Transboundary Water Resources: A Foundation for Regional Stability in Central Asia

NATO Science for Peace and Security Series

This Series presents the results of scientific meetings supported under the NATO Programme: Science for Peace and Security (SPS).

The NATO SPS Programme supports meetings in the following Key Priority areas: (1) Defence Against Terrorism; (2) Countering other Threats to Security and (3) NATO, Partner and Mediterranean Dialogue Country Priorities. The types of meeting supported are generally "Advanced Study Institutes" and "Advanced Research Workshops". The NATO SPS Series collects together the results of these meetings. The meetings are co-organized by scientists from NATO countries and scientists from NATO's "Partner" or "Mediterranean Dialogue" countries. The observations and recommendations made at the meetings, as well as the contents of the volumes in the Series, reflect those of participants and contributors only; they should not necessarily be regarded as reflecting NATO views or policy.

Advanced Study Institutes (ASI) are high-level tutorial courses intended to convey the latest developments in a subject to an advanced-level audience

Advanced Research Workshops (ARW) are expert meetings where an intense but informal exchange of views at the frontiers of a subject aims at identifying directions for future action

Following a transformation of the programme in 2006 the Series has been re-named and re-organised. Recent volumes on topics not related to security, which result from meetings supported under the programme earlier, may be found in the NATO Science Series.

The Series is published by IOS Press, Amsterdam, and Springer, Dordrecht, in conjunction with the NATO Public Diplomacy Division.

Sub-Series

A.	Chemistry and Biology	Springer
B.	Physics and Biophysics	Springer
C.	Environmental Security	Springer
D.	Information and Communication Security	IOS Press
E.	Human and Societal Dynamics	IOS Press

<http://www.nato.int/science>

<http://www.springer.com>

<http://www.iospress.nl>

Series C: Environmental Security

Transboundary Water Resources: A Foundation for Regional Stability in Central Asia

Edited by

John E. Moerlins

Florida State University,
U.S.A.

Mikhail K. Khankhasayev

Florida State University,
U.S.A.

Steven F. Leitman

Florida State University,
U.S.A.

and

Ernazar J. Makhmudov

Institute of Water Problems,
Uzbek Academy of Sciences,
Uzbekistan

Published in cooperation with NATO Public Diplomacy Division

Proceedings of the NATO Advanced Research Workshop on
Facilitating Regional Security in Central Asia through improved Management
of Transboundary Water Basin Resources
Almaty, Kazakhstan
20–22 June 2006

A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN 978-1-4020-6735-8 (PB)
ISBN 978-1-4020-6734-1 (HB)
ISBN 978-1-4020-6736-5 (e-book)

Published by Springer,
P.O. Box 17, 3300 AA Dordrecht, The Netherlands.

www.springer.com

Printed on acid-free paper

All Rights Reserved

© 2008 Springer Science+Business Media B.V.

No part of this work may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission from the Publisher, with the exception of any material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work.

CONTENTS

Preface	ix
----------------	----

Introduction to NATO Advanced Research Workshop on Transboundary Water Management in Central Asia <i>John E. Moerlins and Ernazar J. Makhmudov</i>	1
--	---

Part I: Transboundary Water Management Problems in the Central Asia Region

1. Problems of Water Resource Management in Central Asia <i>Ernazar J. Makhmudov, Ilhomjon E. Makhmudov, and Lenzi Z. Sherfedinov</i>	11
2. Communicating the Issues of the Aral Sea Basin Long-term Vision for the Aral Sea Basin the Aral Sea Basin Management Model (ASB-MM) <i>Joop De Schutter</i>	29
3. Water Ecosystems of Central Asia: Important Factors Affecting the Environmental & Social Prosperity of the Region <i>Yessekin Bulat, Burlibayev Malik, Medvedeva Nina, and Stafin Sanzhar</i>	43
4. NATO/CCMS Pilot Study Meeting on Transboundary Water Management Issues in the United States & Central Asia: Problem Definition, Regulation, and Management <i>Mikhail Khankhasayev and Steven Leitman</i>	65

Part II: Management of Transboundary Water Resources in Central Asia and Caucasus Region

5. Integrated Management of Transboundary Water Resources in the Aral Sea Basin <i>Nariman Kipshakbaev</i>	79
--	----

6. Transition to the IWRM in Lowlands
of the Amu Darya and the Syr Darya Rivers 87
Victor A. Dukhovny and Mikhail G. Horst
7. Improvement of Water Resources Management
in the Aral Sea Basin: Subbasin of the Amu Darya
River in its Middle Reach 105
Kurbangeldy Ballyev
8. Integrated Water Resource Management
of Transboundary Chu and Talas River Basins 123
Elene Rodina, Anna Masyutenko, and Sergei Krivoruchko
9. Chu-Talas Activities 131
Lea Bure
10. Mechanisms for Improvement of Transboundary
Water Resources Management in Central Asia 141
Dushen M. Mamatkanov
11. Science for Peace: Monitoring Water Quality and Quantity
in the Kura–Araks Basin of the South Caucasus 153
*Michael E. Campana, Berrin Basak Vener, Nodar P. Kekelidze,
Bahruz Suleymanov and Armen Saghatelyan*
12. Hazardous Pollutant Database for Kura–Araks
Water Quality Management 171
*Bahruz Suleymanov, Majid Ahmedov, Famil Humbatov,
and Navai Ibadov*
13. On Development of GIS-Based Drinking
Water Quality Assessment Tool for the Aral Sea Area 183
Dilorom Fayzieva, Elena Kamilova, and Bakhtiyar Nurtaev

**Part III: Legal, Technical and Institutional Aspects
of Transboundary Water Management**

14. Lessons Learned from Transboundary Management Efforts
in the Apalachicola–Chattahoochee–Flint Basin, USA 195
Steve Leitman
15. Determining Equitable Utilization of Transboundary Water
Resources: Lessons from the United States Supreme Court 209
George William Sherk
16. Improving Transboundary River Basin Management
by Integrating Environmental Flow Considerations 223
Karin M. Krchnak
17. Transboundary Aquifers as Key Component of Integrated
Water Resource Management in Central Asia 243
Ken Howard and Anne Griffith
18. Integrated Water Management 263
J. Staes, H. Backx, and P. Meire

Part IV: Workshop Conclusions and Recommendations

- ARW Conclusions and Recommendations 305
- Subject Index** 311

PREFACE

The hydrologic cycle on Earth supports an abundance of life, including human life. Freshwater ecosystems are supported by the hydrologic cycle, providing immeasurable services and benefits to humans, ranging from food and water purification to spiritual renewal. Despite growing awareness of the importance of healthy freshwater ecosystems, human actions continue to degrade the freshwater ecosystems upon which we depend. Even with the policy movement toward integrated water resource management, the integration of ecosystem considerations in water management remains largely neglected. Since the early 1960s, mismanagement of water resources has plagued the Aral Sea Basin. The problem became more complex in 1991 when the Soviet Union collapsed and the Aral Sea Basin became a transboundary water body. Overnight, the development of sustainable and equitable water management practices became the shared responsibility of five sovereign nations each with conflicting needs, goals, and priorities.

In response to this growing problem, on 20–22 June 2006, a NATO-sponsored Advanced Research Workshop (ARW) was organized in Almaty, Kazakhstan on Facilitating Regional Security in Central Asia through Improved Management of Transboundary Water Basin Resources. The co-organizers of this workshop were the Institute for International Cooperative Environmental Research (IICER) at Florida State University (FSU) and the Institute of Water Problems (IWP) of the Academy of Sciences of the Republic of Uzbekistan. The precursor to this NATO/ARW was the NATO/CCMS Pilot Study on Environmental Decision-Making for Sustainable Development in Central Asia that was also organized and administered by the IICER at FSU.

The final meeting of the pilot study was conducted in Florida in March of 2005. This meeting, represented the culmination of the five years of the work of this pilot study, and focused on transboundary water issues with a focus on the southeastern United States (i.e., Florida, Alabama, and Georgia) and how this experience may be applied to the Central Asian region. Based on the results of this final pilot study meeting, a unanimous conclusion was reached by the meeting participants to further investigate this fundamental and

important environmental problem of the Central Asian region: shared fresh water resources. This conclusion led to the development of a proposal to conduct this NATO Advanced Research Workshop. This three-day workshop included participation by approximately 30 environmental professionals from 12 countries. Current issues facing the Central Asian region related to Transboundary Water Management were discussed, including specific “case studies” impacting the individual republics. A section on Workshop Conclusions and Recommendations is provided based on the discussions at the workshop.

We wish to express our professional and personal appreciation to the individuals whose expertise, dedication, and hard work made the workshop a success. We especially would like to acknowledge Mr. Steven Leitman for his important impact on the organization and implementation of this NATO Workshop, and serving as a coeditor of these proceedings. We express our appreciation to Dr. Roy Herndon for his efforts and support in organizing and conducting this workshop and the staff of the Institute for International Cooperative Environmental Research at Florida State University. We would like to thank the Center for Basic and Ecological Research (Almaty, Kazakhstan) and, especially Dr. Nurgali Takibaev, a Director, for assistance in organizing this workshop in Almaty. The organizers would like to recognize the efforts of Mr. Norbert Barszczewski for his organizational skills and for preparation of this manuscript. The Organizing Committee would like to thank the following individuals for their significant contributions to the organization and execution of this Advanced Research Workshop: Elmira Baisetova, Paul Winkel, and Randie Denker.

NATO ARW CODIRECTORS

**MR. JOHN E. MOERLINS AND DR. MIKHAIL
KHANKHASAYEV**

*Institute for International Cooperative Environmental
Research, Florida State University*

PROFESSOR ERNAZAR MAKHMUDOV
*Institute of Water Problems, Academy of Sciences of the
Republic of Uzbekistan*

INTRODUCTION TO NATO ADVANCED RESEARCH WORKSHOP ON TRANSBOUNDARY WATER MANAGEMENT IN CENTRAL ASIA

JOHN E. MOERLINS

*Institute for International Cooperative Environmental
Research (IICER), Florida State University, Tallahassee,
Florida, USA*

ERNAZAR J. MAKHMUDOV

*Institute of Water Problems (IWP), Uzbek Academy of
Sciences, Tashkent, Uzbekistan*

Abstract: This paper summarizes the activities and results of a three-day NATO Advanced Research Workshop on transboundary water management issues in Central Asia. This NATO ARW was conducted in Almaty, Kazakhstan on 20–22 June 2006, involving participation by water management experts from the Central Asian region and from NATO countries.

Keywords: NATO Advanced Research Workshop, transboundary water management, conflict avoidance, Central Asia, environmental decision-making, legal/technical/institutional determinants of water issues

1. Introduction

On 20–22 June 2006, a NATO-sponsored Advanced Research Workshop (ARW) was organized in Almaty, Kazakhstan entitled *Facilitating Regional Security in Central Asia through Improved Management of Transboundary Water Basin Resources*. The co-organizers of this workshop were the Institute for International Cooperative Environmental Research (IICER) at Florida State

University (FSU) and the Institute of Water Problems (IWP) of the Uzbek Academy of Sciences.

The precursor to this ARW was the five-year NATO/CCMS Pilot Study on *Environmental Decision-Making for Sustainable Development in Central Asia* that was organized and administered by the IICER at FSU. The final meeting of the pilot study was conducted in Florida in March 2005. The final meeting of this pilot study in 2005 was focused on transboundary water issues utilizing, as an example, an on-going water conflict in the southeastern United States (i.e., Florida, Alabama, and Georgia). Based on the results of this final pilot study meeting, a unanimous conclusion reached by the meeting participants was to further investigate this fundamental and important environmental problem of the Central Asian region: *shared fresh water resources*. This conclusion led to the development of a proposal to conduct this NATO Advanced Research Workshop.

This document has been organized into four Chapters, grouping individual manuscripts into the following sections:

1. Transboundary Water Management Problems in the Central Asian Region.
2. Management of Transboundary Water Resources in Central Asia and Caucasus Region.
3. Legal, Technical, and Institutional Aspects of Transboundary Water Management.
4. Workshop Conclusions and Recommendations.

Papers were presented and manuscripts prepared by the experts participating in Parts I, II, and III in order to provide an overview of current and emerging issues in each area. Care was taken to be sure that both the Central Asian perspective and the perspective from outside the region were presented and discussed. Efforts were also made to include participation by representatives of leading international organizations, both as technical presenters as well as participants during the discussion sessions that were organized throughout the workshop. While not achieving a perfect balance between the Central Asian and non-Central Asian perspectives, great effort was made to encourage parity and inclusiveness during this ARW. A goal of this meeting was to examine possible exchanges of ideas on how best to address these problems in Central Asia and worldwide. For it is only through clear

dialogue can problems be completely understood and effective solutions recommended.

1.1. WORKSHOP DETAILS

This three-day workshop included participation by approximately 30 environmental professionals from the following countries:

- Kazakhstan
- Kyrgyzstan
- Turkmenistan
- Tajikistan
- Uzbekistan
- Azerbaijan
- United States
- Belgium
- Canada
- Italy
- Turkey
- The Netherlands

The following international organizations were also represented during the workshop:

- NATO–Security Through Science Programme
- NATO– Committee on Science for Peace and Security
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- United States Geological Survey (USGS)
- United Nations Development Program (UNDP)
- The Nature Conservancy (USA)
- The Regional Environmental Centre for Central Asia (CAREC)
- The Organization for Security and Cooperation in Europe (OSCE)
- The United States Corps of Engineers

The workshop covered a variety of topics, including the following:

- Ecologically sustainable flows for multi-jurisdictional river basins
- Shared vision modeling
- Integrated Water Resources Management (IWRM)
- Case studies of transboundary water resources management in Central Asia and throughout the world
- Legal & political bases for mediation among competing jurisdictions

1.2. BACKGROUND INFORMATION ON TRANSBOUNDARY WATER ISSUES IN CENTRAL ASIA

It is clear that the availability and distribution of fresh water represents one of the most pressing environmental and potentially social instability problems of the Central Asian region (as well as many regions throughout the world). Problems associated with sharing fresh water exist in many parts of the world and depending on the relative severity of the water misallocations, as well as the availability of possible intergovernmental solutions, these problems can induce conflicts at various levels. In Central Asia, it is believed that this phenomenon will become even more pressing as:

- Country populations grow throughout the region
- Real incomes increase (and, therefore, the demand for fresh water by households, industry and commercial users increase) as a result of oil and gas resource exploitation and other positive economic factors
- External interferences from neighboring countries confound efforts to effectively manage these regional resources (e.g., external efforts to influence the development of additional large reservoirs used for hydroelectric power generation).

The Central Asian republics can generally be classified as either “water producing” republics or “water using” republics. As a result of the relatively uneven distribution of the naturally occurring sources of fresh water (e.g., glacial snow melt in the more mountainous republics) some republics are more naturally endowed with seasonal sources of fresh water than other republics. In addition, the relatively lesser

water-endowed republics are often heavily agriculturally based countries demanding large amounts of fresh water for irrigation, power generation, and other uses. Other issues pertaining to the development of new water reservoirs and associated hydroelectric generating plants make the issue of regional water allocation more complicated politically. The uneven distributions of both water supply and demand create a reasonably high likelihood for regional conflicts to occur over finite water supplies in the future. Since the collapse of the Soviet Union, Central Asia has become a tangle of unresolved transboundary water disputes. Water is considered by many as one of the most critical resources in Central Asia.

In the past, water sharing issues in Central Asia were regulated and controlled by the former Soviet system of centralized governance that set limits on water extraction and use among the Central Asian republics. In addition, and to some extent most importantly, these Soviet regulations governed the extent to which water was to be “shared” with “downstream” republics, as well as the compensation schemes that were to be used among the republics for water sharing. The rules developed by the Soviets for “water sharing” in Central Asia were based almost exclusively on production/engineering criteria that reflected the production needs for agricultural production and power generation. These engineering-based criteria, however, did not generally reflect the ecological and social benefits of the resource, leading to inefficient use and growing conflicts over the resource. Some economists argue that what is needed most to address water resource allocation problems in Central Asia are mechanisms involving “water pricing”, “water markets” and other innovative multi-republic compensation schemes based on modern economic theories. More money is also needed to solve the region’s water problems. As mentioned previously, in the absence of these innovative alternatives, many of these former Soviet use/consumption quotas are still adhered to by the Central Asian republics resulting in a relatively inefficient, non-sustainable and inequitable utilization of this scarce environmental resource.

An additional point of importance relates to the collapse of the Soviet system itself. With the elimination of the Soviet central government, so was eliminated the mechanism of “a higher authority” to mediate and enforce water conflicts among the republics in Central Asia. This enforcement void would represent the near equivalent of

dissolution of the United States Supreme Court to rule on and enforce water conflicts among the states in the United States. Without this higher authority to address multi-republic water sharing in the region, problems have become more prevalent.

One of the world's most widely recognized examples of fresh water-related disasters is the Aral Sea situation. Misuse and inefficient uses of water for irrigation and other agricultural purposes from the Amu Darya and the Syr Darya rivers to irrigate crops in the arid areas of Central Asia caused the Aral Sea to all but dry up – shrinking some 50–75% of its volume. The failures of the Soviet central planning system can be attributed to most of the cause of this disaster, as well as other external factors. While catastrophic in nature, the Aral Sea problem is highly symptomatic of the problems facing Central Asia as the future approaches. In the absence of an effective mechanism for reconciling regional water disputes, more problems like this may occur.

One final introductory comment about the Caucasus is warranted. The neighboring region referred to as the Caucasus consists of essentially Armenia, Azerbaijan, and Georgia. The Caucasus represents a region in Eurasia bordered on the south by Iran, on the southwest by Turkey, on the west by the Black Sea, and on the east by the Caspian Sea. The Caspian Sea is the primary linkage connecting Central Asia to the Caucasus. As such, this hydrological linkage, its geographic proximity and other geopolitical linkages call for inclusion of this region in the discussions at this ARW. Beyond these physical justifications, the water sharing conflicts and experiences of these three countries bring a wealth of information to this ARW (interested readers are directed to the papers presented by Professors Campana and Suleymanov in this document).

1.3. BACKGROUND AND JUSTIFICATION FOR THIS ARW

The title of this NATO Advanced Research Workshop is “Facilitating Regional Security in Central Asia through Improved Management of Transboundary Water Basin Resources” (key words: regional, security). This workshop, supported under the NATO Committee on Science for Peace and Security, has as a goal to provide support to the ‘Central Asian Nations’ decision-making by providing a forum for bringing together scientists, experts, and policy makers to address critical problems

associated with transboundary water management, and by creating networks of experts, and stimulating NATO-partner cooperation. The primary concern that motivated the organization of this ARW was avoidance or mitigation of regional conflict and the steps needed to attain this goal involve a more comprehensive understanding of transboundary water management issues, in general and as these issues are manifested among the Central Asian republics. The typical strengths of participants of NATO Advance Research Workshops are in the realms of technical and scientific input as most participants are affiliated with academia or research arms of ministries/agencies. It was, therefore, anticipated that the primary contributions forthcoming from this ARW would be in the forms of hydrology, water resources sciences, law, economics, conflict resolution theory, and other forms of scientific input.

2. CONCLUSION

The Directors of this ARW would like to thank the participants for their significant and important contributions to this important topic. It is recognized that water resources sharing problems are wide spread, highly complex and evolving; however events like this NATO-sponsored Advanced Research Workshop can hopefully help to address current problems and forestall the development of serious conflicts before they can germinate. Certainly, one of the more productive outcomes of this workshop is the interaction of environmental scientists from Central Asia, the Caucasus, and from NATO member countries who otherwise may not have met professionally, and therefore not had opportunities to collaborate on such an important topic as fresh water resources. The importance of these potential scientific collaborations will grow particularly as these important resources become relatively scarcer in the future, and as the need to determine effective, equitable and efficient resource sharing approaches increases. Unassailable and scientifically defensible bases for environmental solutions to problems involving multi-political jurisdictions can become a linchpin in their acceptance and implementation.