployed. Behind the scene national defence military and civilian personnel who provided aircrew, warehousing, re-supply and administrative support brought the total to over 22,000. The vast majority were regulars but almost 4,000 reservists answered the call to service.

The major tasks facing the military in this situation were to assist in the prevention of the loss of life, to help re-establish essential services and to assist in the clearance of debris. In Ontario the military set up a camp to house and feed 800 hydro workers who were rebuilding the power grid in rural areas. Rounds of thousands of homes were done daily to ensure residents were coping and to identify hazardous heating practices. Of the 27 people who died during this period, many were the result of carbon monoxide poisoning due to improper heaters. The military also assisted local shelters and with the delivery of essential commodities including potable water produced from reserve osmosis plants.

Two side benefits are of note. For many Canadians, this was their first direct contact with the military and it proved to be a rewarding experience for all. Secondly, Canadians could not help but wonder how the military could only be paid about a hundred dollars a day for their efforts with no overtime while the people they were working with were earning as much as sixteen hundred dollars a day.

Again, there were a number of lessons learned.

First, the land force area concept was proven to be valid for this kind of operation. The basic responsibilities of the land areas include the coordination of domestic operations for which they have developed contingency plans. These plans must have sufficient scope to include liaison with other authorities (Federal and municipal), to take other area forces under command and, for very large operations, to hand over command to the deployable joint force headquarters.

Second, the need to mobilise a very large and complex support group for an operation of this size was only possible due to the flexibility and capability of the various Canadian forces support units. It will be necessary to assess whether a contracted-out organisation could have coped which means we have to look at our concepts of “alternative service deliver” and ‘just in time delivery’.

Finally, we need to have a close look at developing criteria for what constitutes endstate. We obviously cannot abandon people in need but by the same token, we cannot become a crutch that inhibits returning things to their proper state.

Conclusion

Responses to these events “of the century” have given the Canadian Forces an opportunity to refine how we plan to conduct future joint operations. Much has been learned and much remains to be incorporated into our plans for any future humanitarian relief or disaster scenario. There is no doubt that military forces have much to offer and must be there as a last line of hope when the scope of the disaster overwhelms local cognisant authority. The effectiveness of the Canadian Forces is perhaps best summed up in the words of our Minister of National Defence following the ice storm.

“The storm of the century highlighted one of the Canadian Forces most essential roles: protecting the lives and property of Canadians in times of crisis. Operation Recuperation was the largest peacetime deployment of the Canadian Forces in history. Your ability to mobilise such large numbers in such a relatively short time and sustain this very high level of effort is testimony to your professionalism and dedication.

As with the devastating floods in Manitoba and the Saguenay region, Canadians saw their military up close, and they were impressed. The Forces have a proud history of responding to those in need anywhere in the world. And now, once again, you have demonstrated to all Canadians that you are truly a national treasure.”

THE ROLE OF THE REPUBLIC OF KOREA MILITARY IN ENVIRONMENTAL DISASTER RESPONSE

**Colonel Imsuk Yang
Ministry of National Defence,
Republic of Korea**

Colonel Imsuk Yang is Director, Office of Environment, Ministry of National Defence, Republic of Korea. Col Yang presented two case studies, both of which occurred in 1995, in order to demonstrate what the Korean Military is doing to manage or control disasters.

Col Yang first provided some briefing information on Korea itself, Korean military law, government law and then some information on the military organisation and the law controlling disaster control, two case studies and some lessons.

Introduction

Korea is in the northern part of Asia. Compared to Australia, it is a very very small country but the population is very large – with about 45,000,000 inhabitants. There is very heavy traffic day and night. South Korea is less than 100,000 square kilometres in size. The Korean Military has been well trained since World War II. After the Korean War, South Koreans needed to become more powerful for protection against North Korea. So with the cooperation of the United States forces the Korean Military is very well trained. The Army numbers about 450,000 army, the Navy approximately 40,000, and some 25,000 Air Force.

Disaster Response Laws

The government of Korea has a disaster control law. 1995 was a very important year in terms of disaster control because prior to 1995 there were many losses. The Fire Department controlled certain functions and the Health Department also had some responsibilities. All the functions and responsibilities were put together and two laws

were made. One is the *Natural Disaster Response Law*; code number 4993. This law was passed on 6 December 1995.

This law governs most natural disasters such as typhoons, storms, floods, snow storms, earthquakes, and so forth. We have a Disaster Response Committee chaired by the Minister of the Interior; the committee is made up of 14 vice-ministers.

The *Man-made (anthropogenic) Disaster Management Law* was passed in July 1995. This law governs fires, collapse, explosions, traffic accidents; chemical, biological or radiological (CBR) accidents, and environmental pollution, *etc.* The Central Safety Management Committee is responsible for the law; the chairperson is the Prime Minister. There are 11 ministerial-level committee members including the Minister of National Defense.

Military Orders for National Disaster Response

The Republic of Korea has two orders for national disaster control response. One is for Search and Rescue. This is Minister of National Defense (MND) Order 463. It was adopted 21 December 1995 and is the responsibility of the Joint Chiefs of Staff committee. The mission is Readiness in Action for Search and Rescue. The Military has to be prepared to search 24 hours a day/ 7 days per week. The response capability requires a reaction of no less than 30 minutes anywhere in the country.

The second is Orders for General Disaster Response. This is MND Order Number 435. It was adopted on 31 August 1991 and is currently being rewritten.

Response System of Search and Rescue Headquarters

Disaster response is controlled from a headquarters. The Director of Logistics in the MND is the chairperson and the members are the 12 section chiefs, including Col Yang himself. The mission is Command and Control during response. This response system for search and rescue works under the Joint Chiefs of Staff. The Central Safety Management Committee and the Disaster Response Committee also have responsibilities. There is a Search Team Control Headquarters which is responsible for the respective Army, Navy and Air Force Search Teams.

The Army has eight teams, the Navy and Air Force each have four teams. Our Air Force and Navy must react within five minutes if they are given a mission. This means that planes have to take off within five minutes.

Case Studies

Col Yang offered two cases studies by way of illustration. The first case involved a drought in the southern area of Korea. It occurred from 13 July 1994 to 8 October 1994. More than 170,000 military personnel participated in relief efforts. 5,600 items of equipment and machinery were used. The military provided in excess of 47,500 tonnes of fresh water per day. The drought was very severe – indeed the most severe within the last 70 years.

The second case involved a wrecked tanker, the *Sea Prince* which had a capacity of 140,000 tonnes. The wreckage occurred on 20 July 1995, off the southern coast of Yeuchon City. It is estimated that more than 5000 tonnes of oil were spilt. The military response in manpower support totalled some 15,600 personnel, and about 400 pieces of equipment and machinery were employed.

Lessons Learned

Traditionally the Korean military has played a very important role in controlling or managing either man-made or natural disasters because the forces are very well trained and have very good equipment. From these kinds of lessons and experience, there are some things that need to be improved. First, there is a need to improve communication channels with non-military forces.

Next is a need to secure equipment and try to improve the responsiveness of these forces. There is also a need to clarify the line of command, as was mentioned before; there is also a need to improve efficiency of the joint training between the military and the non-military forces, such as fire-fighters, for example.

A few years ago, Sampung department store collapsed. At the time, the Korean military emergency rescue team was needed but there were too many helicopters around. They could not communicate with one another, and this caused a lot of problems.

DOMESTIC AND FOREIGN DISASTER RESPONSE

**Major John Henshaw
Special Operations Civil Affairs,
US Pacific Command**

Maj Henshaw introduced his discussion with an explanation of domestic and foreign disasters, providing examples of each. He then offered clear illustrations about humanitarian assistance.

Domestic disasters are defined as those which occur within the United States, its territories and protectorates. Military responders such as the State National Guard troops are often the first to respond to disasters.

Once the disaster is declared the Federal Emergency Management Agency assumes the United States Government lead for co-ordinating their response. They are in command and control.

Some examples assist in illustrating this point: last year, major floods occurred in Nebraska when spring thaw and spring storms occurred simultaneously. The Nebraska State National Guard played a major role in disaster relief, and the Federal Emergency Management Agency (FEMA) was the primary federal player.

In this event, the Department of Defense (DOD) active component military was not involved. Without prior authorisation from FEMA, the active component, Department of Defense, may not be reimbursed for the cost of an operation; however a commander is authorised at any time to do whatever it takes to prevent loss of life or human suffering.

Last month, numerous tornadoes in several American states created disastrous situations to which FEMA and State National Guard immediately responded. Another example of FEMA and National Guard assets being used to assist disaster victims was the California earthquakes. Each year in the western United States, wildland forest fires require disaster-type assistance. It is not uncommon for US Commander-in-Chief Pacific Command (CINCPAC) to provide forces to combat the blazes annually.

Hurricane Andrew in Florida, a few years ago, culminated in co-ordinated disaster response planning with FEMA, State National Guard, and over 10,000 federal troops from two army divisions including civil affairs and psychological operations soldiers; about a million people were displaced during this disaster and over a billion dollars damage occurred.

When super typhoon Parker recently struck Guam, disaster response assets immediately swung into action. After a major disaster, DOD assets will respond to preserve life and property, but commanders must assess and balance the effectiveness of unit readiness and mission capability. Most of the military response during this disaster was on the military bases which were somewhat devastated while FEMA contracted local response. US DOD airlift assets proved to be highly effective in transporting critical and sometimes oversized equipment to the disaster area.

When a Korean Airlines DC10 crashed in a secluded area on Guam a few months ago, US military responders were among the first on site to render assistance and continued to help throughout the duration of the mission.

In foreign disaster response the US State Department's Office of Federal Disaster Assistance (OFDA) takes the lead. Personnel at US Pacific Command (PACOM) maintain close and continual liaison with OFDA throughout the disaster cycles, often times providing DOD assistance when needed. During disasters, the focus of the disaster assistance response team is to co-ordinate the assessment and recommend a US Government response and manage the US government activities.

Foreign Disaster Assistance may include everything from funding, transportation, supplies, services and equipment for relief. Requests for assistance are initiated from the US ambassador. Once he or she makes a disaster declaration the request is passed to the Department of State. From there the request goes to OFDA and if needed to Department of Defence. OFDA then conducts an assessment. It may provide \$25,000 for immediate relief. If DOD involvement is warranted, US CINCPAC does have the capability to deliver disaster related humanitarian assistance programme excess property supplies to fit the needs of the victims. The country and OFDA determine any additional needs.

If US CINCPAC obtains permission to assist, pre-packaged relief supplies from the humanitarian assistance programme, excess property programme, can be sent immediately. This aid consists of palletised items most commonly needed in response to any disaster such as plastic sheeting, medical supplies, water, tools, blankets and cots.

The worst ecological disaster last year in the Pacific occurred when the forests of Indonesia burned out of control. US CINCPAC coordinated three Wisconsin Air National Guard C130 aircraft equipped with the US Forestry Service Modular Airborne Fire Fighting system (MAFF) for 60 days to combat the blazes. This is a prime example of a small single service task force, in this case it was the US CINCPAC's Pacific Airforce.

Under the humanitarian assistance programme the largest US CINCPAC disaster relief operation to date was in Bangladesh during the catastrophic 1991 cyclone and flood. About 9,000 US marines, soldiers, airmen and sailors with amphibious craft, helicopters and cargo planes conducted a massive relief operation. Inherent in disaster response of course is humanitarian assistance. There are many programs for humanitarian assistance, for example, in Palau the US civic action team in 1992 assisted in the construction of a clamp arm which aided in the improvement of quality of life and the local economy. A hydroponic greenhouse also constructed by the civic action team in one of the federated states of Micronesia is another example of humanitarian assistance.

Not only is excess DOD medical property donated to other countries, but there is a programme in place to train others on the use of the donated medical equipment as well as to train medical practitioners on routine medical procedures. With millions of land mines scattered throughout numerous countries our active de-mining programme provides a level of humanitarian assistance beneficial to the environment as well as to the affected populations.

Examples of recent US CINCPAC humanitarian assistance/disaster relief:

- Pacific bridge, when a bridge collapsed, cutting off a portion of the population fresh water was provided on Palau for an extended period;

- The KL DC10 crash rescue and recovery operation efforts;
- Humanitarian assistance and excess property relief supplies were provided to victims in Vietnam after Typhoon Linda;
- During Pacific Haven, we provided a safe haven for over 6000 Kurdish refugees; and lastly
- Two aircraft loads of humanitarian assistance relief supplies were provided to the victims of the China earthquake to the victims.

In conclusion, disaster relief remains an integral part of the engagement strategy at Pacific Command.

DISCUSSION

Environmental Issues and Challenges

The discussion among those who participated in the session on Environmental Disaster Response revealed that there are a number of short and long-term challenges which have various impacts on solutions and planning. The participants concluded that given the magnitude of these issues, there would be no differentiation to any great extent among immediate, short-term issues on the one hand, and long-term issues on the other. Indeed, the vast majority of the issues had elements which were both short and long-term.

1. Inadequate infrastructure

The term “infrastructure” is understood in the broadest sense. Everything that underpins the lifeblood of a country may be subsumed under the definition of infrastructure.

With every disaster there is an immediate, short-term requirement to provide for basic needs in the affected area, including food, water, shelter and medicine. Many countries that will be affected by a disaster have very limited resiliency and often no redundancy in their infrastructure.

In both the short and long-term issues – such as handling displaced persons – accommodating social and ethical factors, providing adequate resources, and improving the local response capacity must be addressed.

Long term, preventive measures to lessen the impact would include providing assistance in reinforcing infrastructure in relevant countries, thereby ensuring some reserve capacity to deal with the effects of a disaster once it occurs.

2. Transboundary impacts

The participants determined that the transboundary effects of a disaster constituted a challenge when discussing how smoke from the forest fires in Indonesia had affected a much larger region. It was felt that in these types of scenarios, finger pointing should be avoided. Matters of responsibility and accountability in transboundary issues require resolution at the highest levels to avoid the escalation of tension.

As such, there is a need for strong leadership at all levels throughout the structure of the country – the highest level of government, within the military, and down to and including the NGO's on the ground. There must be sound leadership able to communicate a plan and respond flexibly when required.

A vigorous information and education program in both the donor and recipient countries is necessary to ensure public support.

3. Instability

The onus is on the political leadership to develop an effective action plan to deal with local security problems. This will require internal resources and may require external support.

If there is a lack of security, or if there is a perception of threat, displaced persons or refugees will be unwilling to return. In the absence of local security, crime, civil unrest, and potentially social unrest in the longer term will follow. Although all nations will want to depend on local capacity there may be a requirement to engage international organizations and agencies. Creating stability is the key for long term solutions.

4. Information exchange

The lack of effective communication systems can impede rapid and accurate information exchange. There is a requirement for coordination and education across governments, agencies, and organizations such as militaries, NGOs, donors, recipients and international organizations.

5. Clear mandate

The key to success in complicated scenarios, particularly in complex emergencies, is a clear mandate for action which includes a very clear extraction plan.

The mandate for action requires that a government makes the request through the normal and appropriate channels. The issue of rules of engagement is particularly important for the military. In addition, NGOs and international organisations must have a clear understanding of the specific requirements and what they are expected and entitled to do in a particular country or region.

Opportunities for Defence Cooperation

1. Cooperative agreements

It should be possible to capitalize on the vast array of existing treaties, arrangements and organizations as a means to focus on this area. The objective is to encourage discussion and cooperation on issues related to the deployment of disaster response teams, particularly in terms of cooperation and coordination among military and civilian agencies and organizations.

Country to country talks were suggested as a means of improving information and technology exchange, developing standard operating procedures, and integrating planning and training. Equally important is the need for common and reciprocal communication, education and training among military and civilian agencies. The use of gaming sessions in joint training among military, NGO and civilian communities could assist in breaking down communication barriers and cultural differences, while encouraging cooperation at both the command and operational level during interagency operations.

A continuous process of interaction among these groups would eventually lead to joint headquarters/coordination center capability that would allow for proactive coordination prior to a crisis and effective action during a crisis. It is essential that all actors be part of the solution.

2. Command and control arrangement

In addition to the need for a clear mandate, there must be a defined concept of operations and an effective command and control structure.

In missions that involve coordinated military, NGO and civilian resources there should be a clear and efficient division of responsibilities and agreed operating procedures. There is a requirement that the process validate the roles of all the players to ensure that each is performing the function they do best so that they may effectively undertake the relief effort. In order to facilitate civil-military interaction at the disaster site, an efficient coordination and liaison mechanism should be established.

3. Capacity building

The key to successful capacity building is the development of proper education and training programs such as the US Pacific Command's Disaster Preparedness Planning Surveys (DPPS), which could be incorporated into the overall capacity building plan for each country. In this sense, information sharing will increase the effectiveness of the response as well as provide opportunities for defence cooperation. Exercises, personnel exchanges, particularly between military and civilian agencies, will be important in fostering new partnerships. These partnerships will be important for the development of disaster warning mechanisms and the creation of contingency plans. The military is included in this category. The military possesses many capabilities which might contribute to preventing disasters from occurring in the future. For example, military assistance or training could be provided in terms of bridge building, fortification of infrastructure, and in some cases, environmental remediation practices. Exchanges to this end would benefit local training while simultaneously supplying a much-needed technology to a particular country or region.

The above examples will reinforce local capacity to deal with disasters; defence has an opportunity to cooperate in each of the suggested areas.

4. Information Exchange

There is a need to ensure that the right kinds of information get to the right people. The same information that is to be disseminated to different agencies, military, government, non-governmental organizations, should be tailored to the particular needs, objectives and uses of the specific group. Clearly, government decision-makers need different information than the NGO on the ground.

A system needs to be put in place so that information gathering and sharing is reciprocal.

APPENDICES

ATTENDEE LIST

Berthiaume, Holmer, Mr
Head, Pollution Prevention & Harzardous Materials, Department Of Defence
D Env P2
National Defence Headquarters
101 Colonel By Drive
OTTAWA, ONTARIO, CANADA K1A OK2
(W) +613 995 3617 Fax +613 992 9422
ac184@issc.debbs.ndhq.dnd.ca

Bobai, Tebano Kabiri, Mr
Under Secretary, Ministry Of Police & National Security
PO Box G.1723
HONIARA, SOLOMON ISLANDS
(W) +677 24510 Fax + 677 25949

Bowling, Curtis, Mr
Assistant Deputy Under Secretary Of Defence, U.S. Department Of Defense
O.D.U.S.D (E.S) E.Q
3400 Defense Pentagon
WASHINGTON, DC, USA 20301-3400
(W) +1 703 604 1624 Fax +1 703 607 3124
bowlincm@acq.osd.mil

Brown, B.R., Captain
Canadian Defence Advisor, Canadian High Commission
AUSTRALIA

Butts, Kent, Dr.
Professor
Centre For Strategic Leadership
U.S. Army War College
CARLISLE BARRACKS, PA, USA 17013-5050
(W) +1 717 245 3728 Fax +1 717 245 4309
buttsk@csl-emh1.army.mil

Colgan, Katherine, Miss
Senior Adviser Ballast Water Section, Australian Quarantine & Inspection Ser
GPO Box 858
CANBERRA, ACT, AUSTRALIA 2601
(W) +612 6272 3198 Fax +612 6272 3036
katherine.colgan@dpie.gov.au

Corey, Rod, Mr
Head Defence Estate, Department Of Defence
C.P3-3-1
Campbell Park Offices
CANBERRA, ACT, AUSTRALIA 2600
(W) +61 2 6266 4300 Fax +61 2 6266 4084
rod.corey@deo.defence.gov.au

Delaney RAN, Jonathan R, Commander
Director Of Environmental Management Navy, Naval Headquarters Canberra
Russell Offices A-2-28
Department Of Defence
CANBERRA, ACT, AUSTRALIA 2600
(W) +61 2 6265 4877 Fax +61 2 6265 5050
Jon.Delaney.2113@navy.gov.au

Dorjtseden, Lamjav, Mr
Deputy Director Of Department Of Policy Coordination, Ministry Of Nature
And The Environment
Government Building
Baga Toiruu 44
ULAANBAATAR, MONGOLIA
(W) +976 1 312 257 Fax +976 1 321 401

Downs, Anthony, Mr
Director General Environment, National Defence
Directorate Of Environmental Protection
National Defence Headquarters
MGen George R. Pearkes Building
OTTAWA, ONTARIO, CANADA K1A 0K2
(W) +613 995 0923 Fax +613 992 9422
aa991@issc.debbs.ndhq.dnd.ca

Driggers, Donald, Colonel
Director Defense Pest Management, ODUSD (ES) Armed Forces Pest
Management Board
Forest Glen Section WRAMC
WASHINGTON, DC, USA 20307-5001
(W) +1 301 295 7476 Fax +1 301 295 7473
driggedp@acq.osd.mil

Dumbrell, Naomi, Ms
Policy Adviser, Environment Australia
International Coordination Section
CANBERRA, ACT, AUSTRALIA 2601
(W) +61 2 6274 1460 Fax +61 2 6274 1858

Egan, Pete, Dr
Environmental Biologist, ODUSD (ES) Armed Forces Pest Management Board
Forest Glen Section, WRAMC
WASHINGTON, DC, USA 20307-5001
(W) +1 301 295 7485 Fax +1 301 295 7473
eganpj@acq.osd.mil

Elliott, Lorraine, Dr
University Lecturer, Australian National University
Department Of Political Science
Faculty Of Arts
CANBERRA, ACT, AUSTRALIA 0200
(W) +61 2 6249 0589 Fax +61 2 6249 0589
lorraine.elliott@anu.edu.au

Fang Zhendong, Dr
Deputy Chief, Science Research Institute
Logistics Engineering College
Chinese People's Liberation Army
No 174 Changjiang Er Road
CHONGQING, CHINA 400016
(W) +86 236 8817676 Fax +86 236 8817676

Fekh L., Vladimir, Mr
Deputy Head Of The Service Of Petroleum & Supply, The United States
Defense
Attache Office
99 Furmanov St
ALMATY, KAZAKHSTAN 480036
(W) +8 3272 21880 Fax +7 3272 507620

Frost, Pam, Ms
Analyst, Strategic Health Intelligence, Defence (Australian)
Defence Headquarters
C.P4-6-13
Campbell Park Offices
CANBERRA, ACT, AUSTRALIA 2601
(W) +612 6266 3836 Fax +612 6266 3784
hints-mail@bigfoot.com

Gorry, George, Mr
Russian Interpreter
(W) 0419 032836

Henshaw, Johnny, Major
Civil Affairs Operations Officer, Civil Affairs
Headquarters USCINCPAC (J322)
Camp Smith
HONOLULU, HI, USA 96861
(W) +1 808 477 5571 Fax +1 808 477 0618
henshajd@hq.pacom.mil

Ho-Chia Siang Pio, Mrs
Staff Officer, Ministry Of Defence Headquarters
SINGAPORE

Hobbs RAN, Richard, Commander
Director Environmental Security Cooperation, Defence Estate Organisation
C.P4-3-3
Campbell Park Offices
CANBERRA, ACT, AUSTRALIA 2600
(W) +612 6226 3734 Fax +612 6266 3692
richard.hobbs@deo.defence.gov.au

Hooke, Cameron, Lt. Colonel
Deputy Director Facilities & Infrastructure Policy, Australian Defence
Headquarters
F-3-19
Russell Offices
CANBERRA, ACT, AUSTRALIA 2600
(W) +61 2 6265 5046 Fax +61 2 6265 6313

Hou Bingde, Sr. Col.
Deputy Director, Bureau Of Environmental Protection, Environment Protection
& Afforestation Bureau
General Logistics Department
23 Taiping Road, Dept. Of Capital Construction & Barracks
Chinese People's Liberation Army
BEIJING, CHINA 10036
(W) +86 10 6821 5393 Fax +86 10 6821 5393

Hux, Jackie, Ms President/ Program Manager, Team Consulting Inc
5515 Cherokee Ave
Suite 407
ALEXANDRIA, VA, USA 22312
(W) +1 703 256 6661 Fax +1 703 256 3810
jhux@tteam.com

Jargalsaikhan, S, Mr
Director Of Energy & Environment,
Baruon Selbe 13
Room # 208
ULAANBAATAR, MONGOLIA
Fax +976 1 322199

Jones, David, Major
U.S. Army Exchange Officer, Defence Health Service Branch
Department Of Defence
C.P4-6-33
Campbell Park Offices
CANBERRA, ACT, AUSTRALIA 2600
(W) +612 6266 3909 Fax +612 6266 3784
ddjones@bigfoot.com

Lipnick, Robert J, Ltc
Deputy Commander, U.S. Army Center For Health Promotion & Preventative
Medicine
CHPPM-PAC, Attn: McNB-AJ-O
SAGAMI, APO AP, JAPAN 96343-5006
(W) +81 3117 63 8489 Fax +81 3117 63 8597
rlipnick@email.zama.amedd.army.mil

Maeda, Kiyoto, Mr
Deputy Director, Facilities Division, Finance Bureau, Japan Defense Agency
JAPAN
kj-maeda@ka2.so-net.or.jp

McCarron, Kathleen, Ms
Staff Officer Strategic Health Intelligence, Department Of Defence
Defence Headquarters
C.P4-6-13
Campbell Park Offices
CANBERRA, ACT, AUSTRALIA 2600
(W) +612 6266 2245 Fax +612 6266 3933
hints-mail@bigfoot.com

McKinnon, Rod, Mr
Director, Policy Planning & Coordination, Emergency Management Australia
PO Box 1020
DICKSON, ACT, AUSTRALIA 2602
(W) +612 6266 5328 Fax +612 6257 7665
rmckinnon@ema.gov.au

Meekins, Warren, Mr
Director, D.E.S.C.I.M. P.M.O.
201 Stoval Stree
Room 12555
ALEXANDRIA, VA, USA 22311
(W) +1 703 325 0002 Fax +1 703 256 3810
wlmeekin@aec.apga.army.mil

Miles, Gerald, Mr
Head, South Pacific Regional Environmental Program
Environmental Management & Planning Division
PO Box 240
APIA, SAMOA
(W) +685 21 929 Fax +685 20 231
SPREP@SAMOA.NET

Murphy, Jim, Mr
District Supervisor, Wildlife Services, US Dept. Of Agriculture
A.P.H.I.S.
3375 Koapaka Street
Suite H420
HONOLULU, HI, USA 96819
(W) +1 808 861 8576 Fax +1 808 861 8570
mmateo@aphis.usda.gov

Oldenberg, Gary, Mr
State Director WA/HI/AK/Pacific Islands, Wildlife Services, US Dept. Of
Agriculture
A.P.H.I.S.
720 O'Leary ST NW
OLYMPIA, WA, USA 98502
(W) +1 360 753 9884 Fax +1 360 753 9466
jgaryold@orcalink.com

Phinney, Catherine, Ms
Environmental Security Policy Officer, Department Of National Defence
Directorate Of Environmental Protection
National Defence Headquarters
MGen George R. Pearkes Building
OTTAWA, ONTARIO, CANADA K1A 0K2
(W) +61 3 995 2375 Fax +61 3 992 9422
AD465@issc.debbs.ndhq.dnd.ca

Pitzler, Mike, Mr
District Supervisor, Wildlife Services, US Dept. Of Agriculture
A.P.H.I.S.
1060 Route 16
Suite 103C
BARRIGADA HEIGHTS, GU, USA 96921
(W) +1 671 635 4400 Fax +1 671 635 4401
mpitzler@ite.net

Rae, Michael, Mr
Program Leader - Resource Conservation, World Wide Fund For Nature
1st Floor
9 Church Street
HAWTHORNE, VIC, AUSTRALIA 3122
(W) +61 3 9853 7244 Fax +61 3 9853 4156
wwfmrae@ozemail.com.au

Rathbun RNZN, William, Captain
Director Land & Facilities Management, New Zealand Defence Force
Headquarters, NZDF
Defence House
Private Bag
WELLINGTON, NEW ZEALAND
(W) +64 4 4960 934 Fax +64 4 4960 929
HQNZDF.LFM@xtra.co.nz

Rudich USN, Bill, Captain
Chief Engineering Division, US Pacific Command
ATT: J44 Box 64020
CAMP HM SMITH, HI, USA 96861-4020
(W) +1 808 477 6011 Fax +1 808 477 0876
wirudich@hq.pacom.mil

Saha, Vijaya Lakshmi Ruby, Mrs
Chief Planner, Government Of Mauritius
PORT LOUIS, MAURITIUS
(W) Fax +230 212 4240
tsaha@intnet.mu

Saomasi, Lester Huckle, Hon.
Minister, Ministry Of Police & National Security
PO Box G.1723
HONIARA, SOLOMON ISLANDS
(W) +677 26178 Fax +677 25949

Shevlin, John, Lt. Commander
Staff Officer 1, Navy Headquarters
Department Of Defence
Russell Offices A-3-30
CANBERRA, ACT, AUSTRALIA 2600
(W) +61 2 6265 1011 Fax +61 2 6265 2036
Tony.Ladamirski.111106@navy.gov.au

Sims, Peter, Lt Col
Regional Estate Manager - Northern Region, Defence Estate
Robertson Barracks
PALMERSTON, NT, AUSTRALIA 0830
(W) +61 8 89352 715 Fax +61 8 89352 699

Standen, Peter, Mr
Senior Environmental Advisor, P.T. Cmps
C/o L10 Arthaloka Building
JL Jend Sudirman No. 2
JAKARTA, INDONESIA 10220
(W) +62 21 2512544 Fax +62 21 251 2545

Sukardi, Kar, Mr
Vice Chairman BAPEDAL, Bapeda
L11 Arthaloka Building
JL Jend Sudirman No. 2
JAKARTA, INDONESIA 10220
(W) Fax +62 212511576

Theriot, Edwin A, Dr
Chief / Aquatic Ecology Branch, U.S Army Corps Of Engineers
3909 Halls Ferry Road
VICKSBURG, MS, USA 391806199
(W) +1 601 634-2678 Fax +1 601 634-2398
therioe@ex1.wes.army.mil

Tirae, Kamaua, Mr
Assistant Superintendent Of Police, Kiribati Police Force
Police Headquarters
PO Box 497
BETIO, TARAWA, KIRIBATI
(W) +686 26187 Fax +686 26370

Urquhart, Kim, Ms
Director, Environment And Heritage, Department Of Defence
C.P4-3-8
Campbell Park Offices
CANBERRA, ACT, AUSTRALIA 2600
(W) +61 2 6266 4707 Fax +61 2 6266 2076
kim.urquhart@deo.defence.gov.au

Vest, Gary, Mr
Principal Assistant Deputy Under Secretary Of Defense, U.S. Department Of
Defense
O.D.U.S.D (E.S)
3400 Defense Pentagon
WASHINGTON DC, USA 20301-3400
(W) +1 703 697 1013 Fax +1 703 693 7011
gvest@acq.osd.mil

Walker, Martin, Mr
Environment Branch
Department Of Foreign Affairs And Trade
RG Casey Building
John McEwen Crescent
BARTON, ACT, AUSTRALIA 0221
(W) +612 6261 2647 Fax +612 6261 2594
martin.walker@dfat.gov.au

Walton, Craig, Mr
Senior Scientist, Australian Quarantine & Inspection Service
Plant Quarantine Policy Branch
Policy And International Division
GPO Box 858
CANBERRA, ACT, AUSTRALIA 2601
(W) +61 2 6272 5564 Fax +61 2 6272 3307
craig.walton@dpie.gov.au

Wing, Ian, Lt. Colonel
Chief Of The Defence Force Scholarship Fellow, Australian Defence Studies
Centre
Australian Defence Force Academy
CANBERRA, ACT, AUSTRALIA 2600
(W) +612 6268 6253 Fax +612 6268 8440
i-wing@adfa.oz.au

Woods, Robert, Mr
Head, Natural Resources (Rural), Department Of National Defence
Director General Environment
National Defence Headquarters
101 Colonel By Drive
OTTAWA, ONTARIO, CANADA K1A 0K2
(W) +613 995 4087 Fax +613 992 9422
aa991@issc.debbs.ndhq.dnd.ca

Yang, Im-Suk, Colonel
Director, Office Of Environment, Ministry Of National Defense
Health & Environment Bureau
Yongsan-Ku
Yongson-Dong
SEOUL, KOREA 140-723
(W) +82 2 748 5430 Fax +82 2 796 0369
yuri@cybergal.com

Zhang Peng, Sr. Colonel
Staff Officer, Foreign Affairs Bureau
General Logistics Department
22 Foxing Road
Chinese People's Liberation Army
BEIJING, CHINA 100842
(W) +86 106 821 5393 Fax +86 106 821 5393

**Biography for
Catherine A.J. Phinney, BA (Hons), MA**

Catherine Phinney is a Policy Officer at Canada's Department of National Defence where she is actively involved in domestic and international environmental security issues. She was previously employed at the Lester B. Pearson Canadian International Peacekeeping Training Centre in Nova Scotia where she lectured on Russian peace operations in the Former Soviet Union and served on the President's executive staff. Ms. Phinney was awarded a Master of Arts in International Conflict Analysis from the University of Kent at Canterbury, England and a Bachelor of Arts in Political Science from Carleton University, Ottawa. In 1994, she studied Russian Foreign Policy at the Institute for the USA and Canada in Moscow. Her publications include her Master's thesis, *Defending the National Interest: Russian Conflict Management in the Former Soviet Union* (1996) and *Enhancing Conflict Termination Through Problem-Solving* for the journal *Peacekeeping and International Relations* (1997).

Biography for Kent Hughes Butts

Kent Hughes Butts holds the George C. Marshall Chair of Military Studies and is Professor of Political Military Strategy in the Center for Strategic Leadership, U.S. Army War College. A graduate of the U.S. Military Academy, he holds a Master's degree in Business Administration from Boston University, an M.A. and Ph.D. in Geography from the University of Washington, and was a John M. Olin Post-Doctoral Fellow in National Security at the Center for International Affairs, Harvard University. He is a graduate of the U.S. Army War College, and is author or editor of numerous environmental publications, and co-author of the book, *Geopolitics of Southern Africa: South Africa as Regional Superpower*, published by Westview Press. His recent environmental publications include: "European Environmental Security Threats and Solutions," in *Environmental Policy With Economic and Political Integration: The European Community and the United States*, (1996) and the "Strategic Importance of Water." *Parameters*. Spring 1997. In 1997 he served as head of the U.S. Delegation to and co-chaired the NATO / CCMS pilot study meetings in Prague and Warsaw.

Agenda

Monday, 11 May 1998

- 0800 – 0900 Registration
Pre Function Foyer, First Floor – Rydges Plaza Hotel
- 0850 MAJ. GEN. Connolly arrives
- 0900-0920 **Welcome and Workshop Objectives**
Welcoming Remarks, Introductions and Workshop
Objectives
Mr. Rod Corey, Head Defence Estate, Australia
- 0920- 0940 Opening Address
MAJ. GEN. Jim Connolly, Commander Australian
Theatre
- 0940-1010 Morning Tea
- 1010-1040 **Keynote Address**
Dr. Lorraine Elliott, Political Science Department
- 1045-1145 **1st Plenary Session**
Definitions and Concepts

Moderator - Dr. Kent Butts
Center for Strategic Leadership
U.S. Army War College

Presenter – Mr. Michael Rae, World Wide Fund for
Nature

Presenter – LTCOL Ian Wing, 1998 CDF Fellow

Objective: To establish clear, workshop definitions that
will permit purposeful communication between policy-
makers, diplomats, NGOs, and military professionals
from different countries, and allow them to address
defence cooperation on environmental issues in the
context of regional security. This session will provide a
comon starting point for participants.
- 1145 MAJ. GEN. Connolly departs
- 1145-1200 Syndicate arrangements, computer access, DENIX
demonstrations and general administration.
Arrangements for the afternoon tour.

1200-1300	Lunch at Rydges Plaza Hotel
1300-1400	Travel to Territory Wildlife Park
1400-1630	Visit the Territory Wildlife Park & “Birds of Prey” Display.
1700-1800	Return to Hotel

Tuesday, 12 May 1998

0730-0800	Coffee Service
0800-0815	Announcements and Administrative Information
0815-1100	2nd Plenary Session Energy, Environment & Global Climate Change Moderator - Professor Kent Butts Presenter - E&E - Indonesia (Mr Kar Sukardi) Presenter – E&E - Sri Lanka (Mr K.A.S. Gunasekera) Presenter – E&E - Mongolia (Mr. Dortjseden) Presenter – GCC – Mauritius (Mrs. Ruby Saha) Presenter – GCC – US (Mr. Curtis Bowling) Presenter - GCC – <i>SPREP</i> (Mr Gerald Miles) Presenter – GCC – Australia (Ms Kathy McCarron) “Environmental Change and Health: Implications for the Australian Defence Force”. Objective: To discuss the security implications of changes to regional energy consumption associated with rising economic growth and examine the potential impacts of Climate Change. Although the rate of consumption of energy will vary with economic cycles, the region is expected to lead the world in increased energy demand for the next decades. This additional energy consumption will increase: air pollution from burning fossil fuels; maritime traffic, especially tankers; risks of marine pollution, especially from oil; risk of marine disaster causing damage to economically important ecosystems like coral reefs; and may contribute to global climate change. The direct effects on human health of energy consumption and climate change will be addressed.
0930-1000	Refreshments

1100-1200	Panel/Open Discussion
1200-1300	Lunch at Rydges Plaza Hotel
1300-1330	Group Photograph - Rydges Plaza Main Staircase
1330-1420	3rd Plenary Session Fisheries & Marine Protection Moderator – Mr Anthony Downs Presenter – <i>SPREP</i> (Mr Gerald Miles) Presenter – Australia (LCDR John Shevlin) Objective: To provide background to participants on land and water quality management in the catchment, reef, and inshore waters. Focus on issues which affect the quality of water which, in turn, have a significant impact on conservation of fish stocks. Include issues such as biodiversity, ecosystem management, prevention of pollution and the ecologically and economically sustainable usage of coastal waters. Address the protection of coral reefs, effects of vessels transiting these areas and discharge of bilge and ballast water.
1420-1500	Panel/Open Discussion
1500-1520	Refreshments
1520-1610	4th Plenary Session Information and Technology Exchange There will be a facility to continuously demonstration DENIX throughout the workshop week. ADF will provide a temporary installation of 3 PCs with internet connections. ‘LightPro’ screen projection facilities will be available for this session. Moderator – Mr Warren Meekins (USA) (0:10) Presenter – <i>SPREP</i> – (Mr Gerald Miles) (0:20) Presenter – USA (Ms Jackie Hux) (0:20) Objective: To provide background to participants on Information and Technology Exchange, with emphasis on establishing a reliable mechanism for information exchange, developing a proposal for the type and style of an exchange, and ensuring that only desired information is forwarded and existing arrangements are enhanced but not duplicated.

1610-1745	Personal Time
1745-1800	Travel by coach to “ Pee Wees at the Point”
1800-1930	Reception hosted by the Trilateral Partners
1930-2000	Return to Darwin Town by coach
2000-800	Dinner (personal choice of venue) and Rest Over Night

Wednesday, 13 May 1998

0730-0800	Coffee Service
0800-0810	Announcements and Administrative Information
0810-0840	Breakout Game - Briefing. Moderator - Prof Kent Butts Objective: To explain the Game Scenario and Roles to the participants focusing their thinking about the defence dimensions of contemporary environmental issues within their specific geographic region.
0840-1200	Game & Workshop Session 1 Workshop Participants move to allocated Game Rooms Team Leader - Energy and the Environment - <i>tba</i> Team Leader - Global Climate Change - <i>tba</i> Team Leader - Fisheries and Marine Protection - <i>tba</i> Objectives: (1) Identify the Environmental Challenges and Issues that threaten regional stability within your topic area; (2) Identify Opportunities for Defence Cooperation; and (3) Put them into a briefing to be presented in plenary session the final day of the workshop.
0840-0940	(Phase I) Environmental Challenges / Issues that Threaten Regional Stability
0940-1110	(Phase II) Opportunities for Defence Cooperation
0950-1010	Refreshments available – may be taken to Game Rooms if desired

1110-1210	(Phase III) Preparation of Recommendations / Briefing
1210-1310	Lunch in Rydges Plaza Resort
1310-1550	5th Plenary Session Non Indigenous Invasive Species Management Moderator - Col Don Driggers (USA) Presenter – USA (Mr Gary Oldenberg) Impact of Non-Indigenous Invasive Animal Species (0:15) Presenter – USA (Dr Mike Pitzler) “The Brown Tree Snake Program in Guam” Presenter – USA (Mr Jim Murphy) Control of Non-Indigenous Invasive Vertebrate Species Presenter – Australia (Mr Craig Walton) Impact of Non-Indigenous Invasive Plant Species Presenter – Canada (Mr Bob Woods) Non-Indigenous Invasive Plant Species Impact on Range Management Presenter – Australia (Ms. Kathy Colgan) Impact of Marine Organisms in Ballast Water and on Ships Hulls Presenter – USA (MAJ David Jones) Role of a US Exchange Officer with the ADF Presenter – Australia (Ms Pam Frost) “Direct Impacts on Human Health of Non-Indigenous Species - A Case Study of feral pigs as a potential reservoir for Japanese Encephalitis transmission” Objective: To provide background to participants on Non Indigenous Invasive Species Management. These flora and fauna reduce the economic productivity and ecological integrity of land and water. Issues to be examined include stopping the spread of more invasive species and reducing the impact of existing invasive species.
1600-1625	Questions
1625-1655	Discussion Panel
1655-1815	Personal Time
1830-1900	Travel by coach to Workshop Dinner
1900-2200	Workshop Dinner at Christo’s on the Wharf
2200-2230	Travel back to Darwin Town

2230-0800 **Rest Over Night**

Thursday, 14 May 1998

0730-0800 **Coffee Service**

0800-0810 **Announcements and Administrative Information**

0810-0900 **6th Plenary Session**
Environmental Disaster Response

Moderator – *Mr Rod McKinnon*

Presenter – Canada (CAPT(N) B Brown) Does the
Military have a Role in Disaster Relief

Presenter – Korea (COL Imsuk Yang) Case Studies

Presenter – US (MAJ Johnie Henshaw)

Objective: To provide background to participants on the
of disasters which regularly cause significant damage
throughout the region. The workshop will explore the
military's role in responding to these disasters. Items for
consideration include planning, coordination, response,
and training.

0910-0930 **Panel / Open Discussion**

0930-1220 **Game & Workshop Session 2 (2:50)**

Workshop Participants move to Game Rooms Game
Breakout Sessions

Team Leader - Information and Technology Exchange -
tba

Team Leader - Non Indigenous Invasive Species
Management - *tba*

Team Leader - Environmental Disaster Response - *tba*

Objectives:

- (1) Identify the Environmental Challenges and Issues
that threaten regional stability within each team
topic area;
- (2) Identify Opportunities for Defence Cooperation; and
- (3) Prepare briefing for final plenary session.

0930-1020 **(Phase I) Environmental Challenges / Issues that
Threaten Regional Stability**

1000-1030	Refreshments available – may be taken to Game Rooms if desired
1020-1120	(Phase II) Opportunities for Defence Cooperation
1120-1220	(Phase III) Preparation of Recommendations / Briefing
1220-1320	Lunch at Rydges Plaza Hotel
1320-1650	Reports and Conclusions
1320-1350	Breakout Session Report - Energy and the Environment and Global Climate Change (20 minute presentation; 10 minute Q&A)
1350-1420	Breakout Session Report - Fisheries and Marine Protection (20 minute presentation; 10 minute Q&A)
1420-1440	Refreshments
1440-1520	Breakout Session Report - Information and Technology (20 minute presentation; 10 minute Q&A)
1520-1550	Breakout Session Report - Non Indigenous Invasive Species Management (20 minute presentation; 10 minute Q&A)
1550-1620	Breakout Session Report - Environmental Disaster Response (20 minute presentation; 10 minute Q&A)
1620-1650	Concluding Remarks

** The Presenter of the Briefing Session Report will be the Team Leader unless there is another suitable volunteer to undertake the role.