

ASSESSING WATER SECURITY IN THE AMU DARYA RIVER BASIN,
AFGHANISTAN

A thesis presented to the Faculty of the US Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE
General Studies

by

JOSEPH A. DIPASQUALE, MAJ, USA
B.A., University of Arizona, Tucson, Arizona, 1988

Fort Leavenworth, Kansas
2006

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE				<i>Form Approved</i> OMB No. 0704-0188	
Public reporting burden for this 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 this 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 Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 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 any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 16-06-2006		2. REPORT TYPE Master's Thesis		3. DATES COVERED (From - To) Aug 2005-Jun 2006	
4. TITLE AND SUBTITLE Assessing Water Security in the Amu Darya River Basin, Afghanistan				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) DiPasquale, Joseph A., MAJ, U.S. Army				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Command and General Staff College ATTN: ATZL-SWD-GD 1 Reynolds Ave, Fort Leavenworth, KS 66027-1352				8. PERFORMING ORGANIZATION REPORT ATZL-SWD-GD	
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 New data and previous studies were used with quantitative analysis to assess Afghanistan's effect on water security in the Amu Darya river basin from 1995 to 2005. An event database constructed from open source news reporting and a geographic information system (GIS) of the basin combined to evaluate the basin's risk for water-related conflict relative to six factors: overall relations; population density, per capita income; freshwater treaty status; internationalization potential of the basin; and water development projects. The thesis evaluated the quantitative techniques employed for their utility in planning, executing, and assessing military operations in relation to water resources. Afghanistan's effect on water security marginally increased the risk of conflict over water while increasing non-water-related levels of cooperation among riparian neighbors. Population density and internationalization potential did not contribute to increased risk, but income level, treaty status, and development projects did contribute to increased risk for conflict. The techniques demonstrated their utility for military planners, principally at the operational and strategic levels as a tool for long-range assessment and monitoring. Tactical utility was found to be limited, but modifications to database and GIS layer development show potential for more use of the techniques in the tactical environment.					
15. SUBJECT TERMS Event Database, GIS, Geographic Information System, Water, River Basin, Afghanistan, Amu Darya, Quantitative, Transboundary Freshwater Dispute Database, Basins at Risk					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE UNCLASSIFIED	UU	147	19b. TELEPHONE NUMBER (include area code)
					Standard Form 298 (Rev. 8-98) Prescribed by ANSI Std. Z39.18

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: MAJ Joseph A. DiPasquale

Thesis Title: Assessing Water Security in the Amu Darya River Basin, Afghanistan

Approved by:

_____, Thesis Committee Chair
Judith A. Jones, Ph.D.

_____, Member
Alan C. Lowe, M.A.

_____, Member
Kevin M. Freese, M.A.

Accepted this 16th day of June 2006 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the US Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

ASSESSING WATER SECURITY IN THE AMU DARYA RIVER BASIN,
AFGHANISTAN, by MAJ Joseph A. DiPasquale, USA, 147 pages.

New data and previous studies were used with quantitative analysis to assess Afghanistan's effect on water security in the Amu Darya river basin from 1995 to 2005. An event database constructed from open source news reporting and a geographic information system (GIS) of the basin combined to evaluate the basin's risk for water-related conflict relative to six factors: overall relations; population density, per capita income; freshwater treaty status; internationalization potential of the basin; and water development projects. The thesis evaluated the quantitative techniques employed for their utility in planning, executing, and assessing military operations in relation to water resources. Afghanistan's effect on water security marginally increased the risk of conflict over water while increasing non-water-related levels of cooperation among riparian neighbors. Population density and internationalization potential did not contribute to increased risk, but income level, treaty status, and development projects did contribute to increased risk for conflict. The techniques demonstrated their utility for military planners, principally at the operational and strategic levels as a tool for long-range assessment and monitoring. Tactical utility was found to be limited, but modifications to database and GIS layer development show potential for more use of the techniques in the tactical environment.

ACKNOWLEDGMENTS

I thank my wife Merri, and our children, Brittaney and Quentin, for their patience and stoicism during yet another long separation. Their confidence, love, and support made not only this thesis, but my year at CGSC possible. The sacrifices they make daily to support the Army are immeasurable.

Each of my committee members, Dr. Judith Jones, Mr. Alan Lowe, and Mr. Ken Freese, offered invaluable observations, advice, and assistance and were always able to find time for my questions and concerns; and made sure I knew it could be done.

Thanks to my classmates in Section 17D for their friendship and professionalism, in particular Major Christopher Eagan, USAF, for his advice and willingness to be a sounding board during this endeavor.

Mr. Bud Bowie, Mr. Tom Creviston, and Dr. Bill McCollum kindly offered their time to sit my MMAS oral examination. I appreciate their assistance, but even more their enthusiasm and skill as teachers which made my time in their classrooms thoroughly enjoyable and challenging.

In the same vein, I am grateful to LTCs Burke Tarble, Richard Faulkner, and Jeffrey Butler. As their student I have grown intellectually and professionally, and appreciate the friendship and kindness they have shown me during my time at CGSC.

Thanks to Dr. Aaron Wolf and Mr. Nathan Eidem of Oregon State University for kindly providing invaluable information and resources for my thesis.

I will close by thanking my thesis seminar instructor Dr. Jim Martin for his pragmatic advice, and paraphrase his pithy observation that kept this project in perspective: "Remember, the best theses are the ones that get done."

TABLE OF CONTENTS

	Page
MASTER OF MILITARY ART AND SCIENCE THESIS APPROVAL PAGE	ii
ABSTRACT	iii
ACKNOWLEDGMENTS	iv
ACRONYMS	viii
ILLUSTRATIONS	ix
TABLES	x
CHAPTER 1. QUANTITATIVE ANALYSIS OF WATER SECURITY	1
Assessing Water Security Using Quantitative Methodologies	1
Resources, Conflict, State Security, and the Role of Analysis	1
Identifying Factors for Conflict	1
Developing Effective Analytical Tools.....	2
Research Question	4
Primary Question	4
Secondary Questions.....	4
Secondary Question 1	4
Secondary Question 2	4
Research Justification	5
Hypotheses.....	5
Hypothesis 1.....	6
Hypothesis 2.....	6
Hypothesis 3.....	6
Hypothesis 4.....	6
Hypothesis 5.....	7
Hypothesis 6.....	7
Definition of Terms	7
Assumptions.....	8
Limitations	9
Delimitations.....	10
Significance of Study	11
Overview of Applying Quantitative Analysis to the Amu Darya River Basin.....	11
Chapter 2: Water Security Analysis Perspectives.....	11
Chapter 3: Methodologies Used to Assess Water Security	12
Chapter 4: Water Security in the Amu Darya River Basin	12
Chapter 5: Assessing Water Security and Methodologies Used.....	12

CHAPTER 2. WATER SECURITY ANALYSIS PERSPECTIVES	15
Why Take the Quantitative Approach?	15
Research Goals.....	15
Literature Supporting the Study.....	17
Global Quantitative Analysis of Water Conflict and Cooperation	17
BAR Event Database Development.....	18
BAR GIS Development	18
Findings of BAR Using Quantitative Methodology	19
BAR Methodology at a Regional Level	20
Data Development for the Amu Darya River Basin	24
Population Data Development	24
Runoff	24
Dams	24
Minority Groups.....	25
GDP.....	25
Overall Relations	25
Freshwater Treaties.....	25
Assessment of Water Security in the Amu Darya River Basin, 1995-2003	25
Defining Riparian Nation Relationships.....	27
Review of Research Question, Supporting Questions, and Hypotheses.....	27
Summary and Conclusions	29
CHAPTER 3. METHODOLOGIES USED TO ASSESS WATER SECURITY	33
Amu Darya GIS and Data Development	34
Hydrologic Features.....	34
Amu Darya Basin Coverage Development.....	35
Population Density.....	35
Water Development Projects	36
Per Capita GDP.....	36
Internationalization Potential	37
Freshwater Treaty Status.....	37
Event Database Development	37
Database Structure	38
Event Sources.....	38
Data Collection Parameters and Processes	39
Event Data Development	40
Event Intensity Scale.....	43
Software and File Formats.....	46
CHAPTER 4. WATER SECURITY IN THE AMU DARYA RIVER BASIN.....	48
Establishing the Event Database Samples	48
Assessing Relations	53
Overall Relations Between Amu Darya Riparian	53

Water Relations within the Basin.....	59
Dynamics in Riparian Relations	65
Implications for Basin Water Security.....	70
Summarizing Afghanistan’s Affect on Basin Water Security	71
Population Risk.....	73
Effects of GDP	76
Basin Internationalization Potential.....	78
Afghanistan’s Water Development Activity.....	79
Basin Freshwater Treaty Status	81
Implications for Military Operations	82
CHAPTER 5. ASSESSING WATER SECURITY AND METHODOLOGIES USED...	86
Findings Review	86
Security Discussion.....	88
Planning and Operations.....	91
Unexpected Outcomes	95
Recommendations for Further Study	96
Final Thoughts	97
APPENDIX A. EVENT DATABASE FOR OVERALL RELATIONS.....	101
APPENDIX B. EVENT DATABASE FOR WATER RELATIONS	117
APPENDIX C. SUMMARY OF STATISTICAL INFORMATION	127
BIBLIOGRAPHY	132
INITIAL DISTRIBUTION LIST	135
CERTIFICATION FOR MMAS DISTRIBUTION STATEMENT	136

ACRONYMS

AIMS	Afghanistan Information Management Service
BAR	Basins at Risk
CAPEs	Combined Arms Planning and Execution-Monitoring System
CPOF	Command Post of the Future
DDR	Disarmament, Demobilization, and Reintegration
FBIS	Foreign Broadcast Information Service
GDP	Gross Domestic Product
GIS	Geographic Information System
GNI	Gross National Income
HIG	Hizb-I Islami Gulbuddin
ICOLD	International Commission on Large Dams
MCS	Maneuver Control System
OSC	Open Source Center
TFDD	Transboundary Freshwater Dispute Database
UNDP	United Nations Development Program
USAID	United States Agency for International Development
UNDP	United Nations Development Program
WNC	World News Connection

ILLUSTRATIONS

Figure 1. Amu Darya River Basin Riparian Nations.....	21
Figure 2. Amu Darya Sub-basins in Relation to International Borders	22
Figure 3. Sub-basins Comprising the Amu Darya River Basin within Afghanistan.....	23
Figure 4. Initial Conflict and Cooperation Event Search Results	41
Figure 5. Conflict and Cooperation Search Results, Filtered for Relevance	42
Figure 6. Initial Water Conflict and Cooperation Search Results.....	43
Figure 7. Final Conflict and Cooperation Event Sample	52
Figure 8. Final Water Conflict and Cooperation Event Sample.....	52
Figure 9. Overall Relations by Issue Type Among the Four Countries	54
Figure 10. Overall Relations by Issue Type, Excluding Afghanistan Associated Issues....	54
Figure 11. Issue Type by Year	55
Figure 12. Issue Type by Year, Excluding Afghanistan	56
Figure 13. Average Conflict and Cooperation Level (All Countries).....	56
Figure 14. Average Conflict and Cooperation Level, Excluding Afghanistan	57
Figure 15. Water Events by Issue Area (All Countries).....	60
Figure 16. Water Events by Issue Area, Excluding Afghanistan.....	61
Figure 17. Issue Type by Year (All Countries).....	62
Figure 18. Issue Type by Year (Excluding Afghanistan).....	63
Figure 19. Average Water Conflict and Cooperation Levels (All Countries).....	64
Figure 20. Average Water Conflict and Cooperation Levels (Excluding Afghanistan)	64
Figure 21. Water Relations Decision Tree	65
Figure 22. Population Distribution in the Amu Darya River Basin, Afghanistan.....	74
Figure 23. Population Density in Amu Darya River Basin, Afghanistan	75

TABLES

	Page
Table 1. Factors Contributing to Basin Risk for Conflict.....	20
Table 2. Event Data Fields.....	38
Table 3. Open Source Center Search Terms.....	40
Table 4. Event Intensity Scale.....	44
Table 5. Correlation Table 1	66
Table 6. Correlation Table 2	67
Table 7. Correlation Table 3	67
Table 8. Correlation Table 4	70
Table 9. Population Density.....	76
Table 10. GNI per Capita in 2004 \$US by Year.....	77

CHAPTER 1

QUANTITATIVE ANALYSIS OF WATER SECURITY

Assessing Water Security Using Quantitative Methodologies

Resources, Conflict, State Security, and the Role of Analysis

The relationship between natural resources and the overall international security environment has emerged as a significant issue in both the developed and developing world. The sources of friction in international relations are varied, and include, inter alia, water, energy, agricultural production, access to mineral resources, and pollution control. As states vie for both resource control, as well as equitable access to resources they cannot control, it is fair to examine how state security is assessed relative to these issues. This in turn leads to questions over the effectiveness of the methodologies used by planners and decision makers to connect resource-related security issues to the overall level of state security. This chapter introduces the topic of methodology utility and effectiveness in assessing the status of water resources as a security risk.

Identifying Factors for Conflict

One aspect of water security assessment is identification of geopolitical regions which may be moving toward conflict. Key to this process is finding those factors most indicative of conflict. By identifying appropriate indicators, a framework for both monitoring and intervention can be developed. Intervention can potentially be either civil or military, or some combination of both. To accomplish this task efficiently, it is helpful to have a means of analysis that is applicable across a wide range of geopolitical regions, is repeatable, and facilitates monitoring of ongoing situations.

Developing Effective Analytical Tools

It is possible to summarize approaches for identifying these indicators along two major lines with regard to water conflict research. The first seeks a deep understanding of a specific conflict environment that is then expanded into more generalized theories of conflict behavior. The unit of analysis will normally be at the level of intrastate or bilateral conflicts, often using an ethnographic or case study approach. The results are then applied to other conflicts exhibiting the same characteristics. Much of the research conducted in this manner uses qualitative data analysis techniques.

The second approach seeks explanation of water conflict from a system level. It will seek to aggregate observations into data packets suitable for quantitative analysis of hypotheses. Its goal is to find repeated patterns of conflict and cooperative behavior. These are then used to develop typologies of conflict situations that are suitable as analytical tools for general use in assessing water as a security issue.

The development of quantitative approaches to water conflict analysis is relatively recent, so it may be considered to be an alternative or challenge to the more traditional qualitative approaches. However, a better description is that both approaches offer a mutually beneficial research strategy. Each reveals aspects of conflict and cooperation that are potentially masked by the other. As noted earlier, qualitative analysis of water security and conflict tends to focus on conflictive versus cooperative behavior, without consideration of the significant number of cooperative interactions over water. This tendency introduces a bias into qualitative research that quantitative research seeks to address. Quantitative analysis, by the fact of its aggregating effect on data to identify

trends or generally applicable explanations of conflict, can have a tendency to mask important situation-specific issues or conditions that qualitative analysis might discern.

An example of a research effort seeking to address these concerns is found in the Basins at Risk (BAR) project,¹ and the Transboundary Freshwater Dispute Database (TFDD) sponsored by Oregon State University.² The BAR and TFDD approach to water resource analysis includes development of quantitative databases that are subject to repetitive analysis, as well as manipulation across a wide range of research questions.

A review of the BAR methodology leads to questions about how it is applied to military contingency planning and assessment of current operations where water is a primary or peripheral factor. The use of this quantitative methodology may also result in tools useful for identifying factors (such as per-capita income) which the military force may not be equipped to directly affect.

The BAR-based research differs from qualitative analysis-based works in several important ways. First, by using a quantitative baseline, there is a background against which to measure more qualitative analysis, such as studies based on ethnography. Second, it bridges the gap between ethnographic and case study approaches to water conflict and larger questions of regional and international mechanisms for conflict and cooperation. The BAR study was chosen as the baseline quantitative methodology for this thesis because of its explicit attempt to define a methodology that is applicable to any river basin environment.

Quantitative analysis offers clear potential to security studies of water and other resource-related conflict issues, which require generally applicable analytical tools. Ethnography and case studies provide needed insight into development of plans for

specific events once they have occurred, or for areas identified as having potential for conflict, and thus warrant increased monitoring. However, because of their specificity to a particular situation, such studies are more difficult to expand into predictive analysis for long-range strategic planning at the global, regional or interstate and intrastate scales. This is principally due to the fact that the issues identified in a particular case study are not necessarily present in other situations. Using linked databases containing geophysical, political, and social information for quantitative analysis allows for correlation of factors present in water-based conflict. Such correlation provides for triangulation with data based on qualitative assessment.

Research Question

Primary Question

What is Afghanistan's effect on water security in the Amu Darya River Basin?

Secondary Questions

Secondary Question 1

At which levels of military operations (strategic, operational, and or tactical) are the selected methodologies best applied? This question explores whether these techniques have broad applicability in the military planning process, or are only useful for specific purposes or situations.

Secondary Question 2

During which phases of planning and execution are these methodologies most useful? This question addresses how these analytical techniques might be applied by military planners within the levels of military operations.

Research Justification

This thesis has relevance to ethnographic or case study analytical approaches towards water conflict on several levels. Successful use of the BAR methodologies for applications outside of its original scope will strengthen the argument for a better balance between qualitative and quantitative analysis of resource conflict and related issues. First, such use will serve to validate its utility as an analytical tool that is generally applicable, as opposed to a study necessarily bound by the geophysical, political, sociological, or anthropological characteristics of a specific subject area. Second, it will provide a way for other researchers to replicate analysis and conduct follow on analysis from a common baseline. Finally, successful use of a quantitative analytical approach has the potential to allow security analysts to investigate water resource on scales varying from worldwide to local and basin specific.

An unsuccessful or neutral outcome in applying the BAR methodology potentially will identify shortcomings that result in appropriate limits to the scope of its application. Either outcome also has the potential for improving the baseline BAR study's results, and by extension, its utility for whatever problem is being studied.

Hypotheses

The general, global-level conclusions drawn by the BAR study delineated six factors for conflict whose presence indicate that a river basin and its riparian countries are at potential risk for conflict over water resources. Of these six, one is related to overall hostility levels between riparian nations. The BAR study found that at the global level, overall hostility also reflects hostility over water. When a similar examination was

performed at a regional level, it was found that regions were generally more cooperative over water than they were cooperative in their general relationships.³

Hypothesis 1

The inclusion of Afghanistan in the assessment of overall hostility between the Amu Darya river basin riparian nations will have no effect on the level of water hostility between them.

Hypothesis 2

In a separate study of Central Asian water security⁴ Valery Votrin concluded that population density within the Amu Darya basin was approximately half the risk threshold identified by BAR on the global level. There is more recent data available to assess this risk factor. Hypothesis 2 is: updated population data will show population density per square kilometer within the basin will remain below the BAR risk threshold.

Hypothesis 3

Per capita GDP for the Amu Darya basin countries was calculated by Votrin at approximately \$300.00 below the BAR risk threshold.⁵ Hypothesis 3 is: inclusion of Afghanistan per capita GDP will not increase basin GDP above the BAR risk threshold.

Hypothesis 4

Increases in internationalization, based on minority political activity, of a river basin are associated by BAR for increases in risk for conflict over water. The Votrin assessment of the Amu Darya indicates that the change in government in Afghanistan has had a similar internationalization affect on the basin. Hypothesis 4 is: inclusion of

Afghanistan event data will show an increase in conflict over water resources within the basin after the US invasion and installation of the transitional government.

Hypothesis 5

The BAR study found that water development projects without benefit of supporting institutions, such as bilateral and multilateral agreements, are a risk factor for a river basin. The Votrin study's assessment of development projects within the Amu Darya river basin supports the BAR conclusion. Hypothesis 5 is: assessment incorporating evidence of Afghanistan water development activities within the basin will show an increase in the risk for conflict over water.

Hypothesis 6

BAR found that basins with no or few freshwater treaties have higher risk for conflict. The Votrin study found similar evidence within the Amu Darya river basin. Hypothesis 6 is: there will be no increase in the number of treaty agreements in the study time period following the US invasion of Afghanistan.

Definition of Terms

Actor. Here, actor refers to communities, nations or regional entities that are part of or associated with a specific riparian environment.

GIS (Geographic Information System). A system of hardware, software and georeferenced databases which allow the study of the interactions between components of the environment.

Riparian. In this study, riparian refers to those actors in relation to their associated river basin. Coriparian actors are those that share the same basin.

River basin. This geographic feature is comprised of the land that drains into a specified river system that subsequently drains into the ocean or an internal body of water. A basin becomes international when this area is made up of more than one country.

Transboundary Freshwater Dispute Database (TFDD). The Oregon State University maintains this database and it is an integral part of the GIS used in the BAR study.

Assumptions

Perceptions about the characteristics of conflict and cooperation, such as their intensity, scope, implications and outcomes, are, by their nature, subjective ones. As such, the quantification of conflict into numerically manageable units is itself problematic. The BAR researchers have attempted to represent intensity of conflict in a logical, numerically quantifiable manner.⁶ The BAR project placed conflict along a 15 point scale representation: 0 is a neutral value, -1 through -7 represent levels of increasing conflict, culminating in all-out warfare (-7), and 1 through 7 representing increasingly cooperative behaviors. This scale was then mathematically manipulated to account for relative differences between events on the scale. For example, it accounts for the difference in the level of hostility expressed on the lower end of the scale consisting of official versus unofficial protest and the difference between official protest and actual violence. Events are then coded against this scale as they are placed into the database. Chapter 3 will provide further explanation of the conflict scale's development and use, and how it is applied to the research conducted for the thesis. The thesis will assume *that* the BAR study's mathematical manipulation of the decided values is correct; and *that* the

variables and their assigned values present a logical and consistent depiction of conflict and cooperative behaviors.

The BAR authors acknowledge that alternative weighting and scaling of events against a valuation system is subject to debate. The structure and valuation only determines where events fall in a quantified scale. Whether a particular event is coded as more or less conflictive does not invalidate the research process, which is the focus of this thesis.

Limitations

Several limitations are applicable to this thesis. The allotted time to research and write the thesis will not allow development of alternative methodologies for quantifying the levels of conflict and cooperation in database events. In addition, this limitation will make reanalysis and validation of the baseline studies unfeasible. Therefore, the existing methodologies for conflict and cooperation quantification within the chosen studies will be used, with acceptance of their inherent limitations. The inherent limitations will be explained in context in subsequent chapters of the thesis where necessary.

The primary studies used as the points of reference in this thesis are limited to the analysis of water-related conflict and cooperation among riparian nations linked by the same basin environment. There was not analysis of water related conflict between actors that did not share a riparian habitat. This is not to imply that potential areas of conflict and cooperation do not exist between non-co riparian actors. Rather it reflects the methodology's focus on geophysical elements as unifying factors for database development. The thesis accepts these limitations and will develop the implications of them in discussion of areas for further research. For an example of an analytical approach

that includes non riparian neighbors, see “Watersheds and Problemsheds: Explaining the Absence of Armed Conflict Over Water in the Middle East”⁸ which illustrates alternative means of measuring water availability and its effects.

Delimitations

The study of conflict and cooperation related to water is a multidisciplinary one. Hydrology, sociology, political science, and anthropology are among them. The intent of this study is not to establish baseline knowledge of the subject in these disciplines. It will confine itself to information from these combined disciplines that can explain the problem from a security perspective and its applicability to strategic, operational, and tactical problem analysis. The development of database contributions is limited to those events and points that assist in explaining security-related issues and how the selected methodologies are applied in an environment experiencing armed conflict. This thesis will not attempt, as a primary purpose, to define specific actions or make specific policy recommendations for operations in Afghanistan. Any such recommendations will be for illustrative purposes showing the utility of the methodology for military operation’s planning and analysis. This thesis will be limited to the analysis of unclassified sources.

The foundation databases used in this thesis have a time frame from 1948 to 1999. The BAR authors chose this date range for several reasons. The primary reason was their professional assessment that this date range had the most relevance for a current analysis of water-related issues. The second was related to manageability. Approximately one-half of the event database was derived from news reporting databases, such as the Open Source Center (OSC, formerly known as the Foreign Broadcast Information Service, FBIS), which required manual and machine coding of individual reports. The event

databases developed for this thesis will cover the time period from 1995 to 2005. This period was chosen to align with coverage in the Votrin study and to provide an event sample range on either side of the US invasion of Afghanistan in 2001.

Significance of Study

Resources are a factor present in some form in almost all military interventions. The practical consequences of the thesis are its potential to illustrate application of new methodologies that account for resources in order to assist in effective mission analysis and planning before, during, and after intervention. Answering the research question has the potential to leverage the extant research into a framework useful to supporting military needs. It also allows the national security community to benefit from the wide range of ongoing academic research into this specialized area of inquiry

Overview of Applying Quantitative Analysis to the Amu Darya River Basin

Chapter 2: Water Security Analysis Perspectives

This chapter will examine the literature relevant to conducting a quantitative analysis of water security in the Amu Darya river basin. The principal information resources will come from the “Basins at Risk” project, based upon the doctoral dissertation by Shira B Yoffe;⁹ “Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential,” a master’s thesis by Valery Votrin;¹⁰ the Transboundary Freshwater Dispute Database (TFDD),¹¹ a website maintained by Oregon State University containing extensive information and resources on water and water conflict issues; and “The Geography of Water Conflict and Cooperation: Internal Pressures and International Manifestations,” a paper describing use

of event databases and decision trees to understand the nature of riparian nation relationships over water.¹² An in-depth review of these documents and the other associated research at TFDD will assist in clarifying the thesis' approach to quantitative analysis of water as a source of resource conflict in the Amu Darya basin. The review will illustrate gaps in the research conducted and how this thesis helps to fill them. Finally, the review will analyze the implications for the BAR methodology's application to planning and execution of military operations.

Chapter 3: Methodologies Used to Assess Water Security

Building upon the work of Yoffe and Votrin, this chapter will explain in depth how the BAR methodology was applied to the Amu Darya river basin during the study period. It will describe the development of the databases, the application of the BAR conflict level assessment, and the statistical analysis performed on these data. Where appropriate, any discovered limitations or shortfalls in the database are described.

Chapter 4: Water Security in the Amu Darya River Basin

In this chapter, the findings from application of the methodology discussed in chapter 3 are presented. A summary of new and baseline data is given. The BAR methodologies are applied to the new data, and the results discussed. The chapter concludes with analysis of how the data either supports or refutes the hypotheses and the research questions.

Chapter 5: Assessing Water Security and Methodologies Used

This chapter reviews the initial research question. This review is then followed by a summation of the hypothesis and research questions relative to the findings in chapter

4. The chapter discusses conclusions drawn from the research findings and the applicability of the methodologies to military planning and operations. Based upon these conclusions, the chapter includes recommendations about the methodology's utility to military planners and decision makers. It concludes with questions and areas for further research that have emerged as a result of this study.

¹Shira B. Yoffe, "Basins at Risk: Conflict and Cooperation Over International Freshwater Resources" (Ph.D. diss., Oregon State University, 2001), [dissertation online]; available from <http://www.transboundarywaters.orst.edu/>; Internet; accessed 25 October 2005.

²Oregon State University, "Transboundary Freshwater Dispute Database" [database online]; available from <http://www.transboundarywaters.orst.edu/>; Internet; accessed 25 October 2005.

³Yoffe, "Basins at Risk," 82.

⁴Valery Votrin, "Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential" (Thesis, Vrije Universiteit Brussel, 2002) [thesis on-line]; available from <http://www.transboundarywaters.orst.edu/>, accessed 25 October 2005.

⁵Votrin, "Transboundary Water Disputes in Central Asia," 44.

⁶Yoffe, "Basins at Risk," 23-27.

⁷Edward T. Azar, Conflict and Peace Data Bank (COPDAB), 1948-1978 (College Park: University of Maryland Center for International Development and Conflict Management, 1993) [database online]; available from <http://www.icpsr.umich.edu/>; Internet; accessed 25 October 2005.

⁸Tony Allan, "Watersheds and Problemsheds: Explaining the Absence of Armed Conflict Over Water in the Middle East," *Middle East Review of International Affairs (MERIA)* no.5 (March 1998), [article online]; available from http://www.ciaonet.org/olj/meria/meria398_allan.html; Internet; accessed on 9 November 2005.

⁹Yoffe, "Basins at Risk."

¹⁰Votrin, "Transboundary Water Disputes in Central Asia."

¹¹Oregon State University, "Transboundary Freshwater Dispute Database."

¹²Meredith Giordano, Mark Giordano, and Aaron Wolf, "The Geography of Water Conflict and Cooperation: Internal Pressures and International Manifestations," *The Geographical Journal* 168, no. 4 (2002): 293-312.

CHAPTER 2

WATER SECURITY ANALYSIS PERSPECTIVES

Why Take the Quantitative Approach?

Statistical analysis in the social sciences is a well-known and well-developed tool, and one that is broadly applied. The use of quantitative analysis to understand components of conflict over water resources is a relatively new phenomenon in the academic research literature. Also used is extensive application of census and other survey methods for acquiring and collecting data for study. The advent of affordable, accessible, and powerful computing technology over the last several decades has opened up significant new avenues for combining and reevaluating these analytical techniques.

Combining many of the more traditional data collection and analytical tools with information systems is a way to effectively complement qualitative analysis of resource issues. The quantitative approaches described here take advantage of the ability of information technology to derive trends and patterns from large, aggregated data sets.

The result of combining quantitative with qualitative analysis enables both approaches to achieve more meaningful and insightful conclusions about the issues studied. Further, these techniques help researchers from disparate disciplines, such as social and geospatial sciences, which in the past were difficult to connect, make practical use of one another's findings during interpretation of their own research results.

Research Goals

The research will examine Afghanistan's effect on water security within the Amu Darya river basin. Through this security assessment, the thesis will also explore how

quantitative techniques can be applied to planning and execution of military operations in areas where conflict over water resources may be a significant or contributing factor.

Although any international river basin is suitable for study, this region offers several advantages. The basin and its rivers connect nations with disparate water requirements. Afghanistan itself has ongoing security issues that provide a number of opportunities to explore the effects of military operations on water relations. Finally, there is a basis of previous research on the area which offers sources of information and opportunities for comparison with the present study.

The present work builds on an earlier study of conflict and cooperation over water in the Amu Darya river basin conducted by Valery Votrin.¹ The basin forms part of the larger Aral Sea river basin. The Votrin study *focused* on the regional level continuum of conflict and cooperation over water resources *and addressed* these levels relative to the overall condition of international relations between the states included in the basin. However, Afghanistan, one of the river basin's riparian neighbors, was excluded from consideration of the basin's international relations status.

This study will examine earlier research from a perspective that includes Afghanistan in order to understand the country's effects on overall levels of water security, gain insight into the effects of the US invasion of Afghanistan on regional water security, assess potential for future conflict and cooperation over water resources in the Amu Darya river basin, and through this analysis, evaluate the potential for using these techniques in planning and executing military operations.

Literature Supporting the Study

The focus of the literature review is an examination of the three core studies around which this thesis builds its research methodology. The first study reviewed will describe the development of the baseline methodology employed in this thesis. In the second study, the baseline methodology is used to examine regional water security issues in Central Asia's Amu Darya river basin. The third study describes a method for interpreting the nature of riparian nation relationships based on correlation between their relative levels of conflict and cooperation. The chapter concludes with a review of the research question, supporting questions, and hypotheses to be examined in the thesis.

Global Quantitative Analysis of Water Conflict and Cooperation

The questions over water resource security reflect a concern that water is a central issue which contributes to driving states or other actors into direct hostility or degradation of overall relationships.² A case study analysis provides evidence supporting these concerns through explanation of specific sets of international and sub national relationships. What was lacking in these studies was an empirical framework in which to test how universal these findings were in explaining the relationship between water and conflict in international relations.

The Basins at Risk (BAR) project³ developed a methodology to quantitatively analyze the role of water in conflict. It consists of development of event databases associated with water conflict and cooperation, general conflict and cooperation, and linkage of these data sets to geographical information systems (GIS) that allow examination of relationships over water in both temporal and spatial contexts.

BAR Event Database Development

Event databases as used in the BAR study describe interactions between riparian neighbors. These interactions are parsed and coded into tabular format within a relational database. The coding process is derived from similar techniques used in the social sciences. Distillation of data into this format then allows it to be subjected to statistical analysis in order to examine relationships between variables. These relationships are then used to gain insight into the behaviors exhibited among the nations within and among river basins. The utility of this approach is that the data can be linked within the framework of a geographic information system. What this allows the researcher to do is examine the data within the context of spatial and temporal reference points within the environment and other data layers in which the studied interactions occurred. In the case of the BAR study, the event data set is global, covering the 263 known international river basins and their associated countries.⁴ A more detailed description of the BAR event database process as applied to the present study is provided in Chapter 3.

BAR GIS Development

A geographic information system (GIS) is the combination of hardware and software that allows, but is not limited to, management and integration of information about geophysical, social-political, and economic phenomena. The BAR GIS utilized commercial, off-the-shelf technology and software, and open-source commercial, government, and academic databases in its construction. In the context of the BAR study, GIS is used to help discover indicators of conflict and cooperation associated with freshwater. The study used this information to evaluate river basins worldwide in order to

determine which basins were showing potential for future conflict. Chapter 3 details the modifications made to the baseline BAR GIS methodology used for this study.

Findings of BAR Using Quantitative Methodology

Utilizing an approach combining GIS and the event data sets, the BAR researchers identified a number of characteristics which indicate a river basin's potential for conflict over water. Basins follow three general categories of risk. Nations engaged in current conflicts have the highest risk, since the existing conditions are already pushing them toward further hostility. In the second category of risk, there are existent or emerging conditions which place stress on the freshwater resources and infrastructures of the nations concerned. In this category, there is public evidence of concern or protest over the conditions. This leads to the third category, in which conditions exist or are emerging, but have not reached a level of awareness where hostility is expressed openly.⁵

In addition to these categories of risk, the BAR study also identified six factors that contribute to the potential risk for water related conflict. These factors include those basins whose riparian nations had a per capita GDP below the World Bank lowest income country definition; a population density above 100 people per square kilometer; generally hostile overall relations between riparian neighbors; the possibility of basin internationalization due to minority group activity; unilateral construction of water development projects, such as dams and hydroelectric power generation stations developed under protest or without consensus of the riparian neighbors; and the lack of freshwater treaties or treaties which are limited in scope or participation (table 1).

Table 1. Factors Contributing to Basin Risk for Conflict
Population Density >100 people/km ²
Per capita GDP < \$765/person
Overall unfriendly relations*
Basin internationalization potential
Proposed water development projects
Freshwater treaty status

* This is defined as having a BAR scale of < -1.0. The BAR scale and its development is discussed later in this thesis.

Source: Shira B. Yoffe, “Basins at Risk: Conflict and Cooperation Over International Freshwater Resources” (Ph.D. diss., Oregon State University: 2001), 95.

BAR Methodology at a Regional Level

The BAR study developed global-level quantitative data and analysis for conflict and cooperation related to water. In “Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential,”⁶ the BAR methodologies are applied at a regional level. That study’s author, Valery Votrin, explores whether or not the overarching factors for conflict risk identified in the BAR study are also present in the relationships between the Aral Sea international river basin riparian countries. To do this, the Amu Darya river basin (a sub-basin of the Aral Sea basin) and its riparian nations were selected as the study’s focal point. The present study uses the same geographic region, with a particular focus on Afghanistan and its portion of the Amu Darya river basin (figures 1, 2, and 3).



Figure 1. Amu Darya River Basin Riparian Nations

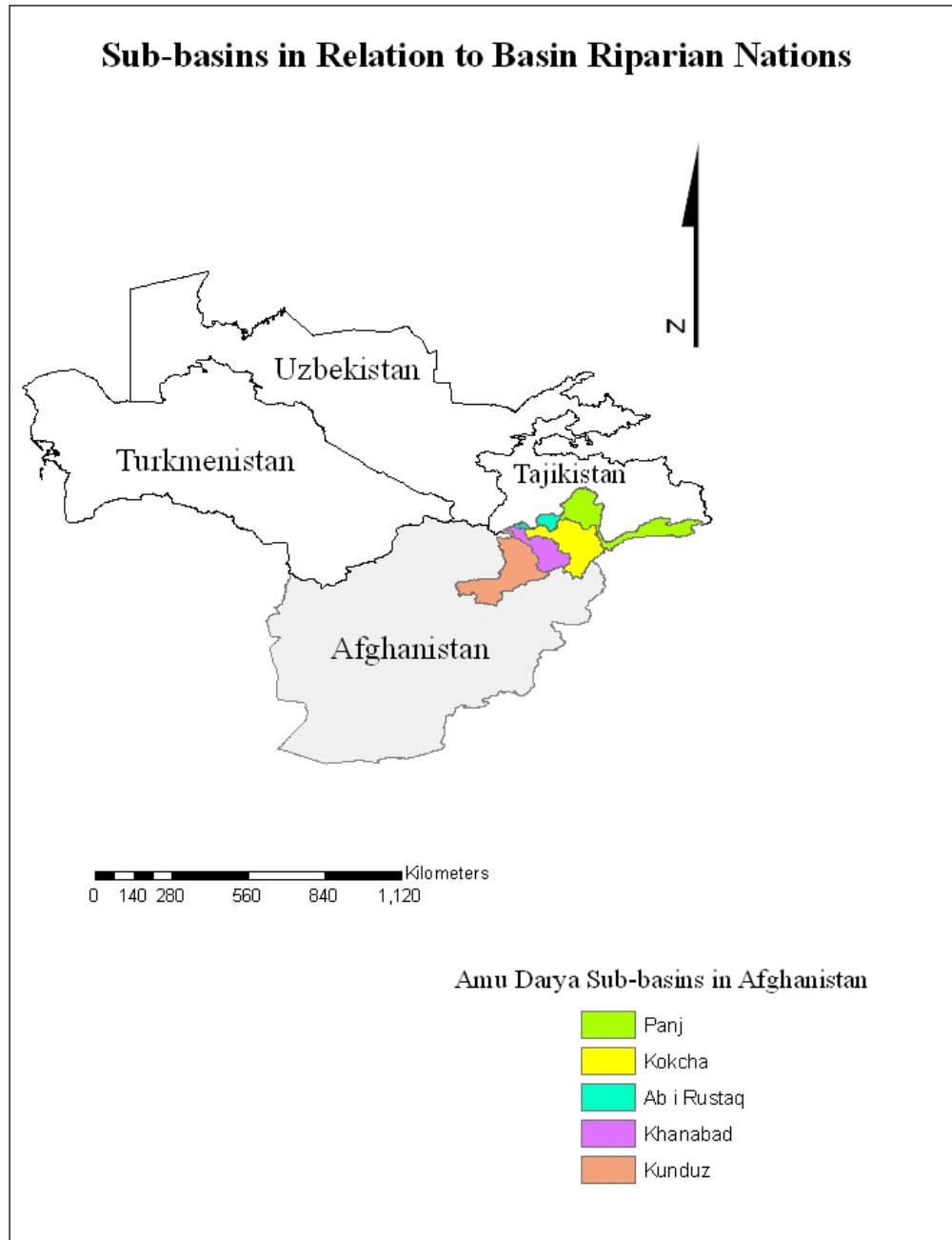


Figure 2. Amu Darya Sub-basins in Relation to International Borders
(All Lie Within Afghanistan National Boundaries)

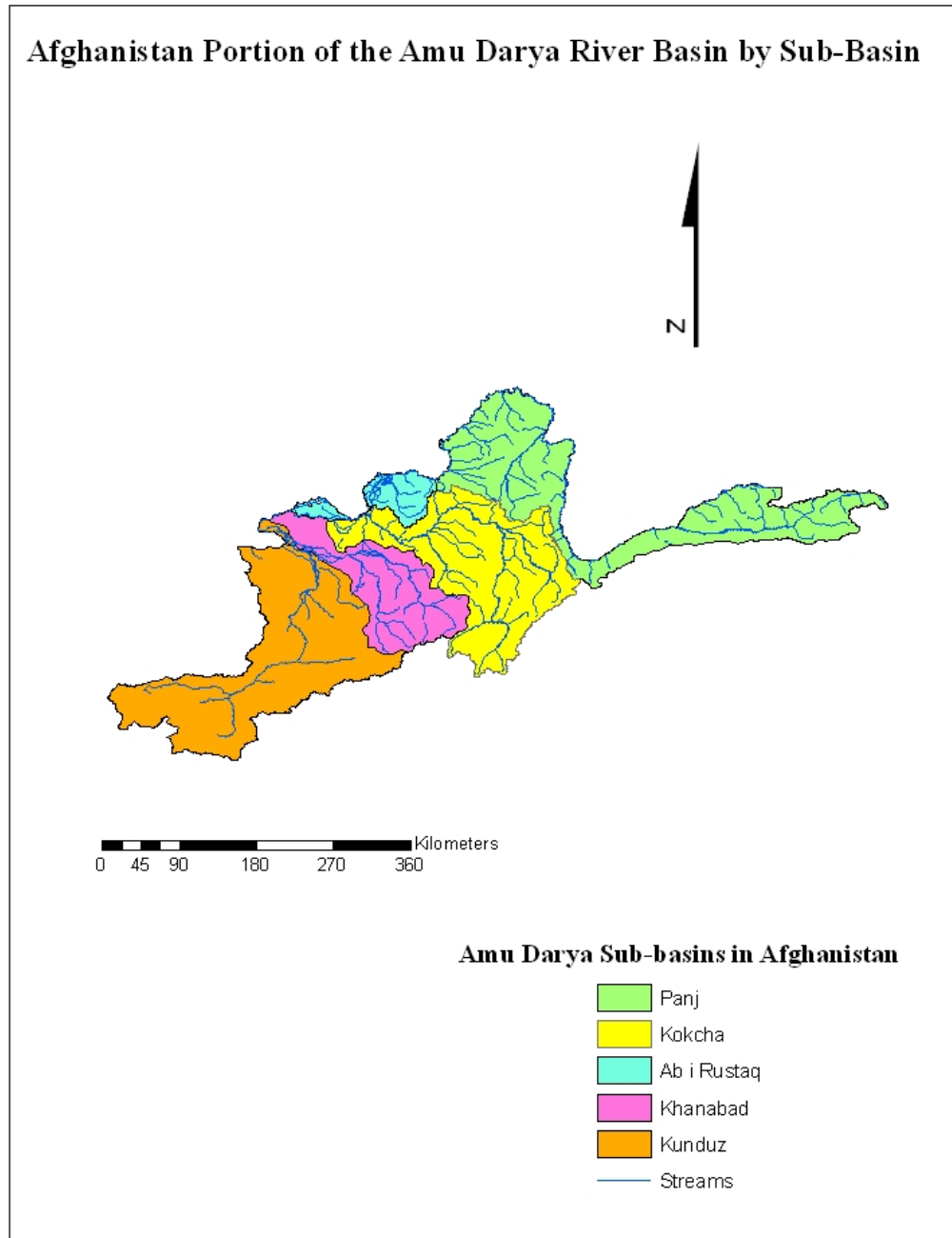


Figure 3. Sub-basins Comprising the Amu Darya River Basin within Afghanistan

Data Development for the Amu Darya River Basin

Following the findings in the BAR study, Votrin's Central Asian study developed data coverage for the following areas: population, runoff, dams, minority groups, GDP, overall relations, and freshwater treaties.⁷ The BAR methodology was then applied to these data sets to examine the relationships between three Amu Darya riparian nations: Uzbekistan, Tajikistan, and Turkmenistan. Afghanistan was specifically excluded from the overall relations and GDP analysis and only given limited treatment relating to development projects.

Population Data Development

Population in relation to water conflict potential is expressed as density per basin. Using Landsat Global Population project data,⁸ density was calculated per square kilometer within the Amu Darya river basin.⁹

Runoff

Runoff in the basin is given as a volume per grid per year. Grid volumes are derived from river discharge observations and simulation, based on values from eight gauging stations on the Amu Darya. Runoff volume per grid is expressed as $(\text{mm} \cdot \text{km}^2/\text{yr})$.¹⁰

Dams

Dam *density and number* were derived from data used to build the Digital Chart of the World as well as information from the International Commission on Large Dams (ICOLD).¹¹

Minority Groups

The Votrin study assessed two data sources for information on potential increased internationalization of the Amu Darya basin based on minority group separatist activity. The first is the Minorities at Risk Project at the University of Maryland and the second is the Unrepresented Nations and Peoples Organization.¹²

GDP

GDP for the Amu Darya riparian nations was derived from World Bank data.¹³

Overall Relations

Overall relations are evaluated based on an event database developed using the BAR methodology described earlier. The data sources used by Votrin include the World News Connection (WNC), and the Transboundary Freshwater Dispute Database (TFDD).¹⁴ As noted, the Votrin study excludes Afghanistan from this data set's development, and excludes Afghanistan from the empirical analysis derived from it. Qualitative assessment of Afghanistan's role in the overall water security status of the basin is provided by Votrin.

Freshwater Treaties

Freshwater treaties information was derived through analysis of the International Freshwater Treaties database.¹⁵

Assessment of Water Security in the Amu Darya River Basin, 1995-2003

A summary review of Votrin's findings on Amu Darya river basin water security relative to the six principal factors studied reveals the following. The population density for the basin was calculated as $<50/\text{km}^2$. This value is less than one-half the threshold

value of $>100/\text{km}^2$ estimated by the BAR study as contributing to risk for conflict over freshwater resources. Per capita GDP was calculated at $<\$465.30$ within the basin. This is considerably less than the $<\$765/\text{person}$ risk factor for the global scale, placing the basin's countries well within the range considered at risk. It is noted that data for Afghanistan was not included in the Votrin calculation. Two major projects the Rogun Dam and the Golden Century Lake are both assessed as destabilizing water development projects, primarily because they are unilateral developments that are not supported by institutional mechanisms for managing the change they bring to water use in the basin.

Potential for further internationalization of the Amu Darya river basin is based on the Karakalpakstan separatist movement in Uzbekistan, as well as qualitative assessment of reconstruction requirements in Afghanistan. Votrin considers northern Afghanistan during the time period of her study (1995-2003) to have transitioned from de facto control and existence under warlords to emerging control by the new central government following overthrow of the Taliban. In so doing, the area is experiencing a transformation similar to those undergone by separatist movements elsewhere, with similar affects on the region's riparian relationships. This issue is further examined in chapters 4 and 5 of the present study.

The quantitative findings for overall relations between the three included riparian (Uzbekistan, Tajikistan, and Turkmenistan), show generally unfriendly relations. Finally, freshwater treaties are of limited scope. In addition, the existing treaties do not include all the member states within the basin.¹⁶

Defining Riparian Nation Relationships

The third baseline study offers an analytical approach to interpreting event database information through correlation of the conflict and cooperation levels of the riparian nations under consideration.¹⁷ Similar to the technique used in the BAR study, the researches developed an event database from open source news reporting. These events were scored along the scale used in the BAR study. The results formed the basis for correlation analysis whose results were applied to a decision tree describing a typology of relations that might exist between the riparian nations.

The study focused on three distinct regional groups. The first used South Africa as the primary nation, the second Israel, and the third India. Each of these nations was compared to their riparian neighbors to establish the levels of friendship or hostility between them. The results were used to define the level of bilateral or multilateral relations and the link between water and non-water issues in those relationships.

Review of Research Question, Supporting Questions, and Hypotheses

The research question is: What is Afghanistan's effect on water security in the Amu Darya River Basin? The secondary questions asked at which levels of military operations (strategic, operational, and or tactical) are the selected methodologies best applied; and during which phases of planning and execution are these methodologies most useful?

The thesis will examine evidence associated with six hypotheses. They are based on the six general risk factors for conflict identified by the BAR study and applied by Votrin in her analysis of the Amu Darya river basin.

The general, global level conclusions drawn by the BAR study delineated six factors for conflict whose presence indicate that a river basin and its riparian countries are at potential risk for conflict over water resources. Of these six, one is related to overall hostility levels between riparian nations. The BAR study found that at the global level, overall hostility also reflects hostility over water. When a similar examination was performed at a regional level, it was found that regions were generally more cooperative over water than they were cooperative in their general relationships.¹⁸ Hypothesis 1 is: The inclusion of Afghanistan in the assessment of overall hostility between the Amu Darya river basin riparian nations will have no affect on the level of water hostility between them.

The Votrin study concluded that population density within the Amu Darya basin was approximately one-half the risk threshold identified by BAR on the global level. Hypothesis 2 is: Updated population data will show population density per square kilometer within the basin will remain below the BAR risk threshold.

Per capita GDP for the Amu Darya basin countries was calculated by Votrin at approximately \$300.00 below the BAR risk threshold. Hypothesis 3 is: Inclusion of Afghanistan per capita GDP will not increase basin GDP above the BAR risk threshold.

Increases in internationalization, based on minority political activity, of a river basin are associated by BAR for increases in risk for conflict over water. The Votrin assessment of the Amu Darya indicates that the change in government in Afghanistan has had a similar internationalization affect on the basin. Hypothesis 4 is: Inclusion of Afghanistan event data will show an increase in conflict over water resources within the

basin due to the internationalizing effect of the US invasion and installation of the transitional government.

The BAR study found that water development projects without benefit of supporting institutions, such as bilateral and multilateral agreements, are a risk factor for a river basin. The Votrin study's assessment of development projects within the Amu Darya river basin supports the BAR conclusion. Hypothesis 5 is: Assessment incorporating evidence of Afghanistan water development activities within the basin will show an increase in the risk for conflict over water.

BAR found that basins with no or few freshwater treaties have a higher risk for conflict. The Votrin study found similar evidence within the Amu Darya. Hypothesis 6 is: There will be no increase in the number of treaty agreements in the study time period following the US invasion of Afghanistan.

Summary and Conclusions

This chapter reviewed the background and literature leading to the development of the thesis research questions and hypotheses. The BAR study and its conclusions for global level risk factors established three categories of Basins at Risk for conflict over water, and defined six general factors for risk.

The second study reviewed demonstrated how the BAR methodology using event database construction combined with GIS technology was applied to a regional level river basin analysis. The subject basin was the Amu Darya river basin in Central Asia. The basin was analyzed relative to the six factors for conflict identified in the BAR study. Conclusions reached by the study were that the overall relationships over water within

the basin were conflictive. The study did not use event data from Afghanistan, one of the basins riparian countries.

The third study interpreted data base findings with the goal of defining the nature of riparian relationships. Its methodology showed how event data can define relationships as primarily bilaterally or multilaterally focused, and how issues of concern in general and over water are connected or independent of one another.

All of the studies reviewed demonstrated how the TFDD was incorporated into event database development and analysis.

The present study will expand on the regional findings presented in the work on the Amu Darya basin. It will include event data associated with Afghanistan for the study time period; update population density analysis through use of recent gridded population data sets; and build a more current GIS of the Amu Darya river basin reflecting improvements in information availability following the US invasion of Afghanistan in October, 2001.

Using this updated data, the thesis will examine Afghanistan's effects on the six primary factors for risk identified in the BAR study and as applied to the Amu Darya by Votrin. Through this examination, the research questions will be answered, and their implications for use of the methodology in the context of military operations is explored.

¹Valery Votrin, "Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential" (Thesis, Vrije Universiteit Brussel, 2002) [thesis on-line]; available from <http://www.transboundarywaters.orst.edu/>, accessed 25 October 2005.

²The political science and security literature has grown considerably in the last decade concerning water and water issues. Approaches include game theory, identification of causality for environmental conflict, relationships between security and water, as well as water's impact as a strategic commodity. The following sources provide

a brief survey: Undala Z. Alam, "Questioning the Water Wars Rationale: A Case Study of the Indus Waters Treaty," *The Geographical Journal* 168, no. 4 (2002): 341-53; Kent Hughes Butts, "The Strategic Importance of Water," *Parameters* Spring 27, no.1 (1997): 65-83; Peter H. Gleick, "Water and Conflict: Fresh Water Resources and International Security," *International Security* 18, no. 1 (1993): 79-112; Moshe Hirsch, "Game Theory, International Law, and Future Environmental Cooperation in the Middle East," *Denver Journal of International Law and Policy* 27, no. 1 (1998): 1-30; Thomas F. Homer-Dixon, "On the Threshold: Environmental Changes As Causes of Acute Conflict," *International Security* 16, no. 2 (1991): 76-116; Miriam R. Lowe, "Bridging the Divide: Transboundary Resource Disputes and the Case of West Bank Water," *International Security* 18, no. 1 (1993): 114-38; Julie Trottier, "Water and the Challenge of Palestinian Institution Building," *Journal of Palestine Studies* 29, no. 2 (2000): 35-50.

³Yoffe, "Basins at Risk."

⁴Ibid, 43.

⁵Ibid, 68.

⁶Votrin, "Transboundary Water Disputes in Central Asia," 35.

⁷Ibid, 31-33.

⁸Oak Ridge National Laboratory, "LandScan Global Population Database" [database on-line]; available from <http://www.ornl.gov/landscan/>; Internet; accessed 25 October 2005.

⁹Votrin, "Transboundary Water Disputes in Central Asia," 31.

¹⁰Balazs M. Fekete, Charles J. Vörösmarty and Wolfgang Grabs, "Global Composite Runoff Fields Based on Observed River Discharge and Simulated Water Balances," available from <http://www.grdc.sr.unh.edu>; Internet; accessed 5 September 2005.

¹¹Votrin, "Transboundary Water Disputes in Central Asia," 32.

¹²Unrepresented Nations and Peoples Organization (UNPO); available from <http://www.unpo.org>; Internet; accessed 22 October 2005.

¹³World Bank; available from <http://www.worldbank.org/data>; Internet; accessed 5 April 2006.

¹⁴Votrin, "Transboundary Water Disputes in Central Asia," 33.

¹⁵Oregon State University, "Transboundary Freshwater Dispute Database" [database online]; available from <http://www.transboundarywaters.orst.edu/>; Internet;

accessed 25 October 2005 in Votrin, "Transboundary Water Disputes in Central Asia," 33.

¹⁶Votrin, "Transboundary Water Disputes in Central Asia," 52-53.

¹⁷Giordano et al, "The Geography of Water Conflict and Cooperation."

¹⁸Yoffe, "Basins at Risk," 82.

CHAPTER 3

METHODOLOGIES USED TO ASSESS WATER SECURITY

The purpose of the research is to evaluate Afghanistan's effect on water security in the Amu Darya river basin. Using this assessment, the research will also examine ways in which the quantitative methodologies used can be applied to planning and execution of military operations where water resources are a principle concern. For this research, the method chosen utilizes development of a geographic information system (GIS), and then uses this GIS with an event database. A GIS is a software-enabled data management system that enables the researcher to investigate the relationships between multiple layers of data, such as geophysical, socio-political, economic, or biophysical data. An event database is, in this research, a compilation of news articles describing events associated with general and water-related interactions between riparian nations in the Amu Darya river basin. In addition, select findings from previous studies will be compared with newly available information and updated where appropriate.

The chapter begins with a discussion of how the GIS are structured. It will review the layer (sometimes also referred to as a feature) coverage chosen for the study from the perspectives of the geophysical, non-geophysical and temporal. Also reviewed are the processes and techniques used to compare data sources and prepare layers for use in the GIS. The data sources for the GIS are discussed. This includes government, commercial and non-government/open source data.

Similarities with and modifications to the baseline BAR Project¹ methodology for event database development are presented. In addition, the event data base is subjected to comparison and contrast with that presented in "Transboundary Water Disputes in

Central Asia”². The content of the data base is described, along with the procedures used to collect and prepare the data for inclusion in the database. The sources of the event data are reviewed, and their limitations discussed.

After the review of GIS and event database development, the chapter will cover how these tools were used in investigating the research question and hypotheses. This investigation centers on the six general factors of risk for water conflict identified in the BAR study, and reviewed in chapter 2 of this thesis. The investigation process is examined in two general parts. A description of data extraction from the GIS and event database is presented first. The second part reviews the hypotheses and the analytical processes that will be used to test them once the data is derived.

Amu Darya GIS and Data Development

Development of a GIS covering the Amu Darya river basin provides a mechanism through which the research questions and hypotheses can be explored. The general pattern of GIS development described in the BAR Project is followed here.

Hydrologic Features

The principle geophysical feature of the GIS is the Amu Darya River and its basin. The baseline coverage employed here utilizes the same initial coverage found in both the BAR Project study and in “Transboundary Water Disputes in Central Asia.”^{3,4,5}

Since the US invasion of Afghanistan, the Afghan government has attempted to move forward with institution and infrastructure development as part of the nation’s overall reconstruction plan. One outcome of these efforts is the establishment of the Afghanistan Information Management Service (AIMS).⁶ One of the project areas of the

service is to build an internal GIS capacity serving a wide range of clients from the public and private sectors.

Amu Darya Basin Coverage Development

The primary GIS data for the basin was obtained from the Afghanistan Information Management Service for hydrologic features within Afghanistan, including rivers, lakes, watersheds and irrigation. These data were then matched against the baseline data used in the BAR Project and “Transboundary Water Disputes in Central Asia” studies in order to develop the hydrologic layer used in this thesis. A complete list of GIS data sources used is provided in the bibliography. Once the hydrologic features were defined, these were then matched to international boundaries for the four riparian nations studied, as well as to the intra-national administrative boundaries associated with the river basin.

Population Density

The present study updates population density data for the Amu Darya basin used in the BAR Project and in “Transboundary Water Disputes in Central Asia.” The source for population data is the Landscan Global Population Project, conducted at the Oak Ridge National Laboratories.⁷ Using a variety of remote sensing technologies, the project developed accurate global population distributions. The BAR Project and “Transboundary Water Disputes in Central Asia” studies respectively utilized the 1998 and 2000 Landscan research results to define population density at the basin level. Unlike more traditional census data, which are generally based on political and administrative boundaries, Landscan estimates of population are instead linked to surface area.⁸ This

approach allows the researcher to not only understand the population of a given administrative boundary, such as a county, but also the physical distribution of the population, such as by hectare, within that boundary. This flexibility makes it possible to represent populations at a complete range of spatial levels.

The latest available Landscan data set was completed in 2004, and is the version the author used in this study.⁹ The population distribution and density within Afghanistan's portion of the basin were derived using GIS software¹⁰, following a similar process used by Yoffe in the BAR Project study. This was done by associating the Landscan grid cells to the cells comprising the Amu Darya basin. The cell values were summed to find the total basin population. Population density was calculated by associating the tabulated grid information with the basin's area to arrive at the density per square kilometer within the basin.¹¹

Water Development Projects

The present study updates previous work with the inclusion of recently available data on water development projects within the basin. The sources of this data included a review of event data and a review of development program reporting, such as that of the United Nations Development Program (UNDP)¹² in Afghanistan and the Afghan Information Management Service.¹³

Per Capita GDP

Per capita GDP is derived from World Bank¹⁴ and other economic data sources. Per capita GDP is presented per basin country by year of the study, and as an average of

all years. Data in the BAR Project and “Transboundary Water Disputes in Central Asia” studies was updated to include all available data from 1995 to 2005.

Internationalization Potential

Internationalization potential was examined from the perspective of the ethno-linguistic groups present within Afghanistan’s portion of the river basin. The level of separatist activity present in these groups was assessed based on event reporting in the database, as well as through information in the Minorities at Risk project database.¹⁵ Other sources included Department of Defense briefings on Afghanistan and its security situation.¹⁶

The estimated area of Afghanistan’s portion of the Amu Darya river basin occupied by each ethno-linguistic group was developed. Once the geographic delineation of the groups was determined, this was then correlated with events in the event data base and the other information sources to gauge their effect on overall relations and relations over water.

Freshwater Treaty Status

This set of data was established by review of event database, TFDD updates historical research and examination of Afghan reconstruction information.¹⁷

Event Database Development

An event database was developed to support analysis using the GIS described above. The two principle coverage sets of the database describe overall relationships between the Amu Darya riparian neighbors, and describe the state of relations concerning the issue of water. To this end, a pattern of database development similar to that used in

both the BAR Project and in the Votrin study was applied. The following paragraphs illustrate the structure and methodology of the event database constructed for this thesis.

Database Structure

Data is coded into a Microsoft Access relational database, based on the coding procedures found in the BAR study. Table 2 shows the principle fields used for coding each of the events. The complete event listing is presented in the appendices.

Table 2. Event Data Fields	
Field	Field Description
Date	The date of the event as posted to the OSC database.
Countries	The countries involved in the event. In this study, there will always be at least two.
BAR Scale	The numerical value/score, from -7 (most conflictive) to 0 (neutral) to 7 (most cooperative), assigned to each event.
Event Summary	A short descriptive summary of each event.
Issue Type	One of thirteen categories of issues. ¹⁸

Source: Modeled after Shira B. Yoffe, “Basins at Risk: Conflict and Cooperation Over International Freshwater Resources,” (Ph.D. diss., Department of Geosciences, Oregon State University, 2002) 135.

Event Sources

Event data for this thesis was collected using the Open Source Center (OSC)¹⁹ databases. OSC is the new name for the Foreign Broadcast Information Service (FBIS). It is also the non-commercial counterpart to the World News Connection (WNC) used by

the BAR Project researchers and Votrin in “Transboundary Water Disputes in Central Asia.” The time frame used for data collection was January, 1995 through December, 2005. This time period was chosen to roughly coincide with that used in the Votrin study, which sampled 100 water and non-water related events in order to develop a picture of overall and water relations between the Amu Darya riparian nations.

Data Collection Parameters and Processes

Database development began by defining the set of search terms to use with the OSC databases. For consistency, the sets of terms used in the BAR study were used as the baseline, modified with appropriate political and geographic terms related to the regional nature of this study. It is possible that a different or broader range of search and exclusion criteria can be developed. This is discussed in chapter 5 as part of areas for further research.

The terms presented here reflect some modification made during the search. For example, “sharia” was added as an exclusionary term, since its inclusion resulted in several thousand additional hits with little or no relevance. The power of the electronic data base search requires a somewhat intuitive approach to the search. Periodic sampling allowed the search parameters to be scoped in such a way as to produce manageable levels of hits. The lack of an automated coding process to parse the hits was a significant constraint that emerged during the course of research. Table 3 shows the search terms for both overall and water related events.

Table 3. Open Source Center Search Terms	
Water Terms	Amu Darya, Amudarya, water resources, water, hydropower, hydroelectricity, irrigation, river*, lake, dam, stream, tributary, diversion, pollution, water quality, flood* , drought* , channel, canal, fish rights, hydroelect*, reservoir
Excluded Terms (Water)	Heart, prison, Paktia, Logar, Ghazni, Paktya, Hirat, Farah, Nimroz, Hilmand, Kandahar, Zabul, Uruzgan, Paktika, Khost, nuclear, sea, ocean, navigat*, nuclear, water cannon, light water reactor, mineral water, hold water, cold water, hot water, water canister water tight water down* flood of refugees Rivera , Suez , Panama , oil , drugs , Three Gorges , sea , ocean , navigation , China , Pakistan , Kazakhstan , Kyrgyzstan , Iran , Egypt , Yemen , Saudi Arabia , sharia)
Conflict and Cooperation Terms	relations , development , dispute , conflict, war, accord, negotiation, treaty, cooperation, hostility, agree*, negotiate*, resolution, commission, secretariat, joint management, basin management, peace, accord, peace accord, settle*, collaboration, dispute* , conflict* , disagree* , sanction* , war, troops, letter of protest, shots fired, hostility, boycott, protest
Excluded Terms (Conflict and Cooperation)	water resources, water, hydropower, hydroelectricity, irrigation, river*, lake, dam, stream, tributary, diversion, pollution, water quality, flood*, drought* , channel , canal , fish rights , hydroelect* , reservoir , Amu Darya , Amudarya , Russia , China , Pakistan , Kazakhstan , Kyrgyzstan , Iran , Egypt , Yemen , Saudi Arabia , sharia

Source: Modeled after Shira B. Yoffe, “Basins at Risk: Conflict and Cooperation Over International Freshwater Resources,” (Ph.D. diss., Department of Geosciences, Oregon State University, 2002) 17, Table 2.3. Words followed by an asterisk were used as a search term that could return hits for multiple words containing the root, for example “agree*” could return “agree,” “agreement” or “river*” returns “river,” “rivers” etc.

Event Data Development

Searches were conducted at one year intervals from 1995 to 2005, in two primary sets; one for general conflict and cooperation events, the other for water-related conflict and cooperation events. Unlike the BAR Project study, which collated all relevant events within its search time frame, the present study is based on a sample of events over the

time period studied. This is primarily to maintain consistency with the Votrin study and for data manageability within the time allotted for the thesis. Potential implications of this choice are further discussed in chapter 4. The results of the overall conflict and cooperation initial search are shown in figure 4.

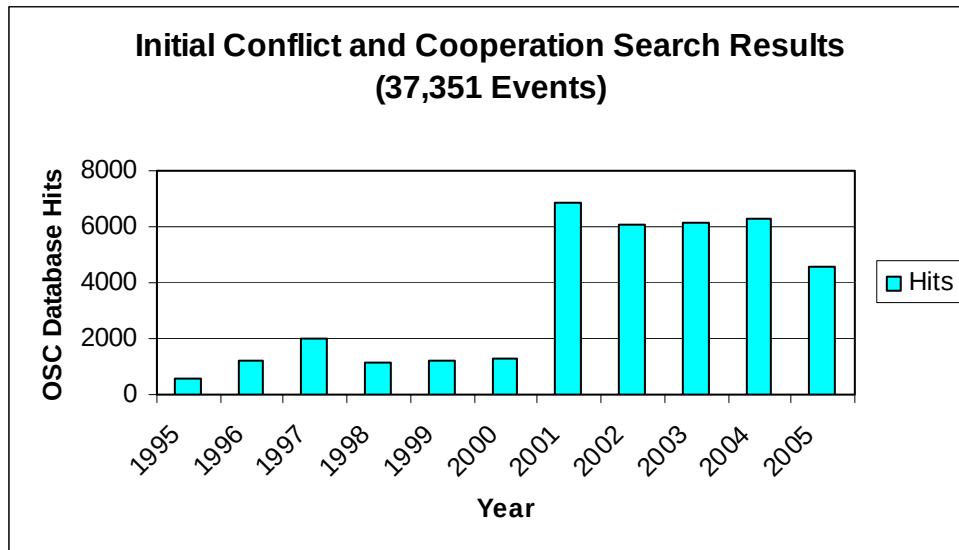


Figure 4. Initial Conflict and Cooperation Event Search Results

The number of hits shows a definite spike in 2001. There are several plausible explanations for the spike. One is that this reflects heightened media interest in the region due to the US invasion. The spike may also reflect an increased capability of OSC to exploit news in the region due to increase in resources, such as translators available to perform the work, or improvements in digitization and storage of information. When the total hits were filtered for relevance, the number of events decreased to 786 and also

followed a somewhat different pattern. The 2001 spike is present, but the years on either side are more symmetrical (figure 5).

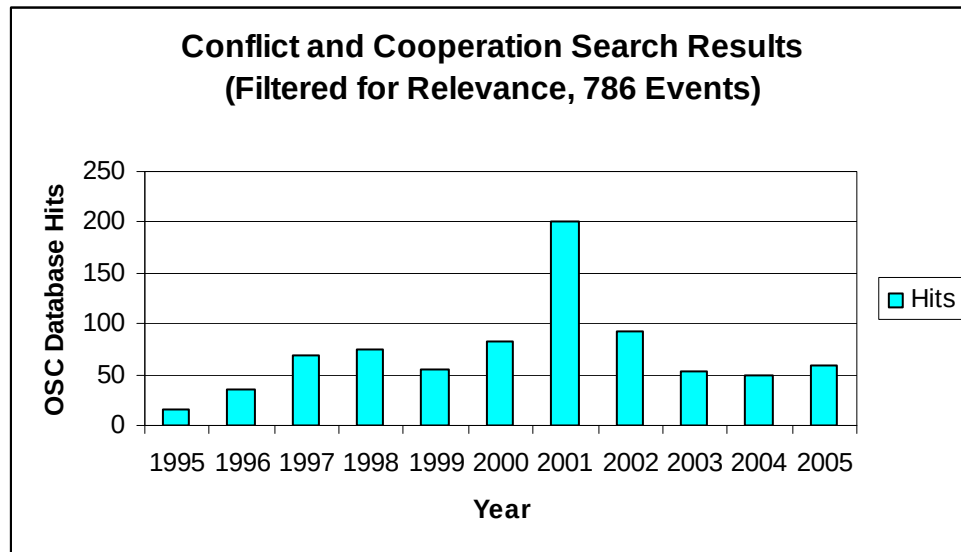


Figure 5. Conflict and Cooperation Search Results, Filtered for Relevance

The search by year for water related events was significantly smaller. Across the entire ten-year period, a total of 178 potential events were returned (figure 6). Figure 6 does not reflect inclusion of data from the TFDD website. These events are accounted for in the final water event database developed for the thesis.

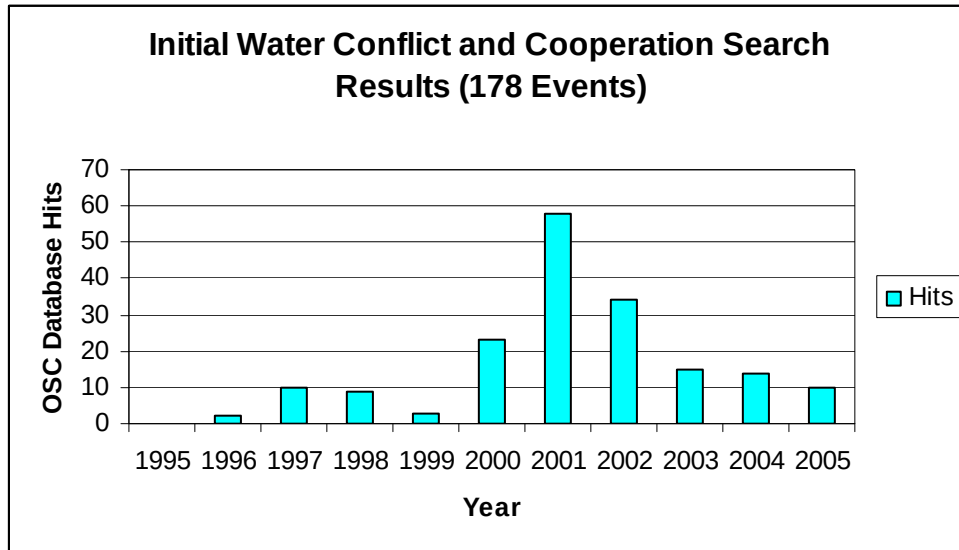


Figure 6. Initial Water Conflict and Cooperation Search Results

The samples used to develop the event databases for water and non-water events were derived from the event lists filtered for relevance. The process for determining relevance and sample size derivation is discussed in chapter 4.

Event Intensity Scale

Once the sample was obtained for both overall relations and for water relations, the author used an event intensity scale to give each a numerical score. This allows each event's intensity to be described relative to all the other events within the sample. The scale used for both sets of events is based on that developed in the BAR Project study.²⁰ The use of the BAR Scale also aligns the research in this thesis with the research on water events and overall relations found in the Votrin study results, since that study also used the BAR scale for event scoring. Table 4 illustrates the BAR event scoring criteria applied to the present study.

Table 4. Event Intensity Scale	
BAR Scale	Event Description
-7	Formal declaration of war
-6	Extensive War Acts causing deaths, dislocation or high strategic cost: Use of nuclear weapons; full scale air, naval, or land battles; invasion of territory; occupation of territory; massive bombing of civilian areas; capturing of soldiers in battle; large scale bombing of military installations; chemical or biological warfare.
-5	Small scale military acts: Limited air, sea, or border skirmishes; border police acts; annexing territory already occupied; seizing material of target country; imposing blockades; assassinating leaders of target country; material support of subversive activities against target country.
-4	Political-military hostile actions: Inciting riots or rebellions (training or financial aid for rebellions); encouraging guerilla activities against target country; limited and sporadic terrorist actions; kidnapping or torturing foreign citizens or prisoners of war; giving sanctuary to terrorists; breaking diplomatic relations; attacking diplomats or embassies; expelling military advisors; executing alleged spies; nationalizing companies without compensation.
-3	Diplomatic-economic hostile actions: Increasing troop mobilization; boycotts; imposing economic sanctions; hindering movement on land, waterways, or in the air; embargoing goods; refusing mutual trade rights; closing borders and blocking free communication; manipulating trade or currency to cause economic problems; halting aid; granting sanctuary to opposition leaders; mobilizing hostile demonstrations against target country; refusing to support foreign military allies; recalling ambassador for emergency consultations regarding target country; refusing visas to other nationals or restricting movement in country; expelling or arresting nationals or press; spying on foreign government officials; terminating major agreements. <i>Unilateral construction of water projects against another country's protests; reducing flow of water to another country, abrogation of a water agreement.</i>
-2	Strong verbal expressions displaying hostility in interaction: Warning retaliation for acts; making threatening demands and accusations; condemning strongly specific actions or policies; denouncing leaders, system, or ideology; postponing heads of state visits; refusing participation in meetings or summits; leveling strong propaganda attacks; denying support; blocking or vetoing policy or proposals in the UN or other international bodies. <i>Official interactions only.</i>
-1	Mild verbal expressions displaying discord in interaction: Low key objection to policies or behavior; communicating dissatisfaction through third party; failing to reach an agreement; refusing protest note; denying accusations; objecting to explanation of goals, position, etc.; requesting change in policy. <i>Both unofficial and official, including diplomatic notes of protest.</i>
0	Neutral or non-significant acts for the inter-nation situation: Rhetorical policy statements; non-consequential news items; non-governmental visitors; indifference statements; compensating for nationalized enterprises or private property; no comment statements.

1	Minor official exchanges, talks or policy expressions--mild verbal support: Meeting of high officials; conferring on problems of mutual interest; visit by lower officials for talks; issuing joint communiqués; appointing ambassadors; announcing cease-fires; non-governmental exchanges; proposing talks; public non-governmental support of regime; exchanging prisoners of war; requesting support for policy; stating or explaining policy.
2	Official verbal support of goals, values, or regime: Official support of policy; raising legation to embassy; reaffirming friendship; asking for help against third party; apologizing for unfavorable actions or statements; allowing entry of press correspondents; thanking or asking for aid; resuming broken diplomatic or other relations.
3	Cultural or scientific agreement or support (non strategic): Starting diplomatic relations; establishing technological or scientific communication; proposing or offering economic or military aid; recognizing government; visit by head of state; opening borders; conducting or enacting friendship agreements; conducting cultural or academic agreements or exchanges. <i>Agreements to set up cooperative working groups.</i>
4	Cultural or scientific agreement or support (non strategic): Starting diplomatic relations; establishing technological or scientific communication; proposing or offering economic or military aid; recognizing government; visit by head of state; opening borders; conducting or enacting friendship agreements; conducting cultural or academic agreements or exchanges. <i>Agreements to set up cooperative working groups.</i>
5	Military economic or strategic support: Selling nuclear power plants or materials; providing air, naval, or land facilities for bases; giving technical or advisory military assistance; granting military aid; sharing highly advanced technology; intervening with military support at request of government; concluding military agreements; training military personnel; joint programs and plans to initiate and pursue disarmament.
6	<i>International Freshwater Treaty; Major strategic alliance (regional or international):</i> Fighting a war jointly; establishing a joint military command or alliance; conducting joint military maneuvers; establishing economic common market; joining or organizing international alliances; establishing joint program to raise the global quality of life.
7	Voluntary unification into one nation: Merging voluntarily into one nation (state); forming one nation with one legally binding government.

Source: Shira B. Yoffe, "Basins at Risk: Conflict and Cooperation Over International Freshwater Resources" (Ph.D. diss., Department of Geosciences, Oregon State University, 2002), 25, Table 2.6, water-specific events are in italics.

Software and File Formats

The GIS software used to process the data in this study is ArcGIS version 9.1.²¹ Event data base information was processed using Microsoft Excel 2003 spread sheet and Microsoft Access 2003 data base software.²²

This chapter reviewed the principle data collection and analytical techniques used to conduct the research for this thesis. Development of the GIS layers was explained, and how the supporting data for the GIS was derived. The structure of the event database was described. The description of the event database included the methodology for collecting the data and an initial description of the event data itself.

¹Shira B. Yoffe, “Basins at Risk: Conflict and Cooperation Over International Freshwater Resources” (Ph.D. diss., Oregon State University, 2001), [dissertation on-line]; available from <http://www.transboundarywaters.orst.edu/>; Internet; accessed 25 October 2005.

²Valery Votrin, “Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential” (Thesis, Vrije Universiteit Brussel, 2002) [thesis on-line]; available from <http://www.transboundarywaters.orst.edu/>, accessed 25 October 2005.

³USGS EROS, “HYDRO1k Elevation Derivative Database” [database on-line]; available from <http://edc.usgs.gov/products/elevation/gtopo30/hydro/index.html>; Internet; accessed 1 May 2006.

⁴Aaron T. Wolf, Jeffrey A. Natharius, Jeffrey J. Danielson, Brian S. Ward, Jan K. Pender. 1999. “International River Basins of the World,” *International Journal of Water Resources Development* 15 no. 4, [article on-line]; available from <http://www.transboundarywaters.orst.edu/>; Internet; accessed 25 October 2005.

⁵USGS GTOPO30 (Global 30 Arc-Second Elevation Data set) [database on-line]; available from <http://eros.usgs.gov/products/elevation/gtopo30.html>; Internet; accessed 1 May 2006.

⁶AIMS (Afghanistan Information Management Service); available from <http://www.aims.org.af/>; Internet; accessed 1 May 2006.

⁷Oak Ridge National Laboratory, “LandScan Global Population Database” [database on-line]; available from <http://www.ornl.gov/landscan/>; Internet; accessed 1 May 2006

⁸Yoffe, “Basins at Risk,” 55.

⁹Landscan, 2004.

¹⁰ArcGIS 9: ArcView 9.1 and Extensions Student Version, ESRI, 2005.

¹¹Yoffe, “Basins at Risk,” 55.

¹²UNDP (United Nations Development Program) Afghanistan; available from <http://www.undp.org.af/default.htm>; Internet; accessed 1 May 2006.

¹³AIMS, 2006.

¹⁴World Bank; available from <http://www.worldbank.org/data>; Internet; accessed 1 May 2006.

¹⁵Minorities at Risk Project (2005) College Park, MD: Center for International Development and Conflict Management; available from <http://www.cidcm.umd.edu/inscr/mar/>; Internet; accessed: 20 October 2005.

¹⁶United States Department of Defense; available from <http://www.defenselink.mil/>; Internet; accessed 7 January 2006.

¹⁷Oregon State University, “Transboundary Freshwater Dispute Database” [database online]; available from <http://www.transboundarywaters.orst.edu/>; Internet; accessed 25 October 2005.

¹⁸An event can be associated with more than one type of issue. In these cases, the author reviewed the entire article and coded the event based on which issue type seemed to predominate.

¹⁹OSC (Open Source Center). 2006: <http://www.opensource.gov>, accessed 9 April 2006.

²⁰Yoffe, “Basins at Risk,” 25, Table 2.6.

²¹ArcGIS 9: ArcView and Extensions, ESRI, 2005.

²²MS Office 2003, Microsoft Corporation, Redmond, Wash., 2003.

CHAPTER 4

WATER SECURITY IN THE AMU DARYA RIVER BASIN

The purpose of the research was to assess Afghanistan's affect on water security in the Amu Darya river basin from 1995 to 2005. Through this assessment, the various techniques used were themselves evaluated for their utility in assisting with the planning, execution and evaluation of military operations where water resources may be a significant security risk. The methodology examined development of an event database containing a sample of conflict and cooperation events, and a geographic information system to assist in spatial analysis of these events. The area under consideration was the Amu Darya river basin, whose riparian members are Afghanistan, Tajikistan, Turkmenistan and Uzbekistan.

The chapter begins with an analysis of the event database development and coding results. The findings of using the event database and geographic information system to assess water security in the basin against six factors of risk for conflict as described in chapter 2 are presented. The research questions are then answered by placing the results of these assessments in the context of the processes used to obtain them.

Establishing the Event Database Samples

The primary quantitative instrument used to assess overall and water relations between the Amu Darya riparian nations were the event databases, constructed from two principle sources. The first was news reporting found in the archives of the Open Source Center (OSC).¹ The second source of events was the Transboundary Freshwater Dispute Database's index of International Freshwater Treaties.² The first data set developed was

used to assess the overall relations between Afghanistan, Tajikistan, Turkmenistan, and Uzbekistan. The second data set was used as the basis to assess relations over water between the nations.

Of the original data points derived from the search criteria described in chapter 2, there were 786 non-water related events and 178 water related events that met the relevancy criteria for inclusion in the database (chapter 3, figures 5 and 6). This in turn was reduced to a final list numbering 201 events describing overall relations, and 38 events describing water relations; the sampling process is discussed below.

The disparity between the initial search results and the final list are attributable to several factors. First, the structure of the OSC database allows for multiple search criteria. In the case of the search for events associated with the Amu Darya riparian nations, the search was geographically delineated by the four countries; Afghanistan, Tajikistan, Turkmenistan and Uzbekistan. Only articles where these countries were mentioned in any context and which included any of the search terms were returned as successful search hits. As a result, articles where a third party mentions any of the countries and in which one or more of the included search terms is present becomes a search return, thereby inflating the initial list of returns from the database. For example, articles primarily about an event in or concerning Saudi Arabia, particularly in the years 2000 and 2001, often mention Afghanistan in a context not related to the present study. Similar patterns were found for Indonesia in articles discussing Islam, or Uzbekistan in the context of Japanese economic development.

A second factor in the outcome of sampling is the review process itself. The initial filtering through database criteria had to be followed up with a manual review of

the tag line for each event. This one to two line mini-summary was used as a further discriminator to separate likely relevant events. This process was relatively efficient from a discrimination standpoint, but extremely time consuming.

The outcome of this second screening points to the relative inefficiency of the initial search. Culling the electronic database required searching the entire article, vice the subject line, which, in turn, led to the high number of returns that then had to be resorted. Although the OSC search allows for a high level of control over search criteria, these results are still similar to the World News Connection and other database limitations found by Yoffe in the BAR study.³

Despite the limitations, the final list of relevant articles pertaining to overall relations was still relatively large, over 700. One of the goals of this study was to define the practicality of using event databases for military planning and assessment. To this end, time efficiency was one measure of practicality. During planning where the situation demands quick reaction and flexibility, such as crisis action planning, developing an event database to support analysis is not feasible using the model presented here. What is feasible is developing event databases for target countries and regions before they become crises. That is, when there is sufficient time available to develop the databases. At this point, event databases become useful during crisis action planning through their potential to inform decisions with information on trends and patterns found within the target. It takes time to develop hypotheses, cull the proper information from the database, and then evaluate the results. Afghanistan is a case in point. It is not likely that water resources and their effect on operations would be analyzed in October, 2001. However, this information included as part of an updated, available and broader country assessment

would be very practical for developing an effective end state to operations. Working in favor of the technique is that once the databases are built, updating them is a much less daunting task than building them initially.

Reading and coding individual articles is a labor-intensive process. The impracticalities of manually coding soon become obvious. An attempt to mitigate this was made by sampling the data set in order to achieve adequate representation of each country and each time period.

A random sample of both the general event list and the water specific list was made using a random number generator.⁴ Similarly, the sample size chosen from this list was generated using a sample size calculator.⁵ Using the initial non-water population of 786, with a confidence level of 95 percent and confidence interval of 5, the sample size of 258 was determined. During coding, and after a complete reading of the articles, it was determined that 57 of the 258 did not meet relevancy criteria. This final sample of 201 equates to a confidence level of 95 percent and confidence interval of 5.97, based on the initial population of 786. Adjusting the original population to 729, the 201 event sample equates to a confidence interval of 5.89. The summary statistics for the final samples are found in Appendix C. Figure 7 illustrates the sample breakdown.

The water event list was small to begin with, and so was not sampled, but coded in its entirety. As can be seen in the figures, and similar to the non-water event sample, once each article was coded, further cuts of events occurred when a full reading of the article indicated it did not meet the relevancy criteria for inclusion in the data set. The total number of water-related articles used for analysis was 38, including the TFDD⁶ data (figure 8).

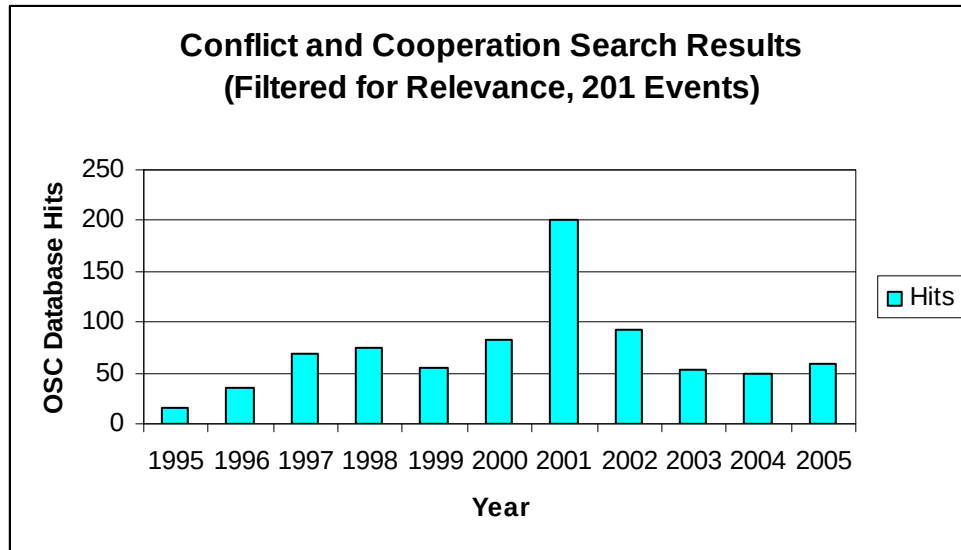


Figure 7. Final Conflict and Cooperation Event Sample

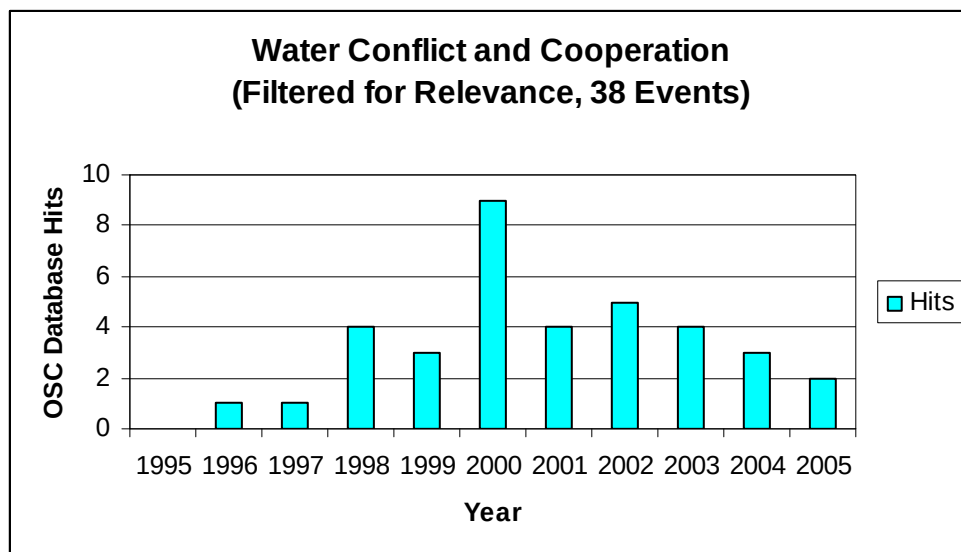


Figure 8. Final Water Conflict and Cooperation Event Sample

Assessing Relations

The first hypothesis for evaluation was: The inclusion of Afghanistan in the assessment of overall hostility between the Amu Darya river basin riparian nations will have no affect on the level of water hostility between them.

Summary analysis of the data illustrates the pattern of relations between the Amu Darya riparian. In the following discussion, the addition of events for Afghanistan is highlighted to show the effects of that country on both general and water specific relations.

Overall Relations Between Amu Darya Riparian

Non-water events are categorized as Cooperation, Economic Cooperation, or Security.⁷ Certain events had characteristics of several categories; in these cases the author of the present study coded based on what was judged the primary issue (figure 9). For comparison, figure 10 illustrates the breakdown without the Afghanistan associated events.

As illustrated, when Afghanistan is excluded, the overall relationship changes from Security and Cooperation dominated, to a greater emphasis on the Economic Cooperation issue type. The distribution of issues across the study time frame that includes all countries demonstrates a fairly marked shift away from security issues toward the year 2005. As security declines as an issue, cooperative events take on more importance (figure 11).

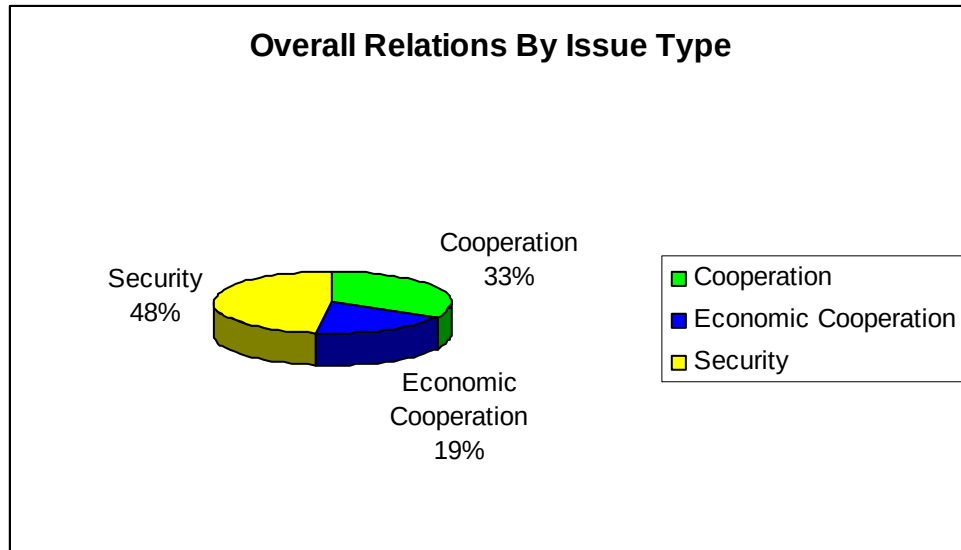


Figure 9. Overall Relations by Issue Type Among the Four Countries

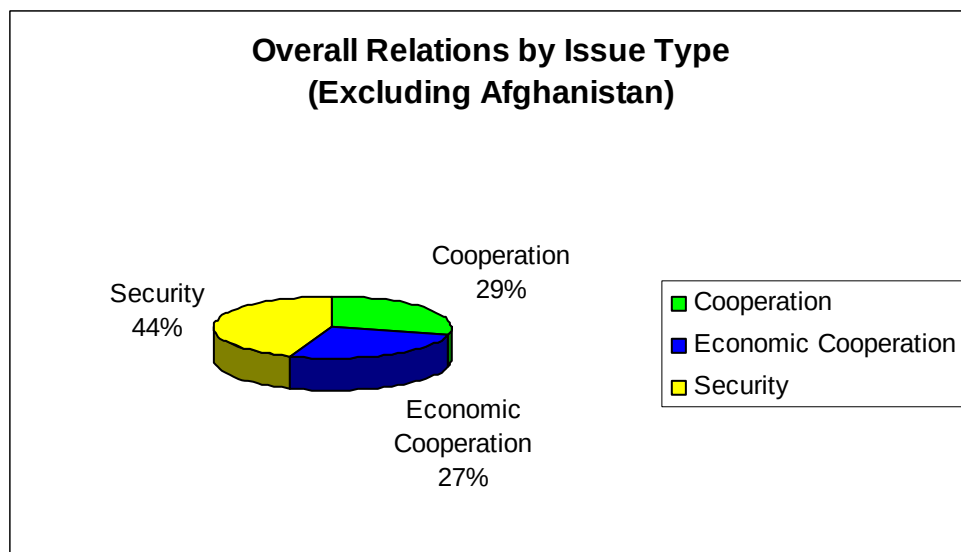


Figure 10. Overall Relations by Issue Type, Excluding Afghanistan Associated Issues

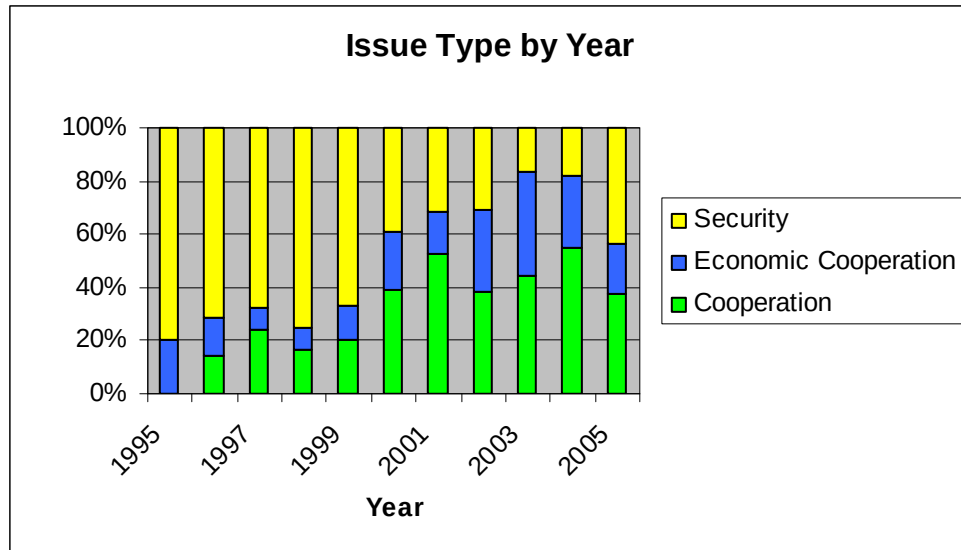


Figure 11. Issue Type by Year

Note: Shows the distribution of issues over the study time period for all countries.

When Afghanistan is excluded from the distribution, the issues do not show this trend, with security remaining more evenly distributed across the years (figure 12), with the exceptions of years 1996 and 2003, where Afghanistan accounted for all the events associated with security, whether the initiator or receiver of an event. In general, the inclusion of Afghanistan in the assessment makes overall relations in the region follow a less cooperative trend.

The overall level of conflict and cooperation among the basin's neighbors was examined by calculating the average BAR⁸ value for all of the countries in the basin for each year of the study. The split between cooperative and conflictive years is about even, with most cooperative years occurring after 1999 (figure 13).

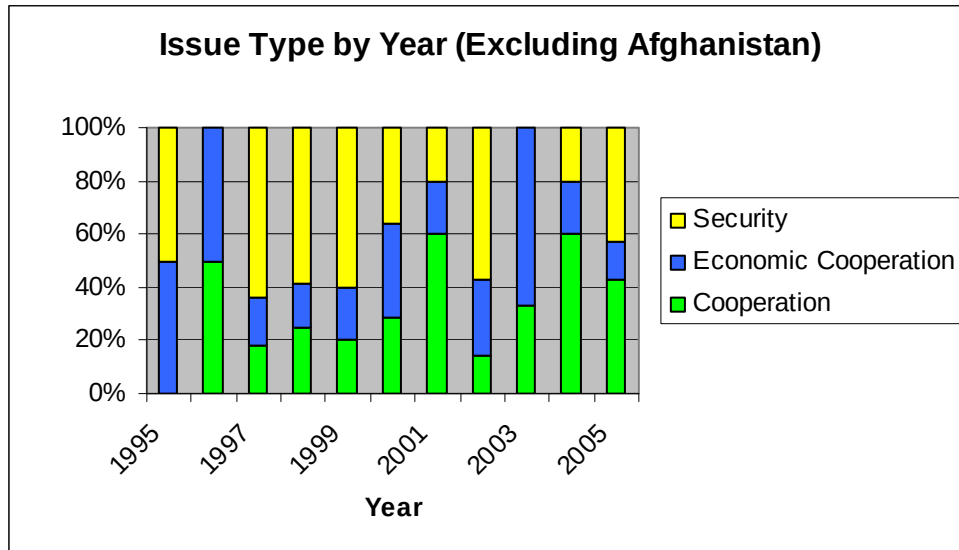


Figure 12. Issue Type by Year, Excluding Afghanistan
 Note: Shows the distribution of issues over the study time period for all countries except Afghanistan.

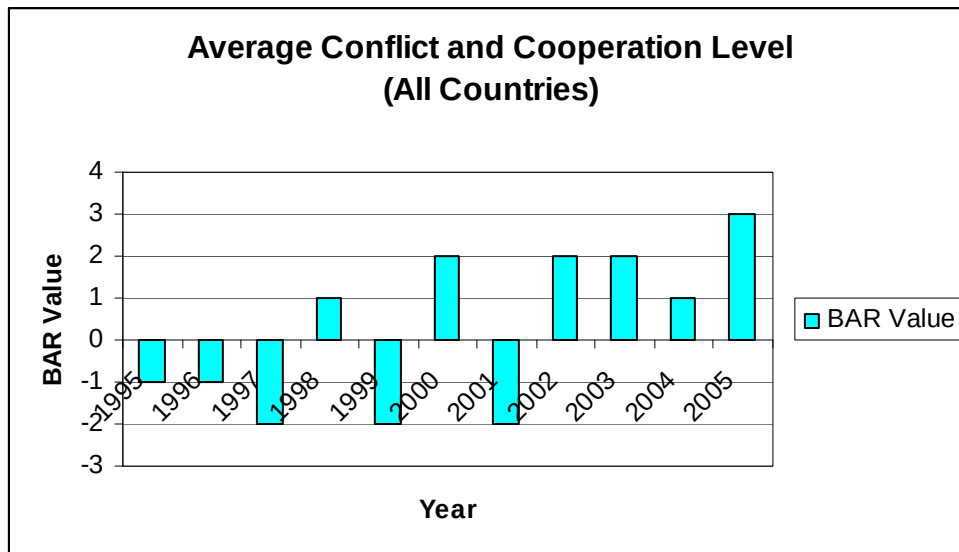


Figure 13. Average Conflict and Cooperation Level (All Countries)
 Note: The BAR values were calculated using the anti-logged values, then reconverted to their closest BAR value. All BAR valuations in all charts use the anti-logged scale as the basis for calculations.

In comparison to the data when Afghanistan is excluded, the difference in cooperative versus non cooperative years is significant. The average BAR values are positive in all but three years; two of the negative years coinciding with the aggregate BAR valuation, the third changing from positive to negative when Afghanistan is excluded. The generally negative average in the years from 1995 to 1999 corresponds well to Afghanistan's overall violence and instability during this period (figure 14).

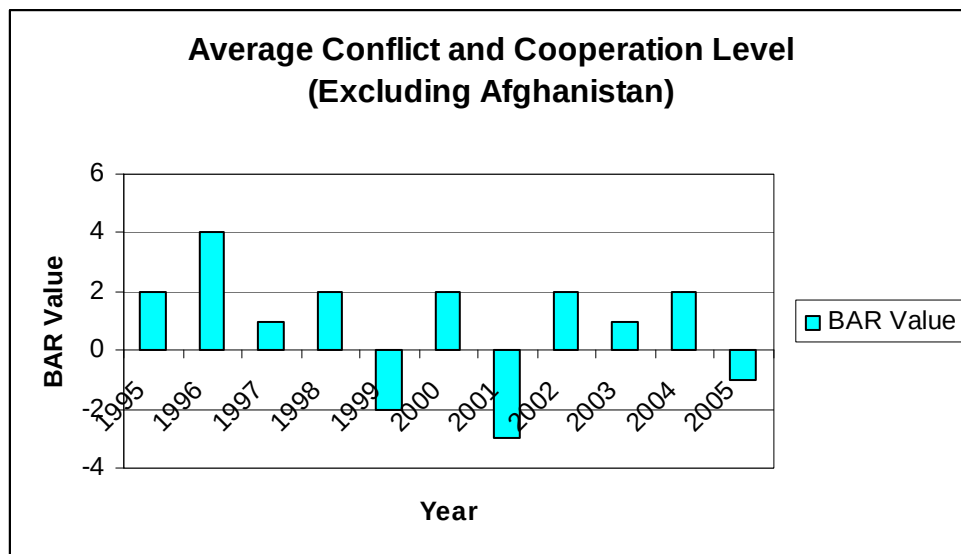


Figure 14. Average Conflict and Cooperation Level, Excluding Afghanistan

The author assesses that the rise in cooperation seen in 2000 on both charts equates to Taliban government attempts at promoting Afghanistan's relations with its neighbors amid an increasing level of international hostility, particularly with the United States. Conflictive events on both charts were negative in 2001, slightly more so when Afghanistan is excluded. When Afghanistan is included in the data, the years after 2001 show there is an overall increase in cooperative behavior among the basin's riparian.

After the US invasion in 2001, the country began to legitimize under a provisional central government. Backed by US and other international forces, the government in Kabul sought, and received, broad international recognition of its legitimacy. This recognition was also apparent in its relations with the other basin riparian neighbors. Distracting from this legitimacy is the security threat under which the Kabul government operates. Three principal sources comprise this threat. The first is Gulbuddin Hekmatyar's Hizb-I Islami Gulbuddin (HIG) organization, the second are remnants of the Taliban forces, and the third are al Qaeda cells operating in the country.⁹ In the background in the country's northern region are the multiple warlord commanders and their supporting militias whose management is a delicate leadership challenge for Kabul's central government.

Several factors mitigate these challenges to legitimacy. The increasing ability of coalition forces in combination with Afghan National Army and Afghan police operations to marginalize HIG, Taliban and al Qaeda operations has contributed to increasing internal stability and legitimization of the Kabul central government. Provincial power, under the warlords, is managed and reduced through selective lateral promotions of these leaders, cantonment of heavy weapons, and constant DDR (disarmament, demobilization and reintegration) operations directed at the militia forces.¹⁰ The result, combined with effective electoral processes, has further legitimized the Afghanistan national government, and given it more capability to interact with its neighbors.

The event database indicates that overall relations among the Amu Darya river basin's riparian nations are generally characterized by a focus on security issues. Whether

Afghanistan is included or not, the relative percentage of events associated with security does not change substantially. There is a substantial shift in focus between economic cooperation issues and general cooperation issues. When Afghanistan is excluded, economic cooperation takes on more importance, and is nearly even with general cooperation issues. When Afghanistan is included, security takes on more importance, and economic cooperation issues form a much smaller percentage of issues. This indicates that over the time period studied Afghanistan focused the region more closely on security and general cooperation issues vice economic cooperation.

Over the course of the study, the affect of Afghanistan on the relative importance of each issue type appears to be a trend of increasing importance of economic and general cooperation, and a lessening of security issues as time passes. These increases appear to coincide with periods of relative internal stability under the Taliban and the increased legitimacy of the transitional government.

The levels of conflict and cooperation in the region show Afghanistan has a substantial effect. Prior to 2001, Afghanistan has a generally negative effect on the overall level of cooperation among the four nations; causing the trend to be conflictive in five of the six years. In the years after 2001, the opposite is true, with Afghanistan's inclusion driving a generally cooperative trend within the basin.

Water Relations within the Basin

Of the eleven water issue areas, the events coded used six.¹¹ The majority of events were in the areas of water quality and quantity, although, with the exception of economic development, the difference in percentage among issues was not generally large. Figure 15 illustrates the breakdown among all nations.

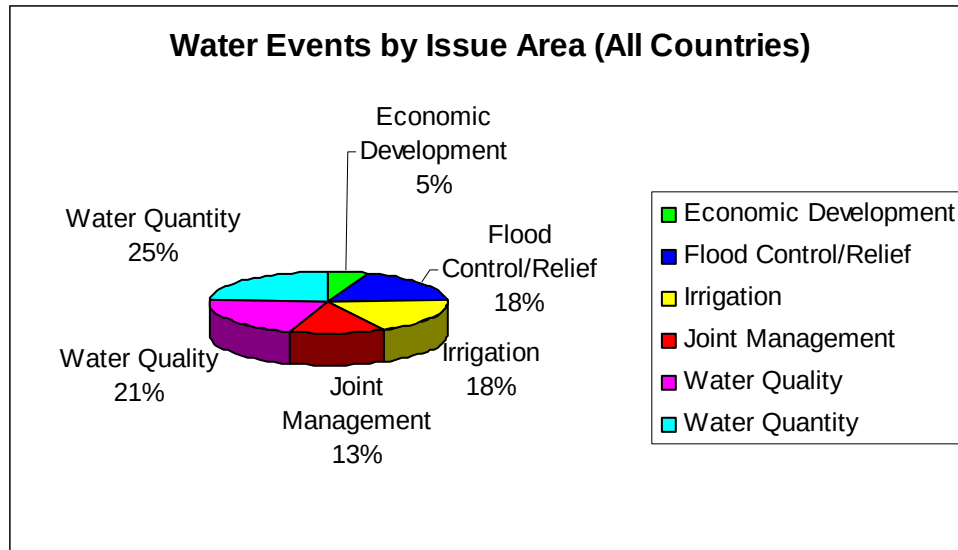


Figure 15. Water Events by Issue Area (All Countries)

Note: Events covering more than one issue were coded based on the author's assessment of the primary issue concerning the event.

When Afghanistan is excluded from the water issues overview, the effect is minimal. Of the entire water event database, Afghanistan was the initiator in only two events. There is some leveling between water quantity and quality, joint management becomes slightly less of an issue, and irrigation gains slightly in importance (figure 16).

Afghanistan's overall lack of stability and legitimacy during the earlier years of the study period may have influenced its ability to effectively engage with its neighbors across the range of issues concerning the river and its basin. In fact, the two events in the database occurred in 2003 and 2004. This trend is similar to the pattern observed in the assessment of Afghanistan's overall relations; whereby Afghanistan's contribution to cooperative behavior within the basin occurs primarily after the US invasion.

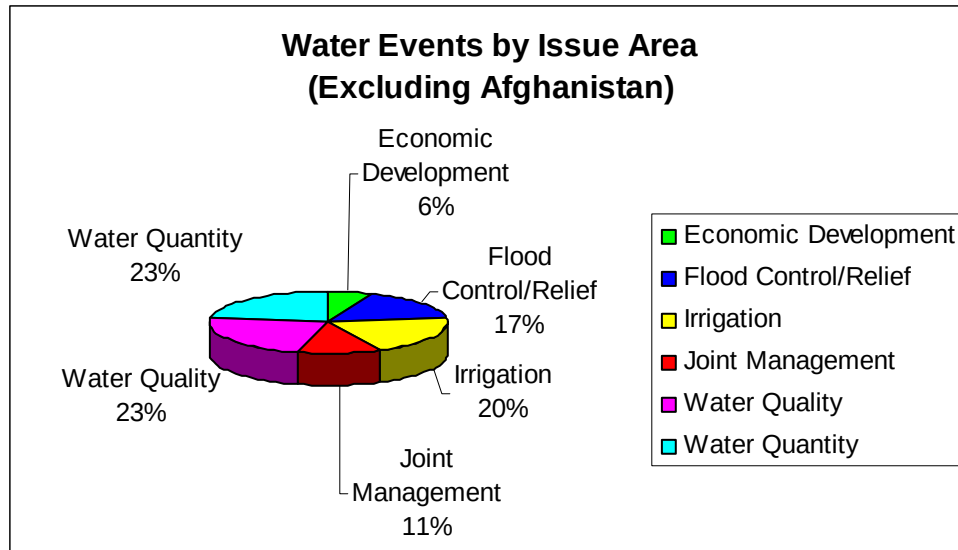


Figure 16. Water Events by Issue Area, Excluding Afghanistan

Despite the national and regional level significance of the river basin, it may also be that issues surrounding the basin's use and condition are not in and of themselves newsworthy when it comes to Afghanistan, when compared to the large scale projects and influence of the other basin riparian countries; and thus resulting in less representation of Afghanistan in the database. Afghanistan's internal water activities, particularly those associated with reconstruction and their basin level effects, may not be registering with the regional news producers. It is not for lack of news coverage in the basin, as the extensive attention to border incursions, skirmishes and flooding problems attests. Another consideration may be that these regional issues are being covered and discussed in other forums, such as the internet, that are not being captured by the OSC reviews.

An examination of distribution across the study time period brings out the difference in focus even more. When the few Afghanistan related events are removed

from consideration, it is observed that issues of Joint Management and Water Quantity disappear entirely in the years from 2003 to 2005. This coincides with the extensive drought and flooding which the region endured during those years. It is perhaps not surprising, given the dearth of apparent management efforts in the aggregate, the dependence on water-intensive crops such as cotton and an already stressed ecosystem that the country level focus was on irrigation, flood control and quantity of water (figures 17 and 18).

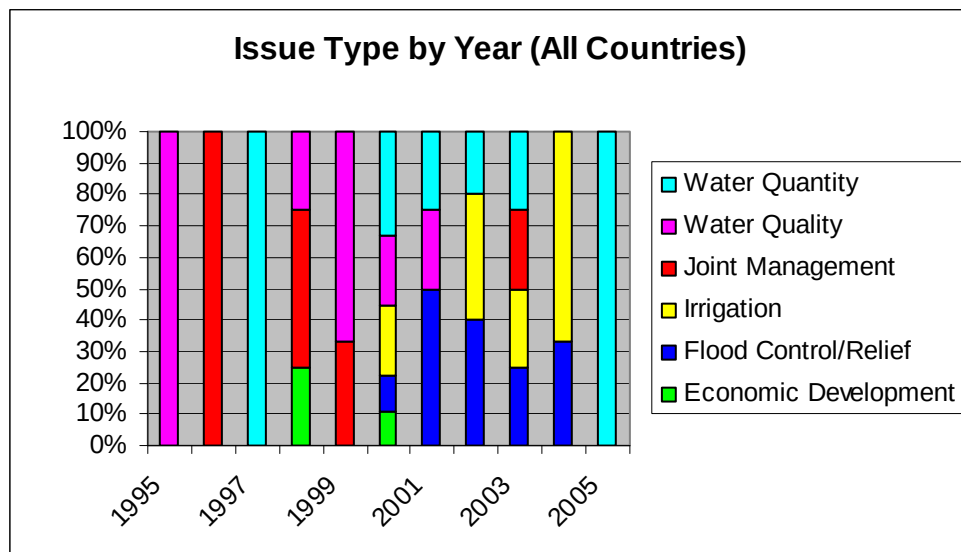


Figure 17. Issue Type by Year (All Countries)

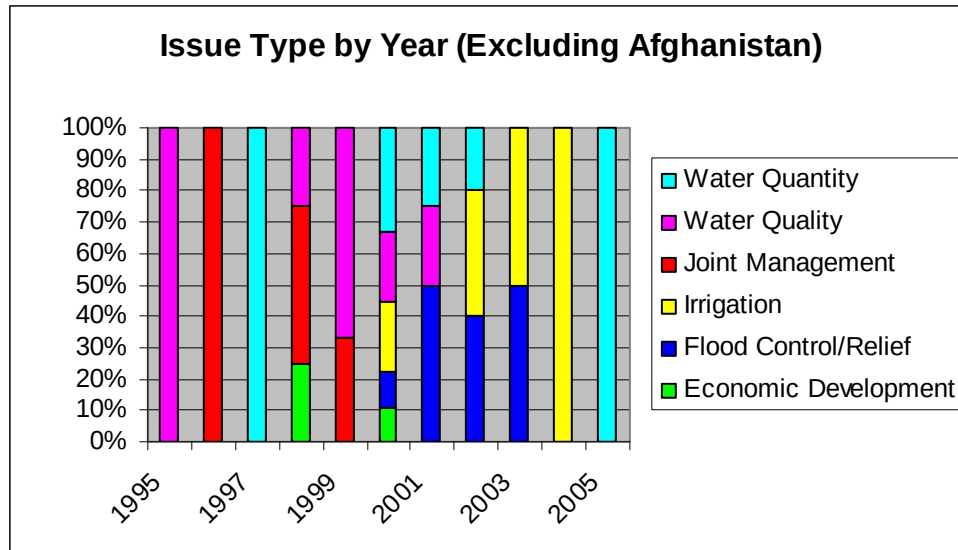


Figure 18. Issue Type by Year (Excluding Afghanistan)

The average BAR valuations per year across the time split between the years 1999 and 2000. Figure 19 shows the earlier years indicate more cooperative behavior, the later less. A review of the event data shows that the major treaties and agreements concerning the Amu Darya river basin were signed during the early period, which has a positive effect on the BAR scoring. The later years are marked by lack of formal treaties or agreements, with most positive events associated with state visits and the ensuing discussions over water issues.

Afghanistan's exclusion removed the one negative event in 2004, which put the year on a positive trend for water relations. Otherwise, the pattern of positive trends from 1995 to 1999 and negative trends from 2000 to 2005 continues (figure 20.)

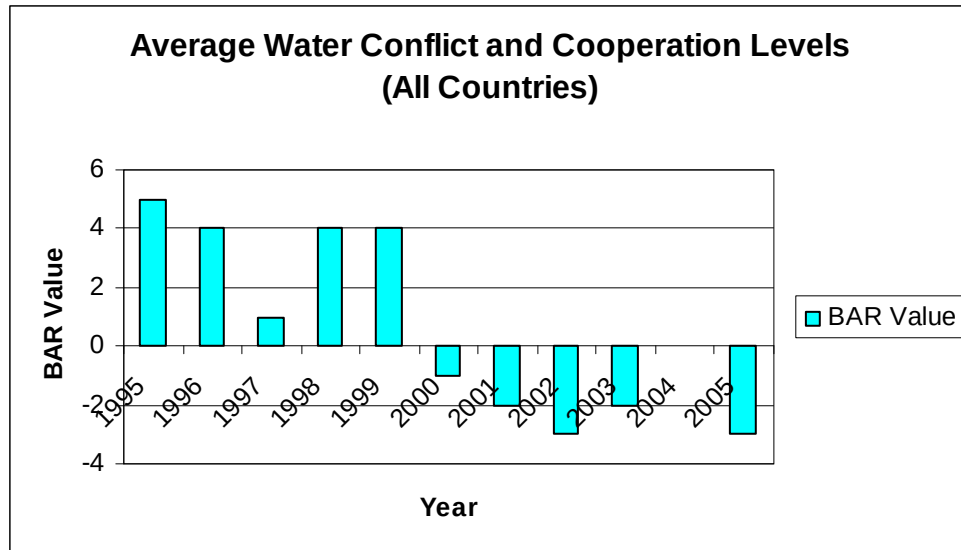


Figure 19. Average Water Conflict and Cooperation Levels (All Countries)

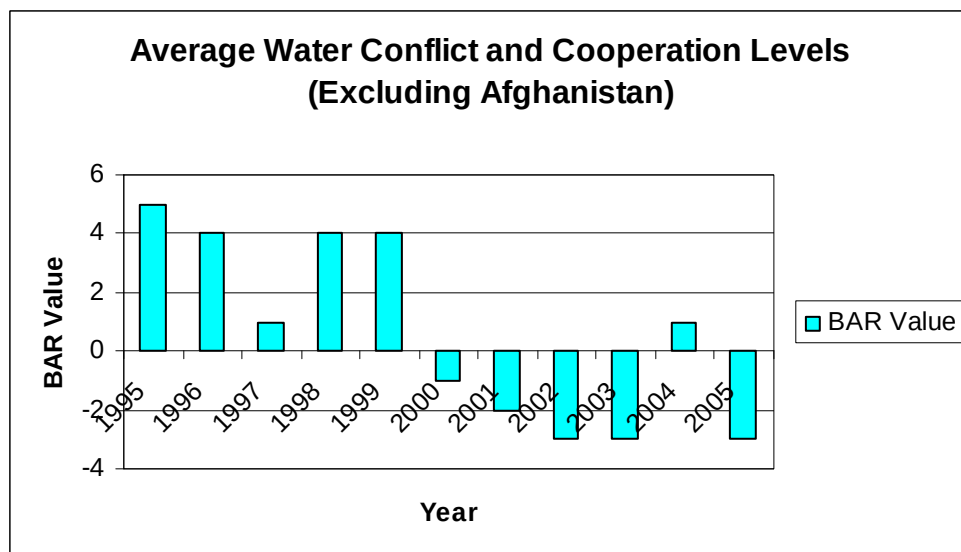


Figure 20. Average Water Conflict and Cooperation Levels (Excluding Afghanistan)

Dynamics in Riparian Relations

These graphic and tabular data provide a start point for drawing out patterns of activity regarding conflict and cooperation among the basin's neighbors. What follows is an application of this data within an analytical framework for examining possible linkages between these data and some of the inferences about the nature of the relationships between the countries.

The model chosen is based on a decision tree (figure 21). The tree begins with three foundation questions about event data from the perspectives of overall conflict and cooperation (in the figure "friendship and hostility"); overall conflict and cooperation and water-related conflict and cooperation; and finally overall water-related conflict and cooperation between the basin's neighbors.¹²

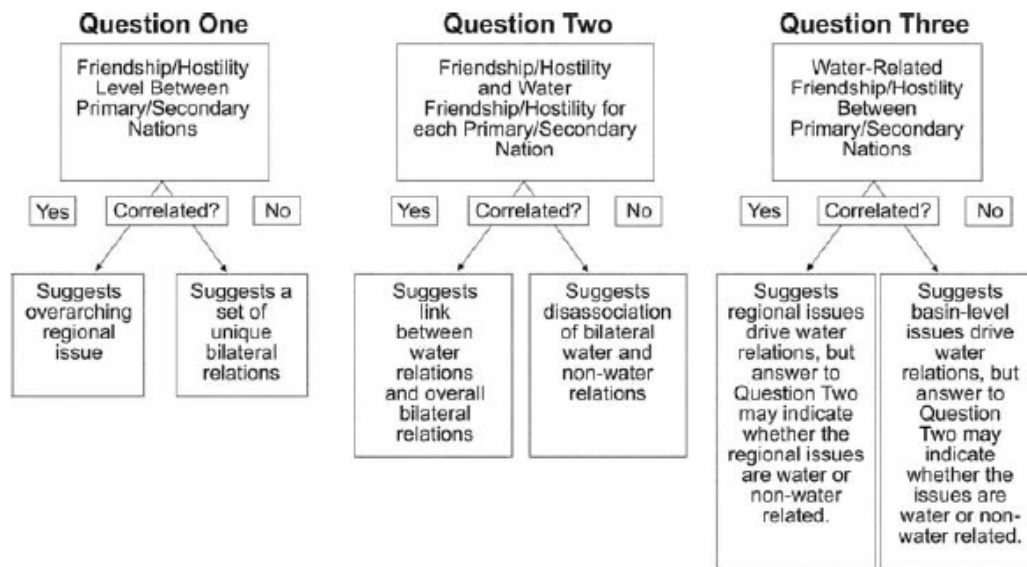


Figure 21. Water Relations Decision Tree

Source: Meredith Giordano, Mark Giordano, and Aaron Wolf, "The Geography of Water Conflict and Cooperation: Internal Pressures and International Manifestations," *The Geographical Journal* 168, no. 4 (2002): 303.

In the first question of the model, the basin's countries were divided into sets of primary and secondary country pairs. The author correlated the average conflict and cooperation values between these pairs against one another for each year of the study. Based on an absolute value scale, the results (whether positive or negative) were scored as correlated, mildly correlated or uncorrelated (table 5).¹³

Reviewing the results for each of the four countries, none of them shows a correlation between primary and secondary pairs. This indicates that each of the countries treats its general relations with its neighbors as discrete patterns of bilateral relations, rather than developing them in the context of multicountry issues.¹⁴

Table 5. Correlation Table 1			
Correlation of Conflict and Cooperation Between Primary and Secondary Country Pairs			
Country Pairs		Correlation Coefficients	Correlation
Afghanistan (Primary)			
AFG TJK	AFG TKM	0.703	Correlated
AFG TJK	AFG UZB	0.135	Uncorrelated
AFG TKM	AFG UZB	-0.161	Uncorrelated
Average Value		0.225667	Uncorrelated
Tajikistan (Primary)			
TJK AFG	TJK TKM	-0.182	Uncorrelated
TJK AFG	TJK UZB	-0.094	Uncorrelated
TJK TKM	TJK UZB	-0.037	Uncorrelated
Average Value		-0.10433	Uncorrelated
Turkmenistan (Primary)			
TKM AFG	TKM TJK	-0.303	Uncorrelated
TKM AFG	TKM UZB	-0.238	Uncorrelated
TKM TJK	TKM UZB	-0.184	Uncorrelated
Average Value		-0.24167	Uncorrelated
Uzbekistan (Primary)			
UZB AFG	UZB TJK	0.175	Uncorrelated
UZB AFG	UZB TKM	-0.02	Uncorrelated
UZB TJK	UZB TKM	0.358	Mild Correlation
Average Value		0.171	Uncorrelated
Country abbreviations used in the tables are: AFG (Afghanistan), TJK (Tajikistan), TKM (Turkmenistan), and UZB (Uzbekistan)			

The second question explores the relationship between overall conflict and cooperation and the levels of water-related conflict and cooperation; both in the aggregate across the time period studied as well as bilaterally between the primary and secondary countries (tables 6 and 7).

Table 6. Correlation Table 2		
Correlation of Average Conflict and Cooperation with Water-Related Conflict and Cooperation		
Afghanistan (Primary)		
-0.727	Correlated	
Tajikistan (Primary)		
-0.387	Mildly Correlated	
Turkmenistan (Primary)		
-0.325	Uncorrelated	
Uzbekistan (Primary)		
0.079	Uncorrelated	

Table 7. Correlation Table 3		
Correlation of Bilateral Conflict and Cooperation with Water-Related Conflict and Cooperation		
Afghanistan (Primary)		
Tajikistan	0.171	Uncorrelated
Turkmenistan	-0.61	Mildly Correlated
Uzbekistan	-0.346	Mildly Correlated
Tajikistan (Primary)		
Afghanistan	0.171	Uncorrelated
Turkmenistan	0.932	Correlated
Uzbekistan	-0.139	Uncorrelated
Turkmenistan (Primary)		
Afghanistan	-0.61	Mildly Correlated
Tajikistan	0.932	Correlated
Uzbekistan	0.214	Uncorrelated
Uzbekistan (Primary)		
Afghanistan	-0.346	Mildly Correlated
Tajikistan	-0.139	Uncorrelated
Turkmenistan	0.214	Uncorrelated

Afghanistan and Tajikistan's average interaction between themselves and their secondary countries possibly indicate that there is a link between their general bilateral relations and their relations concerning water. Turkmenistan and Uzbekistan indicate that general and water bilateral relations are not linked. For Afghanistan and Tajikistan, this suggests the possibility that for these countries, water issues are not an overarching concern in their interactions with other countries, but have relatively the same importance with other issues. The analysis indicates that for Turkmenistan and Uzbekistan, water is a significant issue in their relations with other countries, and may in fact override other issues in importance.

Analysis of table 7 indicates that in its relationships with Turkmenistan and Uzbekistan, Afghanistan may place water issues on relative par with the other issues. The data conversely suggests that water may be a much more significant issue in its relations with Tajikistan.

The data also suggest that water affects Tajikistan's relationship with Uzbekistan to a greater degree than it does the relation with Turkmenistan. Similarly, water also plays a more independent role in Turkmenistan's relations with Uzbekistan, less so with Afghanistan and Tajikistan. Finally, in Uzbekistan's bilateral relations, the data indicates that its relationship over water with Afghanistan moves in relative importance with all of its other relations with that country.

Uzbekistan's disassociation of bilateral and water relations may be related to the significant and seemingly intractable problems it has in its relations with Tajikistan and Turkmenistan over Amu Darya water management and access. Tajikistan is pursuing construction of the Rogun Dam project. One of the largest dams in the world, its

completion will significantly increase Tajikistan's already influential control (over 40 percent) over Amu Darya flow to Uzbekistan.¹⁵ Turkmenistan is constructing the Golden Century Lake. This project is causing significant concern in Uzbekistan because of disagreement over how the lake will be replenished, effect on Amu Darya water availability to Uzbekistan and concern that an environmental disaster similar to the current Aral Sea destruction is inevitable with the project.¹⁶

The final question in this framework reviews the level of conflict and cooperation over water between the four countries. Correlation or lack of correlation is related to the outcomes of question two in order to discern whether the level of issues (regional or basin) behind water relations are possibly water or non-water driven (table 8).

The uncorrelated nature of Afghanistan's water relations suggests that its water relations are driven by basin level issues. The general correlation between its water and non-water issues relative to conflict and cooperation indicates that these basin level issues are probably driven by overall bilateral relations. Tajikistan follows a similar pattern of emphasizing basin level issues in its water relations, but the impact of overall bilateral relations as the driver is somewhat less. This aligns with the country's significant issues with Uzbekistan concerning the Rogun Dam project.

By contrast, Turkmenistan's data shows that regional level issues drive its water relations, and the lack of correlation between water and overall relations indicates that these regional issues may be water related.

Like Afghanistan and Tajikistan, Uzbekistan's water relations appear to be related to basin level issues. Similar to Turkmenistan, the data suggest that the basin level issues are water related.

Table 8. Correlation Table 4 Water-Related Conflict and Cooperation Between Primary and Secondary Country Pairs			
Afghanistan (Primary)			
AFG TJK	AFG TKM	-0.199	Uncorrelated
AFG TJK	AFG UZB	-0.385	Mildly Correlated
AFG TKM	AFG UZB	0.186	Uncorrelated
Average Value		-0.13267	Uncorrelated
Tajikistan (Primary)			
TJK AFG	TJK TKM	-0.117	Uncorrelated
TJK AFG	TJK UZB	-0.165	Uncorrelated
TJK TKM	TJK UZB	-0.012	Uncorrelated
Average Value		-0.098	Uncorrelated
Turkmenistan (Primary)			
TKM AFG	TKM TJK	0.247	Uncorrelated
TKM AFG	TKM UZB	0.637	Mildly Correlated
TKM TJK	TKM UZB	0.695	Correlated
Average Value		0.526333	Mildly Correlated
Uzbekistan (Primary)			
UZB AFG	UZB TJK	-0.107	Uncorrelated
UZB AFG	UZB TKM	0.415	Mildly Correlated
UZB TJK	UZB TKM	0.258	Uncorrelated
Average Value		0.188667	Uncorrelated

Implications for Basin Water Security

The analyses of overall relations between all four of the riparian countries in the Amy Darya river basin show a trend towards focusing on discrete bilateral relationships versus framing national policy relative to a regional viewpoint. This implies that promoting cooperation and security over water within the region may rest in part on identifying the separate issues concerning each nation pair, finding solutions to the problems, and then de-confliction of these issues, rather than developing overarching regional solutions.

A workable water-security framework may be easier to develop among Afghanistan, Tajikistan and Turkmenistan than between these countries and Uzbekistan. The data indicate that for Afghanistan and Tajikistan, the link between overall relations and water relations offers more flexibility in regional negotiations than does Uzbekistan; despite the fact that water tends to be a local issue for these countries. Mitigating for Turkmenistan to achieve success in regional water negotiations is its tendency to have its water relations driven by regional issues. Lack of flexibility for Turkmenistan may come from its tendency to have water behind these regional issues.

Uzbekistan appears to be the most problematic of the four. Several factors work against regional success in water negotiations. The data indicates a tendency toward basin level focus in its water relations. Further, the issues behind these basin level water concerns appear to be independent of its overall relations and national interests, giving it less negotiating flexibility when dealing with the other riparian neighbors.

Summarizing Afghanistan's Affect on Basin Water Security

The inclusion of Afghanistan data points in a quantitative assessment of Amu Darya river basin security has both positive and negative impacts. In the years prior to 1999-2000, the event database indicates the country's internal instability had a significant negative impact on overall cooperation within the basin. However, from 2000-2005, the trend is generally cooperative, even with inclusion of Afghanistan. This cooperative trend appears to have begun with Taliban government attempts to engage regionally in response to general degradation of relations internationally. The international recognition of the legitimacy of Afghanistan's transitional government

emplaced following the US invasion bolstered this cooperative upswing as Afghanistan attempted to reintegrate with its regional neighbors.

With regard to security and cooperation over water, Afghanistan's inclusion in the analysis shows little quantitative impact. General relations over water across the basin show a decline post-2000. Prior to 2000, the event database shows little engagement by Afghanistan regarding water issues, which is consistent with its overall instability and inward focus. It is generally the recipient of action over water, not the instigator. The majority of agreements and treaties concerning water signed during the study period also occurred in the pre-2000 time period, and the cooperative index reflects the affects of these treaties as an increase in cooperation.

Post-2000 the region has been marked with drought, as well as a significant upsurge in unilateral development of the Amu Darya river water. The same stability and legitimacy the transitional government is bringing to Afghanistan is also allowing the country to be more proactive in its engagement with its neighbors, allowing more opportunity for discord as well as cooperation.

The analysis of relationship typology indicates that Afghanistan does not view water issues as regional concerns. Instead, its water relations are driven by basin level issues, and that these issues are possibly driven by the condition of its overall bilateral relations with the neighbor of concern.

The first hypothesis was partially confirmed. Inclusion of Afghanistan into the event database provided further insight into water and non-water relations within the basin; but did not demonstrate that the country had a disproportionately negative impact on overall water relations.

From an overall security perspective, this analysis supports Tajikistan, Uzbekistan, and Turkmenistan as the current and likely future principle sources of conflict over water resources within the region. These countries' choices in how to manage the Amu Darya's resources will drive the level to which Afghanistan contributes to instability over the Amu Darya's water.

Population Risk

The second hypothesis for evaluation was: Updated population data will show population density per square kilometer within Afghanistan's portion of the basin will remain below the BAR risk threshold of greater than 100 people per square kilometer.

Two data sources were used to investigate this hypothesis. Population distribution data was derived from the Landscan population model (figure 22).¹⁷ Amu Darya basin delineations for boundaries and areas were derived from data sets obtained through the Afghanistan Information Management (AIM) service.¹⁸ Geographic information system software¹⁹ was used to process the data from which population densities were calculated (figure 23). The data is based on the AIM data set division of the basin, with Afghanistan's overall density average given for comparison (table 9).

Since the US invasion and subsequent installation of the transitional government, Afghanistan has made concerted attempts at repatriation of refugees as well as Afghan nationals living abroad. Despite these efforts, the data demonstrates that there has not been a substantial change in Afghanistan's population density within the basin since the earlier studies.²⁰ The basin's areas remain at a relatively low population density, nearly half the threshold level used as an indicator for conflict in the BAR study, thus confirming the hypothesis.

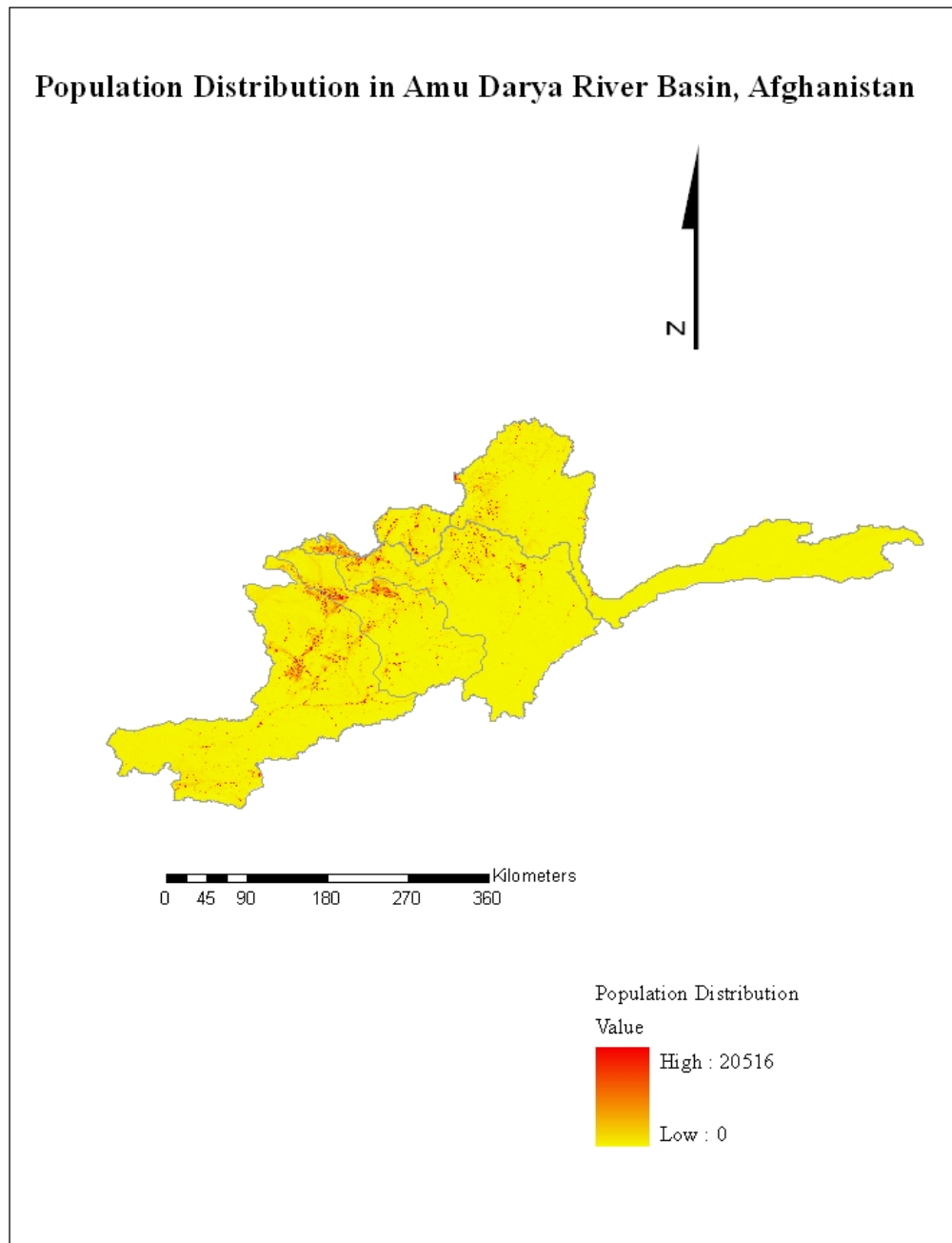


Figure 22. Population Distribution in the Amu Darya River Basin, Afghanistan

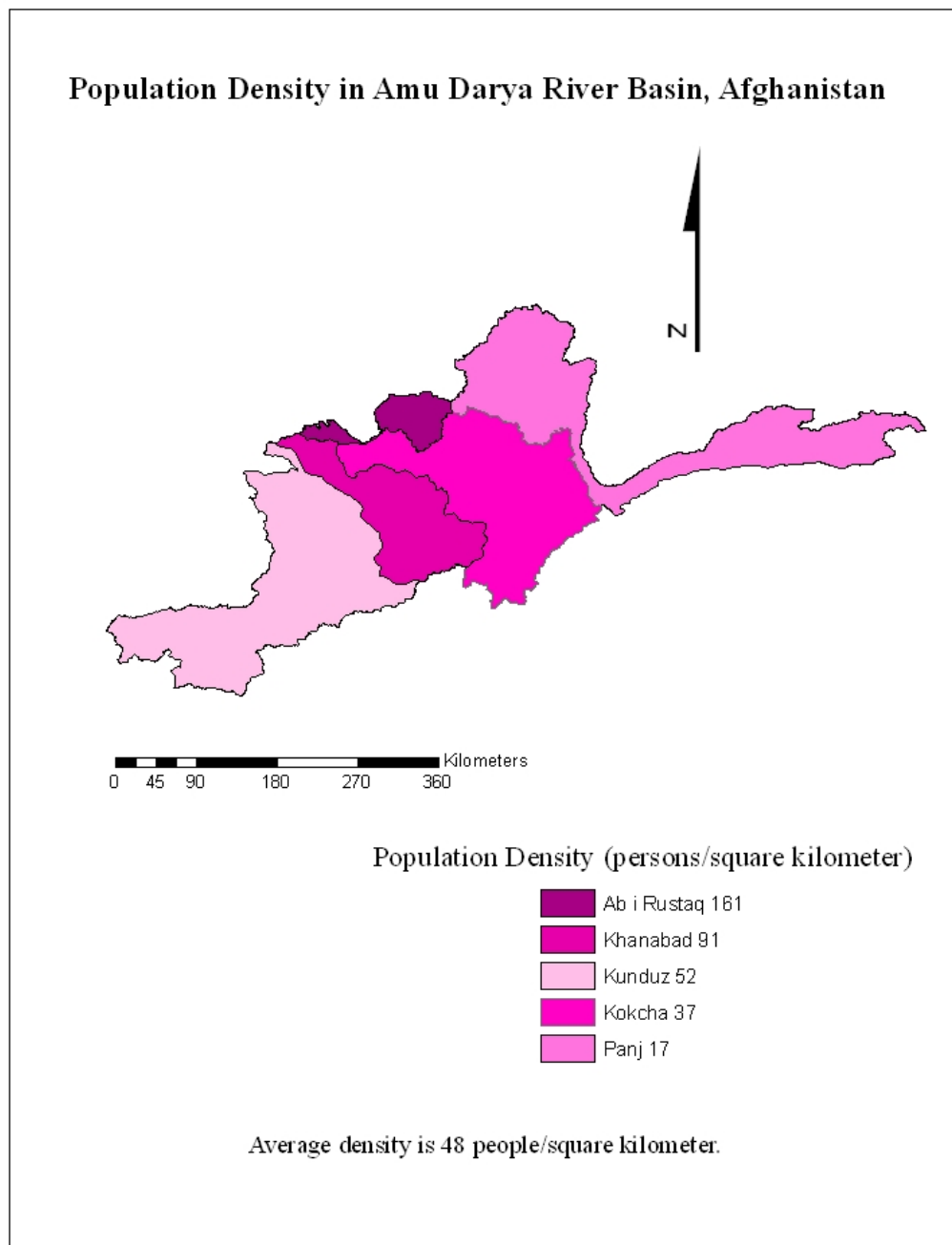


Figure 23. Population Density in Amu Darya River Basin, Afghanistan

Table 9. Population Density Population of the Amu Darya river basin within Afghanistan.			
Sub-basin Name*	Sq. Km	Population	Density (Pop/Sq. Km)
Ab-i-Rustaq	3670.374	592770	161.50
Khanabad	11993.51	1096921	91.46
Kunduz	28023.6	1478645	52.76
Kokcha	22367.69	841184	37.61
Panj	24636.71	434156	17.62
	90691.89	4443676	Avg Basin Density 48.10
Afghanistan	643926.6	28511038	44.28

*These sub-basins form Afghanistan's portion of the Amu Darya river basin.

Two of the five sub-basins, Ab-i-Rustaq and Khanabad, do not follow the overall basin trend. The first is nearly double the threshold value; the second is almost at the threshold. The event database did not allow for analysis of whether the area's increased density correlated with an increase in either overall conflict or conflict over water.

Some issues that will likely affect the future status of this indicator include continued repatriation efforts by Afghanistan as well as settlement programs in support of agricultural development and industrialization in neighboring riparian countries. Decisions regarding the type of agricultural and industrial development will also factor into the direction population density takes in the future.

Effects of GDP

The third hypothesis for evaluation was: Inclusion of Afghanistan per capita GDP data will not increase basin GDP above the BAR risk threshold of a per capita GDP below \$785 per year. This number was based on the World Bank lowest income country

definition for 2002.²¹ The World Bank presents this information as a Gross National Income (GNI) value in 2004.

The entire Amu Darya basin is quite economically depressed. In its country assessments based on 2004 data, the World Bank places Afghanistan, Tajikistan, and Uzbekistan in the low-income category of countries. These are countries with a gross national income (GNI) per capita that is \$825 or less per year. Only Turkmenistan has a higher income level. It is placed in the lower-middle income class of countries, those with a per capita GNI of \$826 to \$3255 per year.

Although stability and the economy of Afghanistan are improving, there is no question that the country remains devastated economically. Income in the country and throughout the region, with the exception of Turkmenistan, remains well below the BAR thresholds and remains a negative contributing factor from the perspective of water security and cooperation (table 10). Note that Afghanistan is not reported except at the national aggregate level. Per capita GNI of the basin remains below the World Bank low-income threshold of \$825 per year. A per capita GNI estimate based on World Bank population data and country GNI for Afghanistan, of \$200 per year depresses the average even further. These results show no substantial change from the earlier studies, and confirm the hypothesis.

Table 10. GNI per Capita in 2004 \$US by Year				
	2000	2003	2004	2005
TJK	180	210	280	No Data
TKM	640	No Data	1340	1340
UZB	620	420	460	No Data
AFG	Not reported by World Bank. GNI annual was \$4.3 and \$5.5 billion in 2003-2004			

Basin Internationalization Potential

The fourth hypothesis for evaluation was: Inclusion of Afghanistan event data will show an increase in conflict over water resources within the basin due to the internationalizing effect of the US invasion and installation of the transitional government.

The initial methodological approach to assessing internationalization potential relied on development of three primary layers: one to relate geographical dispersion of the primary ethnic groups within the basin to the event database; another to examine a time sequence of control over the basin against events; and a third to assess the role of administrative/government control during the same temporal series (1995-2005).

However, the level of detail of the event database did not support this approach. In particular, geographic references within the event sources allowed only the most generalized location of the event within the basin. Further, in very few of the data points it possible to associate the activity with a particular ethnic group. This lack of geographic detail limited meaningful time-series developments for the questions of military and administrative control.

This hypothesis is best answered in light of the results for the first hypothesis. This data showed, generally, that after the invasion, the basin's water relations were generally negative, but that Afghanistan's influence was not overly significant. Inclusion of Afghanistan also showed a generally neutral to positive contribution to overall relations in the basin post-invasion. Pre-invasion, its inclusion had a generally negative effect.

The Amu Darya river basin has a broad base of ethno-linguistic groups. Principal in the basin are the Tajiks and the Uzbeks. The Uzbeks, represented primarily by the National Islamic Front, are assessed as presenting a relatively low separatist risk to the transitional government. Most of its conflict is inter-communal with other minority groups, such as the Pashtuns and the Tajiks.²² Since the emergence of the transitional government, the Tajiks have established representation there, despite their ongoing inter-communal strife with the Pashtuns.

Leaders from both the Tajik and Uzbek groups sought and lost the bid for the presidency as the replacement of the transitional government occurred following the election in 2004. Each group continues to conduct sporadic fighting inside enclaves within the basin. The ability of Hamid Karzai, a Pashto, to maintain this inclusiveness contributes to the low separatist risk posed by each group. As long as the central government can move the regions comprising the Amu Darya basin away from warlord activity and influence, these non-separatist behaviors will continue.^{23, 24}

Although separatist sentiment is minimized, inter- and intra-communal strife may affect internal cooperation over the Amu Darya's water resources within Afghanistan. Investigation of this possibility is beyond the scope of this research, but is a consideration worth further study.

Afghanistan's Water Development Activity

The fifth hypothesis for evaluation was: Assessment incorporating evidence of Afghanistan water development activities within the basin will show an increase in the risk for conflict over water.

The event database showed considerable evidence of active, unilateral water development behavior in the basin. However, Afghanistan was conspicuous by its near absence of activity. Uzbekistan and Turkmenistan were the primary drivers behind unilateral activity in the sample. This is attributable to the large scale national projects both were engaged in during the study period, and the subsequent representation of these projects within the body of news reporting. Between 1998 and 2000, Uzbekistan leveraged over \$600 million into irrigation and water reclamation projects. Among them was a scheme to set up a series of pumping stations on the Amu Darya River to irrigate 400K hectares of the Kashkadarya region; diversion of Amu Darya water into the Pachkamar canal for drought relief to the Guzar District; and a drainage system to send Amu Darya wastewater into the Karakalpakstan region. For its part, Turkmenistan pursued the Zeyit reservoir project in the Lebap region, increasing its capacity to 3.6 billion cubic meters of water from the Amu Darya. Other projects undertaken by Turkmenistan were the Amu Darya fed Garagum canal reservoir developments, with the goal of achieving a 9.7 billion cubic meter capacity by 2002.²⁵

Despite Afghanistan's under representation in the event database, review of reconstruction and development activity reveals considerable activity, particularly toward infrastructure to supply basic human water needs.²⁶ Country Action Plans of the United Nations Development Program in Afghanistan²⁷, USAID²⁸ and other public and private organizations recognize the importance of coordinated regional efforts in sustainable development of the river and its basin.²⁹

However, the immediacy of Afghanistan's current situation is so critical that regional concerns appear secondary to ameliorating near term requirements for basic

irrigation, sanitation and human consumption. Scale may be of particular importance in reference to Afghanistan. The country is still a developing agrarian society so many of its water problems also reflect local level concerns.³⁰

The BAR study found that water security in relation to water project development was linked with institutional capacity to absorb change. Without treaties, cooperative water management or other mechanisms capable of dealing with changes, development projects tend to engender conflictive behavior. In the case of the Amu Darya basin, there is a great amount of development activity, on both large and small scales. This activity is not supported by strong institutions for management and enforcement. This lack of capability is shared by Afghanistan, and its present impact on this situation appears to contribute to conditions of less rather than more cooperative behavior.

Basin Freshwater Treaty Status

The sixth hypothesis for evaluation was: There will be no increase in the number of treaty agreements in the study time period following the US invasion of Afghanistan.

There was no substantial treaty signings by the region's riparian nations since 1998. Afghanistan has not become signatory to any of the existing major agreements, continuing the trends observed in earlier studies.³¹ Although a review of the TFDD and the event database show meetings, discussions and signings of various documents on bilateral cooperation; there is little substantive movement in implementation or enforcement observed. Of the four countries, Afghanistan does not appear to be significantly engaged in these water-related discussions and agreements, thus confirming the hypothesis.

Implications for Military Operations

The goal of this research was to use a primarily quantitative approach to analyzing Afghanistan's effect on water security in the Amu Darya river basin. The research also sought to demonstrate and relate, through this real world situation, the potential of these techniques for planning, execution and assessment of military operations; and to identify the level at which the techniques offer the most utility. The framework for data derivation and analysis presented in this research offers clear utility for military planners. The development of the event database showed how narrative data sources such as news reports can be coded and broken out into discrete data sets subject to quantitative analysis. The application of the procedures suggests their potential for combining with existing open source and classified intelligence collection and analysis techniques. An example is use of open source human intelligence collection to provide information for event data at the village level within a province.

The decision tree model for resource analysis presented one example of a logical framework for interpreting the database results. The technique appears to offer, as does the database development process itself, a method that can be applied to similar analysis of other security issues in which resource access, allocation or management are issues.

Although the scope of its use was more limited than originally envisioned, the use of GIS to assist in processing and interpretation of data proved efficient and effective, with some caveats. First, like all technologies, it has definite thresholds of understanding the user must achieve before the technology can be used appropriately. Secondly, to achieve widespread use of GIS software as an analytical, vice map-making, tool, planning staffs will either have to commit to training that is beyond normally expected

skills (such as use of office suites like Microsoft Office), or to identify specific personnel and staff positions required to have this training and expertise.

¹OSC (Open Source Center) [database on-line]; available from <http://www.opensource.gov>; Internet; accessed 9 April 2006. This organization was formerly known as the Foreign Broadcast Information Service (FBIS).

²Oregon State University, "Transboundary Freshwater Dispute Database" [database online]; available from <http://www.transboundarywaters.orst.edu/>; Internet; accessed 25 October 2005.

³Shira B. Yoffe, "Basins at Risk: Conflict and Cooperation Over International Freshwater Resources" (Ph.D. diss., Oregon State University, 2001), [dissertation on-line]; available from <http://www.transboundarywaters.orst.edu/>; Internet; accessed 25 October 2005, 18.

⁴Random.org; available from <http://www.random.org>; Internet; accessed 1 February 2006.

⁵Sample Size Calculator, MaCorr, 2006.

⁶Oregon State University, "Transboundary Freshwater Dispute Database."

⁷Valery Votrin, "Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential" (Thesis, Vrije Universiteit Brussel, 2002) [thesis on-line]; available from <http://www.transboundarywaters.orst.edu/>, accessed 25 October 2005, 63.

⁸BAR value. A scale for assessing levels of conflict or cooperation. The same scale is applied to both water and non-water events.

⁹Sean M. Maloney, "Afghanistan Four Years On: An Assessment," *Parameters*, Autumn 35, no. 3 (2005), 23 [on-line ed.]; available from <http://www.carlisle.army.mil/usawc/Parameters/05autumn/maloney.htm>; Internet; accessed 6 April 2006.

¹⁰*Ibid*, 26.

¹¹Yoffe, "Basins at Risk," 33. In addition to those used here, the others are: hydropower, navigation, technical cooperation, and border issues.

¹²Meredith Giordano, Mark Giordano, and Aaron Wolf, "The Geography of Water Conflict and Cooperation: Internal Pressures and International Manifestations," *The Geographical Journal* 168, no. 4 (2002): 293-312.

¹³Ibid 308. The absolute value scale is: 0.0 – 0.33 (Uncorrelated), >0.33 and < 0.67 (Mildly Correlated), and >0.67 (Correlated). The author uses the correlation process with the same caveats presented by Giordano et al in footnote 30, that the statistical analysis presented provides a set of general indicators of relationships vice “formal tests of statistical significance.”

¹⁴Ibid, 302.

¹⁵Artyom Fradchuk, “Tajikistan’s Energy Dilemma,” IWPR (Institute for War and Peace Reporting); available from <http://www.iwpr.net>; Internet; accessed 4 May 2006.

¹⁶Votrin, “Transboundary Water Disputes in Central Asia,” 39.

¹⁷Oak Ridge National Laboratory, “LandScan Global Population Database” [database on-line]; available from <http://www.ornl.gov/landscan/>; Internet; accessed 1 May 2006

¹⁸AIMS (Afghanistan Information Management Service); available from <http://www.aims.org.af/>; Internet; accessed 1 May 2006.

¹⁹ArcGIS 9: ArcView and Extensions, ESRI, 2005. The specific tool used in these calculations was the Spatial Analyst Extension.

²⁰Votrin, “Transboundary Water Disputes in Central Asia,” 34.

²¹Yoffe, “Basins at Risk,” 95.

²²Minorities at Risk Project (2005) College Park, MD: Center for International Development and Conflict Management; available from <http://www.cidcm.umd.edu/inscr/mar/>; Internet; accessed: 20 October 2005.

²³Ibid. This review of qualitative assessment by the MAR group is based on quantitative and qualitative analysis of data sets revised in 2003.

²⁴Monty G. Marshall, Ted Robert Gurr, Victor Asal, Barbara Harff, Deepa Khosla, Amy Pate. 2005. *Peace and Conflict 2005: A Global Survey of Armed Conflicts, Self-Determination Movements, and Democracy*. 85.CIDCM, University of Maryland, College Park; available from <http://www.cidcm.umd.edu/inscr/mar/>; Internet; accessed 10 February 2006.

²⁵Information derived from article summaries within the event database. See Appendix A for all background data.

²⁶AIMS, 2006.

²⁷United Nations Development Program (UNDP) Afghanistan; available from http://www.undp.org.af/media_room/archives/key_docs/key_docs.htm; Internet; accessed 3 February 2006.

²⁸USAID project opportunities listings. See also *National Program for Reconstruction Report*, December 2002. Both available from: http://www.export.gov/afghanistan/bus_climate/construction.html; Internet; accessed 8 February 2006.

²⁹Michael H. Glantz, “Water, Climate, and Development Issues in the Amudarya Basin,” *Mitigation and Adaptation Strategies for Global Change* 10 (2005): 23–50.

³⁰Aaron T. Wolf,, Annika Kramer, Alexander Carius, and Geoffrey D. Dabelko, “Chapter 5: Managing Water Conflict and Cooperation,” in *State of the World 2005: Redefining Global Security*. The WorldWatch Institute. Washington, D.C. 81-82.

³¹Votrin, “Transboundary Water Disputes in Central Asia,” 45.

CHAPTER 5

ASSESSING WATER SECURITY AND METHODOLOGIES USED

The research question posed in this thesis was: what is Afghanistan's effect on water security in the Amu Darya river basin? Specifically, it assessed how Afghanistan affects interstate security over the water resources of the Amu Darya River from 1995 to 2005. This allowed a comparison of findings with other studies, as well as gaining insight into the effects of the US invasion in 2001. The methodologies chosen to conduct the analysis were themselves examined to determine their applicability to the levels of military operations and their associated planning phases. In this way, the two secondary questions were answered. These were: at which level of military operations, strategic, operational and tactical, are the selected methodologies best applied; and during which phases of planning and execution are these methodologies most useful?

Using open source news reporting, an event database concerning general relations and relations over water was constructed. In order to support use and interpretation of the database, data from a variety of sources was combined to form a geographic information system (GIS) of the basin.

Findings Review

Assessment of water security within the Amu Darya basin was done through examining evidence supporting or refuting six indicators for conflict defined in previous research on river basins on a global scale.

Relations among the riparian members of the Amu Darya basin are generally characterized by a focus on security, with concerns over general cooperation and

economic cooperation evenly split. The inclusion of Afghanistan in the overall assessment does alter the primacy of security as the major interstate issue. Prior to the US invasion, Afghanistan had a significant negative affect on overall relations within the basin. Post invasion, and following the establishment of the interim government in 2001-2002, Afghanistan contributed to the overall cooperative trend shown in event database analysis.

Inclusion of Afghanistan in the event database demonstrated the country had relatively little impact on the trend of water relations between the basin's riparian nations. The data indicated that from 1995 to 1999, the overall trend in water relations was cooperative, and from 2000 to 2005, the trend was conflictive. Even the cooperative years show a steady decline in cooperative behavior as each year passes. The author attributes this trend to the weakness of existing water treaties; their lack of implementation and enforcement; and an increasingly legitimate and engaged Afghan government which is able to voice concerns over issues. In addition, the insistence of basin riparian to unilaterally pursue projects such as the Rogun Dam and Golden Century Lake contribute to instability and conflict over water. Severe drought has exacerbated these conditions.

The relations within the basin are typified by a focus on unique bilateral relations, both generally and with regard to water. The nations differ on whether regional or basin level issues drive their water relations, and on whether these issues are water or non-water related. Afghanistan and Tajikistan differ slightly from Turkmenistan and Uzbekistan in the area of linking water and non-water issues, with the latter two tending toward disassociating water issues from other areas of concern.

Based on year 2004 data, the population density within Afghanistan's portion of the basin remained approximately half the conflict indicator threshold given in the BAR study. All basin countries, except Turkmenistan, had per capita income levels that were well below the minimum risk-avoidance level found in the BAR study. Turkmenistan was marginally better, falling within the World Bank lower middle income classification.

Although inter-ethnic conflict continues in Afghanistan, the country's major ethnic groups within the basin are not engaged in separatist movement or activity. The trend appears to be toward integration with a stable central government, and advocacy for the group through participation.

Within the basin, large scale unilateral water development projects continue. Afghanistan, as part of its overall reconstruction effort, has a broad base of water infrastructure and development projects underway. There is little evidence that these projects are tied to regional level coordination with the other riparian. The situation is further exacerbated by several years of drought conditions during the later years of the time period studied.

Treaty agreements and other instruments for water management are limited within the basin. Afghanistan is not a signatory to any of the major agreements developed during the study time frame. The event database offers little evidence of any significant engagement by Afghanistan in regional water discussions.

Security Discussion

The research results suggest that Afghanistan had a generally negative affect on regional relations from 1995 to 2000. The lack of border security in particular was a major factor in overall relations, with numerous incursions and firefights spilling into

neighboring countries. Afghanistan's trend toward more positive relations with its neighbors began following the Taliban takeover of the government. Some of this outreach may have been in response to declining relations internationally, such as with the United States and its allies. The event data also suggests it was related to Taliban attempts to institute its own reform agenda, including eradicating the illicit traffic in opium. Working against these efforts were regular accusations and reports of Taliban support to militants in neighboring Tajikistan and Uzbekistan.

From 2001 to 2005, the event data presents an overall cooperative trend in relations across the region. The increase in international legitimacy of the transitional government allowed Afghanistan to more effectively engage in dialogue with its neighbors. In addition, there is some evidence in the data base to support the idea that the central government has both improved capability to establish more functional bureaucratic organs to support day to day operations of government; and is able to do so with more fairness and equity across the country. This is allowing more interaction across borders for business groups and other civil society entities, although levels of interaction are still not flourishing.

The general decline in cooperation over water issues from 1995 to 2005 reflects the lack of commitment by all countries to developing regional water security architecture. The emphasis on unique bilateral relations is not complemented by concerted efforts to understand their effects on the aggregate relations between the countries over water. Because of the nature of their competing interests and internal development policies, understanding of second and third order effects of bilateral negotiations and agreements over water becomes critical. For example, in 1987 four

former Soviet Union states signed onto an agreement known as Protocol 566 that defined Amu Darya water allocation among Uzbekistan, Turkmenistan, Tajikistan and the Kyrgyz Republic. This agreement assumed an Afghanistan withdrawal of no more than 2.1 billion cubic meters per year.¹ However, the 1946 agreement between Afghanistan and the former USSR authorizes up to 9 cubic kilometers of withdrawal.² A decision by Afghanistan to exercise its treaty rights while its neighbors are operating under a completely different set of assumptions and expectations has the potential for significant conflict.

Afghanistan's lack of representation in the water event database is problematic. It does tend to generally refute earlier research assumptions that by virtue of its internal instability, the country necessarily contributes to a conflictive status quo over water. The data shows Afghanistan had little influence on the general state of water relations in the region. Afghanistan's instability from 1995 to 2000 appears to have had a neutral affect on water relations because of its inability to effectively focus outside its borders and become involved in the issues over water.

The scant evidence of activity over water that is present is found only post-invasion, and is uncooperative. During this period of increasing legitimacy of the government, when the country could begin engagement on a more regular and effective basis with its neighbors, Afghanistan was also in a greater position to voice concerns or displeasure over water issues. Legitimacy was a double edged sword---when it was lacking, the country was ignored, in a sense, by its neighbors. When present, issues begin to rise to the surface.

Afghanistan's monumental task of reconstruction is also necessitating an inward focus that may be having a limiting effect on its ability and desire to concern itself with regional water issues. The large numbers of unilateral development projects also reflect the requirement to simply get the country back to basic levels of functionality. The neglect and destruction caused by so many years of war and instability may be making regional considerations of these projects' impacts a practical impossibility. Positive developments can be found in reconstruction documents and objectives that at least address water as an overarching regional concern. This possibly indicates room for more effective policy in the future.

Planning and Operations

Applying the quantitative analysis at the regional level in Afghanistan shows that these techniques can assist in strategic level assessment of the status of water resource conflict and cooperation in the countries of interest. The techniques also allow some insight into the mechanics of relations between the regional actors, and help to delineate the way each interprets their interests unilaterally, bilaterally and multilaterally.

This is particularly important to planners because without understanding the needs driving the country's relations, it is difficult to estimate the effects of decisions on enhancing cooperation and security generally as well as over water resources. Implementation of aid or reconstruction projects that appear to be positive in one area may be ill advised when viewed from a perspective that incorporates all the regional actors.

Interpretation of the six factors for conflict and cooperation over water offers some insight into how planners can approach the issue. First, there is little if any role for

the military's kinetic capabilities. The nature of conflict over water indicates planners should focus on how military capability enables the other aspects of national power to influence water relations and increase awareness of the issue. For example, during peace keeping operations, this could mean ensuring forces sent into a theater have treaty enforcement included within their mandate.

The analysis of Afghanistan's role in the Amu Darya basin also indicates that applications of the elements of national power, whether diplomatic, informational, military or economic (DIME), which ensure stability may have the greatest impact on increasing cooperation over water in the shorter term, regardless of the nature of the regime running the country of concern. Changes which cause instability, even positive, as in the case of Afghanistan, can require acceptance of greater risk for conflict over resource issues. From this perspective, planners will have to reconcile mitigation of resource conflict with the overall strategic goals in a region, which may be at cross purposes with one another.

For example, part of Afghanistan's long term reconstruction goals include increases in both quantity and stability of electrical energy supplies. To this end, the country entered an agreement in February, 2006 with Tajikistan and Iran to establish a high voltage electrical line into Afghanistan from hydroelectric generating stations on the Amu Darya and from the Rogun Dam project³ Tajikistan's pursuit of large scale electrical energy export capability puts its water use at odds with the multiple water needs of Afghanistan and the other riparian.

When planning and executing operations, maintaining visibility on the status and placement of refugees and internally displaced persons should be viewed in both the long

and short terms from the perspective of impact on water resources. At the global level, a density of <100 persons/square kilometer appears to be the threshold where population starts to contribute to instability over water. Although not prescriptive, it does offer a start point for planning that if properly considered early on may avoid development of long-term conditions of population density that are counterproductive. This is also an example that shows how quantitative analysis must marry with qualitative analysis. Although density in the basin is well below the threshold during the time period studied, other factors, such as overall infrastructure capability may mitigate against increases in population density, even if they remain below the general threshold values applied on the global scale.

Regarding stability, support and reconstruction operations; security over water appears to benefit most from economic development efforts that focus on increasing real individual income. This is from evidence at the global level. Afghanistan's income level is less than half the World Bank definition of lowest per capita income countries. As such, it is a factor for risk that is present, but the data does not allow interpretation of how this income level is actually affecting the level of water security in the basin. The data also does not account for the effects of income from opium production, which in Afghanistan may be close to equaling the country's legitimate GNP.

The analysis of security in the Amu Darya basin shows a high level of unilateral activity in development of water projects which is a factor for risk. This indicates that cooperative planning between military, government and non-governmental organizations should attempt to maintain visibility on the second and third order effects of their projects during stability, support and reconstruction operations. This is difficult with the

competing mandate to relieve suffering in the aftermath of combat or natural disaster. However, choosing to ignore these effects can exacerbate the country's long term ability to engage regionally over water issues. This research supports previous research which emphasizes the importance of viewing river basin security as a systemic issue that cannot be limited by political boundaries.

The utility of these techniques at the tactical level is much more problematic than the strategic or operational level. The use in its present form of open source data, coding it, then applying it towards understanding the tactical environment is limited. The level of detail and subject matter present in these reports is unpredictable, and would likely not be in the quantity or timeliness needed to affect tactical operations.

Potential modifications to the processes described here might enable them to be used tactically. Fundamentally, there is no limit to the sources of information that can be used to populate the data base. Mission reporting and debriefing in a tactical commander's area of responsibility could themselves be coded. Pre-formatted reporting tools designed to elicit specific information are already in common use at the tactical level, and combined with automated parsing of the data offer a possible information source that these techniques could effectively exploit. The decision tree presented in chapter 4 is also a potentially useful tool to develop an understanding of inter-relationships of political and social groups in the area of operations and their interaction over the environment. The extended periods of time over which stability, support and reconstruction operations take place make them particularly amenable to adapting these techniques.

The GIS proved useful in establishing the baseline of information used in the study. It allowed comparison of information in previous studies with newly available information obtained from various sources supporting the present work. The technology is already in use at all levels of planning, and can be expected to grow in importance. Key to enabling that growth is more formalized training in the analytical capabilities inherent in the software. Currently, GIS capability is exploited mainly in the form of interactive graphic planning aids, such as the Maneuver Control System (MCS), Command Post of the Future (CPOF) and the Combined Arms Planning and Execution-monitoring System (CAPES) used by the US Army.

Unexpected Outcomes

The lack of increase in population within the basin was not expected. It was thought that population would increase substantially as the transitional government gained in legitimacy and capability, and facilitated return of refugees and other displaced persons. This expectation was based principally on qualitative interpretation of the news reporting used in the construction of the event database.

Maintenance of population density below 100 persons per square kilometer contributes, generally, to cooperative interaction over water. The current calculated density shows room for growth overall in the basin, although the data also show that areas within the basin have exceeded this number. However, due to lack of infrastructure and maintenance, as well as effective regional management, the supportable density within the basin may be lower than the threshold.

Recommendations for Further Study

Investigating the utility of these techniques at administrative levels lower than the international level would offer further insight into their use for planning and analysis of military operations. For example, the provincial and district level administrative units in Afghanistan have complex relations with their counterparts in Tajikistan, Turkmenistan and Uzbekistan. In order to do this, the detail level of the database would have to be improved. In particular, more information on specific locations of events, as well as the personalities and roles of the individuals involved, is needed. Here is where alternative data sources, such as tactical reporting, may be of assistance, or translation and exploitation of local, vice national, news sources, if available.

A more in-depth understanding of how other agencies, such as USAID, anticipate second and third order effects of projects within regional constructs such as the Amu Darya river basin are important. For example, how does construction of drip irrigation in one area of the river affect downstream farming in another area? How are identified effects mitigated? If mitigation is not possible, what are the alternatives to the project? Gaining this understanding would enable planners to make more soundly grounded recommendations if they understood the goals of the water development projects in their areas of responsibility and operations.

Insight and understanding of the significance of opium production on water use, as well as its economic impact would greatly improve the usefulness of the present research. For example, without a clear understanding of the water requirements for opium production, it makes calculation of water needs in the basin based on legitimate agricultural production suspect. This affects planner's advice to the decision makers as

well, since it is critical to avoid decisions and policy implementation that inadvertently supports illicit activity.

Further insight into deriving effective sample sizes and screening criteria during the development of event databases will enhance the utility and applicability of the research techniques presented in this thesis. Possible avenues for this research may be found in the techniques and software currently used to conduct content analysis research in the communications field.

Final Thoughts

A quantitative assessment of water security in the Amu Darya river basin was accomplished. It offered insight into the role of Afghanistan in the region's overall water security posture and security over water. Generally, Afghanistan was found to have a negative effect on overall cooperation over water within the Amu Darya river basin. However, this effect was not substantial relative to the effects of the basin's other riparian nations. All of the riparian nations show a trend toward emphasizing unique bilateral relationships over water, vice establishing relationships based on overarching regional concerns.

The research demonstrated that the global scale techniques employed in the BAR study can be applied at a regional level. The analytical approach is sound, and is flexible enough for application at the strategic and operational levels. Its utility is strongly dependent on establishing and maintaining the databases as part of long-range assessment of a region. The research indicates that this is the only practical way of making it possible to use this type of analysis during crisis action planning.

Modifications to how the data base is populated will also increase its utility. Potential sources of information include exploitation of existing tactical reporting procedures and record keeping, combined with automated parsing of these reports. However, in its present form, the development of the event database is limited in its use at the tactical level. Tactical use of the analytical processes presented in this research has the most potential for use during stability, support and reconstruction operations where longer term monitoring and development of projects are a critical part of day to day operations.

To the extent it was used, GIS was effective, but greater exploitation of system capabilities will require training to a significantly higher level than is presently done or is available.

Putting these techniques into best practice requires recognition of several things. First, the techniques are not fast. It is unfeasible to expect a rapid builds of databases from scratch. The research experience showed that development of the database, finding the information, and most important, developing the proper questions and key word lists for searches was a critical and time consuming process.

Optimally, this type of inquiry will be part of wide ranging regional studies that form the backbone of mission analysis. It is too late when the crisis is already occurring to ask the types of questions found here. On the other hand, it is also unfeasible to conduct in depth research on every possible contingency. This is where the effectiveness of these techniques as screening tools enters into play. In the initial BAR study, on a worldwide scale the BAR researchers identified river basins that by virtue of a

confluence of the indicators derived from their research are susceptible to conflict over water resources.

It is possible to build on these initial findings and apply similar screening techniques to other sub-basins that are of interest, and if similar risk tendencies become apparent, shift the necessary resources to investigate further.

The planner providing guidance to the decision-makers must be able to back up recommendations with supportable evidence. In environments where cultural intelligence has a more central role, this task runs the risk of becoming clouded with bias and an over-reliance on intuition. Quantitative analytical techniques help to avoid bias and intuitive leaps when considering qualitative evidence.

When limited resources are available, it is critical the right choices be made regarding allocation. The analytical techniques presented here offer the potential to scope requirements and properly focus in-depth quantitative and qualitative assessments of a chosen operational environment.

This research shows that the quantitative techniques and research methodologies presented in this thesis offer planners and decision makers an effective and complimentary analytical toolset to qualitative analysis. These techniques provide insight into one aspect of cultural intelligence that is often overlooked during planning, but has potentially critical long term effects on the ultimate outcome of military operations.

¹Masood Ahmadd, and Mahwash Masiq, *Water Resource Development in Northern Afghanistan and Its Implications for Amu Darya Basin* (Washington, DC: The World Bank, 2004), 33. Offers a detailed discussion of Afghanistan's water treaty history, as well as an overview of legal opinion regarding validity of these treaties after the changes to governments in the years following signing of the agreements.

²Valery Votrin, “Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential” (Thesis, Vrije Universiteit Brussel, 2002) [thesis on-line]; available from <http://www.transboundarywaters.orst.edu/>, accessed 25 October 2005. 43

³Artyom Fradchuk, “Tajikistan’s Energy Dilemma,” IWPR (Institute for War and Peace Reporting); available from <http://www.iwpr.net>; Internet; accessed 4 May 2006.

APPENDIX A

EVENT DATABASE FOR OVERALL RELATIONS

Date	Countries Involved	BAR Scale	Event Summary	Issue Type	Source
6/12/95	Afghanistan, Tajikistan	-1	Tajik Deputy Security Minister reports increase in cross border drug traffic and seizures with AFG.	Economic Cooperation	Turkmen Press
7/20/95	Tajikistan, Turkmenistan	1	TJK and TKM engage in trilateral talks with Iran on TJK access to TKM processed Iranian oil and petroleum products.	Security	Moscow INTERFAX
8/31/95	Tajikistan, Turkmenistan	2	Turkmen president lauds signing of inter-Tajik peace agreement in TJK, with hopes it will increase cooperation between TJK and TKM.	Security	Moscow INTERFAX
10/11/95	Afghanistan, Tajikistan	-2	TJK government protests shelling from AFG territory of Russian border guard vehicle.	Security	Moscow INTERFAX
11/30/95	Afghanistan, Tajikistan	-2	Russian border guards detain 6 men illegally crossing from AFG to TJK vicinity 9th Pyanj border unit.	Security	Moscow INTERFAX
1/8/96	Afghanistan, Tajikistan	-3	Russian Border guards from Border Picket 9 of the Pyandzh Border Detachment engage 15 Tajik opposition militants attempting to cross from AFG. Several militants killed, the rest withdraw back across to AFG.	Security	Radio Tajikistan Network
1/18/96	Turkmenistan, Uzbekistan	3	Presidents of Uzbekistan and Turkmenistan sign interstate agreement on friendship, cooperation and mutual assistance.	Security	Moscow INTERFAX
3/7/96	Afghanistan, Tajikistan	3	ISA President visits Tajikistan.	Security	Moscow ITAR-TASS
4/11/96	Afghanistan, Tajikistan	-3	Pyandz border guard unit fires on 7 militants attempting to cross from AFG. Probably connected with 21kg of heroin seized earlier in the day.	Security	Moscow INTERFAX
5/19/96	Afghanistan, Tajikistan	-2	Badakhshan Province: ISA Afghan government submits note of protest to TJK government over two planes which bombed two villages in the districts of Baharak and Khas in Badakhshan Province on 16 May 96.	Security	Radio Tajikistan Network
5/25/96	Tajikistan, Uzbekistan	4	Tajik and Uzbek prime ministers sign agreement on coal and gold mining in Tajikistan.	Security	KHOVAR

6/13/96	Afghanistan, Tajikistan	0	Moskovskiy and Pyanj border areas, and Pamir foothills: Asst. Director of the Federal Border guards makes predictions on level of Tajik Opposition incursion attempts from AFG, warns them and their supporters. Puts estimate at 2000 opposition fighters.	Security	Moscow ITAR-TASS
9/3/96	Afghanistan, Tajikistan	1	Tajik President and Afghan Deputy Foreign Minister meet to discuss regional security cooperation.	Economic Cooperation	Uzbekistan Television
9/10/96	Afghanistan, Tajikistan	-5	Shuganskoye ulusvolstvo (district), Khorog (regional center of the Gorno-Badakhshan autonomy of Tajikistan): Russian border guards under shelling from AFG side of border, activity result of internal fighting as well as Tajik United Opposition forces operating from AFG.	Security	Radio Afghanistan Network
12/10/96	Afghanistan, Tajikistan	1	Tajik President and Tajik Opposition leader meet for talks in Khosdekh community, Torkhor province, northern Afghanistan.	Security	Moscow ITAR-TASS
12/13/96	Afghanistan, Tajikistan	1	Gen Masud, Republic of Afghanistan supporting Pres Rabbani, praises results of talks between Tajik president and the United Tajik Opposition.	Cooperation	Radio Afghanistan Network
1/8/97	Tajikistan, Uzbekistan	1	Uzbek and Tajik officials meet to discuss settlement agreements on a variety of economic issues, including transportation and petroleum products.	Economic Cooperation	Moscow ITAR-TASS
1/10/97	Tajikistan, Uzbekistan	-1	Uzbekistan government formally protests to Tajik government over artillery shells from inter-Tajik fighting landing in Uzbek territory, wounding and killing Uzbek civilians.	Cooperation	Pravda Vostoka
1/24/97	Afghanistan, Uzbekistan	0	Uzbek president supports peaceful resolution to Afghan war, proposes arms embargo against warring factions in the country.	Security	Moscow ITAR-TASS
2/18/97	Tajikistan, Uzbekistan	-3	Besharyk district of Fergana Region of Uzbekistan: 3 Uzbek customs officials wounded in border attack by persons from Tajikistan.	Security	Moscow ITAR-TASS
3/9/97	Afghanistan, Tajikistan	-3	Russian border guards in Pyandhz region kill 2 and capture 4 gunmen attempting to cross border from Afghanistan into Tajikistan carrying 74 kg of narcotics.	Security	Moscow NTV
4/5/97	Turkmenistan, Uzbekistan	3	Turkmenistan and Uzbekistan conduct working groups to enable economic agreements and cooperation between the countries.	Security	Moscow INTERFAX

5/23/97	Afghanistan, Tajikistan	0	Afghan government official warns of Pashtun-Uzbek inter-ethnic conflict and potential refugee crisis if Taleban forces capture Faryab province and clash with Uzbek General Dostum and his forces.	Security	Moscow ITAR-TASS World Service
5/26/97	Afghanistan, Tajikistan	-3	Tajik government reinforces border with Afghanistan to prevent uncontrolled movement of refugees from AFG to TJK in response to fighting in Northern Afghanistan.	Security	Moscow INTERFAX
8/18/97	Tajikistan, Uzbekistan	1	Uzbek president warns Tajik rebels not to enter UZB, or they will be handed over to the Tajik government.	Security	Moscow ITAR-TASS
8/19/97	Tajikistan, Uzbekistan	-1	Uzbek Foreign Ministry denies Tajik rebels operating out of Uzbekistan.	Cooperation	Tajik Radio First Program Network
8/26/97	Tajikistan, Uzbekistan	1	Uzbek President meets with UN representative, will support Tajik refugee repatriation from Afghanistan to Tajikistan, as well as efforts to end internal Tajik violence.	Security	Tajik Radio First Program Network
9/18/97	Afghanistan, Tajikistan	1	Panj-e Poyon: 254 Tajik refugees repatriated across checkpoint into Tajikistan.	Cooperation	Moscow Radio Rosii Network
9/19/97	Afghanistan, Uzbekistan	-3	Hairaton, Termez: 3 Uzbek nationals wounded by rocket fire during exchanges between warring Afghan factions on the Afghan side of the border.	Cooperation	Tajik Radio First Program Network
10/4/97	Afghanistan, Tajikistan	-4	Four Tajik refugees were killed and 40 wounded in the Kampisahi camp in Afghanistan as a result of a Taleban air attack on Mazar-e Sharif.	Security	Moscow INTERFAX
10/4/97	Afghanistan, Tajikistan	1	Panj-i Poyon checkpoint, AFG: Tajik refugees continue to return to Tajikistan after becoming caught between Taliban militia and anti-Taleban coalition forces. They are leaving Sakhi refugee camp.	Cooperation	Moscow ITAR-TASS World Service
10/8/97	Afghanistan, Tajikistan	1	Sakhi camp [near Mazar-e Sharif] in northern Afghanistan: 78 Tajik refugees repatriated.	Security	Moscow INTERFAX
10/10/97	Afghanistan, Tajikistan	1	After talks in the Afghan town of Konduz, Tajikistan and Taleban agree to UNHCR funded return of Tajik refugees from AFG.	Cooperation	Tajik Radio First Program Network
10/22/97	Afghanistan, Tajikistan, Uzbekistan	1	Hayraton-Termez checkpoint, Termez: (ISA) AFG, TJK, UZB agree to conditions and schedule for return of TJK refugees from AFG. Also agree to establish refugee facility in Termez.	Cooperation	Dushanbe Radio Tajikistan Network
10/27/97	Tajikistan, Uzbekistan	0	Uzbekistan military reported to support Tajikistan insurgency.	Security	Moscow INTERFAX

10/29/97	Afghanistan, Tajikistan	-3	Russian guards of the Khorog border detachment engage 3 armed persons attempting to cross from AFG to TJK. 2 killed, one detained, 1 kg heroin confiscated, armed positions on AFG side supporting infiltration were destroyed.		Dushanbe Radio Tajikistan Network
10/29/97	Tajikistan, Uzbekistan	-1	Uzbekistan denies its territory was used by rebels to enter Tajikistan.	Security	Moscow ITAR- TASS
10/30/97	Tajikistan, Uzbekistan	3	Tajik and Uzbek governments engage in working group level talks on border security issues between the nations.	Security	Moscow INTERFAX
11/24/97	Afghanistan, Tajikistan	0	Tajik authorities express fear two Tajik opposition groups, led by field commanders Mullo Umar and Junaydullo, are preparing to break through in the Qala-i Khum section of the Tajik-Afghan border.	Economic Cooperation	Ashgabat TMT 1 Television Network
11/27/97	Afghanistan, Tajikistan	-3	Khorog border guards kill 2 armed infiltrators attempting to cross Panj by boat; after short engagement, remainder of infiltrators withdraws to Afghan side.	Security	Moscow ITAR- TASS World Service
1/4/98	Tajikistan, Uzbekistan	3	Tajikistan President visits and meets Uzbekistan President to discuss bilateral relations.	Security	Tashkent Uzbekistan Television
1/8/98	Tajikistan, Uzbekistan	4	Uzbekistan and Tajikistan sign bilateral economic cooperation agreement.	Security	Moscow INTERFAX
2/5/98	Tajikistan, Uzbekistan	4	Uzbek and Tajik presidents sign package of bilateral cooperation agreements covering social and economic issues.	Security	Moscow INTERFAX
5/11/98	Afghanistan, Tajikistan	0	Envoy from Tajik Government Commission for Drug Control makes statements on number of drugs entering Tajikistan from Afghanistan. Places narcotics estimate on Afghan side at over 200 tons.	Economic Cooperation	Moscow ITAR- TASS World Service
5/25/98	Tajikistan, Uzbekistan	-1	Uzbekistan demands Tajikistan take measures to hand over Uzbek extremists operating in Tajikistan.	Security	Dushanbe KHOVAR News Agency
6/3/98	Afghanistan, Tajikistan	3	Farkhor region of Khatlon region: Tajik president signs ordinance reopening border crossing into Afghanistan.	Security	Moscow ITAR- TASS World Service
6/6/98	Afghanistan, Tajikistan	-1	Border guards seize 53 kg of drugs on Tajik Afghan border as well as explosives.	Security	Dushanbe Asia-Plus
6/25/98	Afghanistan, Tajikistan	1	Panj-i Poyon [southern Tajikistan] [border]: Tajikistan government official visits Afghanistan to discuss repatriation of Tajik insurgents.	Security	Moscow ITAR- TASS World Service

7/9/98	Afghanistan, Tajikistan	-5	Khorog border guards engage in defensive action against small arms and artillery fire from across Afghan border.	Security	Dushanbe KHOVAR News Agency
8/3/98	Tajikistan, Turkmenistan	1	TJK and TKM presidents confirm satisfaction with progress in mutual cooperation and security.	Security	Radio Tashkent Network
8/7/98	Afghanistan, Tajikistan	-1	Moscow border guard's detachment detains 3 persons attempting to infiltrate from Afghanistan, and confiscate 2.5 kg of heroin.	Cooperation	Moscow ITAR- TASS World Service
8/11/98	Afghanistan, Tajikistan	-1	Tajikistan government appeals to UN and CIS to end combat in Afghanistan, facilitate political solution, and prevent foreign intervention into the conflict.	Economic Cooperation	Radio Mashal
8/12/98	Afghanistan, Tajikistan	-1	Tajik government denies accusations its forces are fighting inside Afghanistan in support of Northern Alliance forces.	Security	Moscow ITAR- TASS
8/12/98	Afghanistan, Tajikistan	-3	Taleban forces closing in on Tajik border in the vicinity of the Moscow border detachment during fighting in Afghanistan.	Security	Moscow ITAR- TASS
8/12/98	Afghanistan, Uzbekistan	0	Surkhandarya border: Government statement on stability and lack of activity on border.	Security	Moscow ITAR- TASS World Service
8/29/98	Tajikistan, Uzbekistan	1	Uzbekistan president declares support for Tajik president and the Tajik government regarding Tajik insurgency, urges peaceful means to end conflict.	Security	Moscow Radio Rosii Network
10/16/98	Turkmenistan, Uzbekistan	1	Presidents of Uzbekistan and Turkmenistan sign joint communiqué on bilateral cooperation relations development.	Security	Moscow Informatsionnoye Agentstvo Ekho Moskvy
10/16/98	Turkmenistan, Uzbekistan	3	Presidents of Uzbekistan and Turkmenistan meet for talks on bilateral cooperation in areas of culture, science and technology and economics.	Security	Moscow ITAR- TASS
10/22/98	Afghanistan, Uzbekistan	0	Uzbek president discusses Uzbek support of peaceful settlement for conflict in Afghanistan.		Moscow ITAR- TASS
11/5/98	Tajikistan, Uzbekistan	1	Tajik and Uzbek presidents exchange confirmation of support for bilateral agreements, and Uzbekistan supports Tajik efforts against Tajik insurgents.		Moscow ITAR- TASS
11/9/98	Tajikistan, Uzbekistan	-1	Tajik government accuses Uzbekistan of harboring insurgents in violation of bilateral agreements.	Security	Radio Tajikistan External Service
11/10/98	Afghanistan, Tajikistan	1	ISA (AFG) censures attempted coup in Tajikistan, and reiterates support of Tajik government against the insurgents.	Security	Moscow ITAR- TASS

11/11/98	Afghanistan, Tajikistan, Uzbekistan	-1	Leninabad Region: Tajik government says Tajik POWs indicating Tajik insurgents, supported by Afghan and Uzbek mercenaries operating from bases in Afghanistan and Uzbekistan.	Cooperation	Moscow INTERFAX
11/12/98	Tajikistan, Uzbekistan	-1	Tajik government issues statement expressing unhappiness with what it characterized as Uzbek government disinformation on several issues, including Tajik insurgent operations in Uzbekistan.	Security	Moscow ITAR-TASS
1/12/99	Afghanistan, Tajikistan	-5	Qala-i Khum sector of the Tajik-Afghan border: Afghan border guards enter Tajikistan. Tajik border guards captured in Tajikistan by Afghan border guards following gun battle, and taken to Afghanistan.	Security	Tashkent Radio Tashkent Network
1/14/99	Afghanistan, Tajikistan	1	Qala-i Khum section of the Tajik-Afghan border: Afghan villagers release Tajikistan border guards held hostage after negotiations between Tajik and Afghan officials.	Cooperation, Economic Cooperation	Moscow Nezavisimaya Gazeta
2/11/99	Afghanistan, Turkmenistan	1	Turkmenistan supports and hosts UN-sponsored talks between Afghan warring factions.	Economic Cooperation	Moscow ITAR-TASS
3/2/99	Turkmenistan, Uzbekistan	0	Tajik-Uzbek power line disabled by unknown person(s). Officials investigating.	Cooperation	Moscow RIA
3/15/99	Afghanistan, Turkmenistan	1	Turkmen President offers verbal support to Afghan faction's success during negotiations.	Security	Moscow ITAR-TASS
3/16/99	Afghanistan, Tajikistan	0	Moscow border detachment troops detained 3 Afghani citizen illegally entering Tajikistan; weapons confiscated.	Security	Dushanbe Asia-Plus
4/11/99	Afghanistan, Uzbekistan	1	Taleban officials visit Uzbekistan for talks on bilateral cooperation and relations.	Security	Moscow RIA
5/9/99	Afghanistan, Turkmenistan	1	Taleban and Turkmenistan government officials hold talks in Turkmenistan on bilateral economic cooperation, agree to further talks.	Security	Moscow ITAR-TASS
5/15/99	Tajikistan, Uzbekistan	1	Tajikistan and Uzbekistan discuss bilateral cooperation.	Security	Dushanbe Asia-Plus
6/1/99	Afghanistan, Uzbekistan	1	Taleban and Uzbek government officials meet in Kabul for talks on cooperation and interstate relations.	Cooperation	Kabul Radio Voice of Shari'ah Network
6/8/99	Tajikistan, Afghanistan	3	(ISA and Tajikistan sponsored), Afghanistan Peace center established in Tajikistan to promote peaceful settlement of Afghan intrastate conflict.	Cooperation	Moscow ITAR-TASS
6/17/99	Tajikistan, Uzbekistan	-3	Tajikistan to expel Uzbek refugees.	Economic Cooperation	Kabul Radio Voice of Shari'ah Network

8/6/99	Tajikistan, Afghanistan	1	Tajik President calls for peaceful settlement to Afghan violence and establishment of broad based representative government.	Cooperation	Balkh Voice of Radio Shari'ah
8/25/99	Tajikistan, Uzbekistan	0	UNHCR works with Tajikistan to determine status of Uzbek citizens living in the Tajik Qarotegin valley.	Security	Dushanbe Asia-Plus
10/24/99	Tajikistan, Uzbekistan	-4	Tajik government representatives seek release of Japanese hostages from Uzbek insurgents.	Security	Moscow ITAR-TASS World Service
2/2/00	Afghanistan, Tajikistan	0	Tajikistan border security stops infiltrators from Afghanistan.	Economic Cooperation	Moscow ITAR-TASS World Service
2/2/00	Afghanistan, Turkmenistan	1	Taleban and Uzbek foreign ministers meet to discuss general cooperation issues and bilateral relations.	Security	
2/8/00	Afghanistan, Tajikistan	1	Tajikistan president calls for regional talk and assistance to establish non-military solution to Afghan conflict.	Security	Moscow ITAR-TASS World Service
2/18/00	Afghanistan, Uzbekistan	1	Taleban officials meet with Uzbek border security officials for general talks on relations.	Security	Moscow ITAR-TASS World Service
4/18/00	Afghanistan, Turkmenistan	1	Taleban hand over Turkmen POW to Turkmenistan government.	Security	Turkmenistan.ru WWW
5/2/00	Afghanistan, Uzbekistan	-2	Uzbek President denounces Afghan government support of terrorism.	Economic Cooperation	Asia-Plus
5/17/00	Tajikistan, Uzbekistan	1	Tajik and Uzbek internal affairs ministers meet and develop agreement on inter-governmental cooperation on crime and narcotics issues.	Cooperation	Asia-Plus
5/17/00	Tajikistan, Uzbekistan	1	Tajik and Uzbek foreign ministers meet to discuss developments and improvements in bilateral relations.	Cooperation	Asia-Plus
5/30/00	Tajikistan, Uzbekistan	1	Tajik premier meets Uzbek premier for economic and general cooperation talks to enhance bilateral relations.		Tajik Radio 1
5/30/00	Tajikistan, Uzbekistan	1	Tajik delegation goes to Uzbekistan for talks on mutual cooperation and bilateral relations with Uzbek government counterparts.	Security	Asia-Plus
7/1/00	Afghanistan, Turkmenistan	1	Afghan Taleban trade representative group meets with Uzbek trade and government representatives to discuss agreements to facilitate and increase trade between the countries.	Cooperation	Moscow ITAR-TASS

7/27/00	Turkmenistan, Uzbekistan	-3	Turkmen government declares special border zone in border region with Uzbekistan, resulting in implementation of restrictive movement and travel document procedures.	Cooperation	Turkmen Radio 1
8/8/00	Tajikistan, Uzbekistan	2	Tajik government hands over suspected Uzbek insurgent to Uzbek government in support of larger efforts by security forces of both governments to control illegal border movement between he countries.	Economic Cooperation	Jumhurriyat
8/17/00	Tajikistan, Uzbekistan	3	Uzbek hands over mine to Tajikistan, will begin cooperative operation of the mine for ore extraction and processing as part if implementation of intergovernmental agreement on mining operations and control.	Cooperation	Narodnoye Slovo
8/28/00	Afghanistan, Turkmenistan	1	Turkmen delegation engages in talks with Taleban leader of Islamic Emirate of Afghanistan.	Security	Moscow ITAR-TASS
8/30/00	Tajikistan, Uzbekistan	4	Tajikistan and Uzbekistan sign cooperation agreement on cotton textile enterprises.	Security	Afghan Islamic Press News Agency
9/1/00	Afghanistan, Turkmenistan	2	Turkmenistan government mediates between warring factions in Afghanistan, and seeks international support to end conflict.	Economic Cooperation	Tajik 1 Radio
9/1/00	Tajikistan, Uzbekistan	4	Tajikistan and Uzbekistan implement intergovernmental agreement on visas.	Cooperation	Radio Voice of Shari'ah
9/20/00	Turkmenistan, Uzbekistan	0	Turkmen official makes rhetorical statements on status of Turkmen-Uzbek relations pending visit of Uzbek president.	Economic Cooperation	Asia-Plus
9/21/00	Turkmenistan, Uzbekistan	3	Uzbek president goes to Turkmenistan for talks with Turkmen president on bilateral relations and Afghan security situation.	Security	Asia-Plus
9/22/00	Tajikistan, Uzbekistan	4	Tajiks and Uzbeks sign protocol on joint development of coal fields in Tajikistan.	Security	Esger
10/13/00	Afghanistan, Uzbekistan	2	Uzbek president declares willingness to recognize Taleban government, states government position on Afghan internal affairs.		Radio Voice of Shari'ah
10/19/00	Afghanistan, Tajikistan	0	Tajik opposition party leader encourages Afghan leaders to find a peaceful settlement of war in Afghanistan.	Economic Cooperation	Uzbek Radio 1
11/21/00	Tajikistan, Uzbekistan	0	Tajikistan concerned over supplies of Uzbek natural gas.	Cooperation	Tajik Radio 1

11/30/00	Afghanistan, Tajikistan	3	"An office of the mission of the Islamic State of Afghanistan [under the ousted president, Borhanoddin Rabbani] was opened in Khorugh [centre of Mountainous Badakhshan Autonomous Region (MBAR) in eastern Tajikistan]."	Security	Tajik Radio 2
12/7/00	Afghanistan, Tajikistan	0	Afghan opposition diplomat feels Afghan refugees should not be moved to Tajikistan.	Cooperation	Tajik Radio 2
12/10/00	Afghanistan, Turkmenistan	1	Turkmenistan hosts talks between warring Afghan factions.	Cooperation	Moscow ITAR-TASS
1/18/01	Afghanistan, Turkmenistan	1	Afghan and Ubeq government officials meet to discuss issues of mutual interest including repair of 10km road connecting Emam Nazar and Karlki near the Turkmen border, Balkh province, Afghanistan.	Security	Radio Voice of Shari'ah
3/15/01	Afghanistan, Uzbekistan	-1	Uzbekistan expresses public concern over Taleban destruction of religious and historical sights, as well as overall destruction of sites due to warfare in Afghanistan.	Cooperation	Radio Voice of Shari'ah
5/14/01	Afghanistan, Turkmenistan	4	Turkmenistan installs power lines to facilitate export of power to Afghanistan.	Security	RIA
6/14/01	Afghanistan, Turkmenistan	1	Turkmenistan president expresses public support to peaceful, internally directed resolution of violence in Afghanistan, and offers Turkmenistan assistance to facilitate peace.		Radio Voice of Shari'ah
6/25/01	Tajikistan, Uzbekistan	1	Tajikistan and Uzbekistan continue talks on confirming borders based on modern surveys and information.	Security	Asia-Plus
7/6/01	Tajikistan, Uzbekistan	1	Tajikistani and Uzbekistani officials meet to discuss construction of border technical and engineering facilities as well as improving cooperation between border security organizations.	Economic Cooperation	Dushanbe Asia-Plus
8/30/01	Afghanistan, Turkmenistan	1	Taleban and Uzbek government officials meet to discuss cooperation in the area of trade.	Security	Soghd Varorud News Agency
9/21/01	Afghanistan, Tajikistan	1	Tajikistan states it will assist Afghan refugees in adherence to UNHCR conventions on refugee status and protection.	Cooperation	Tashkent Uzbek Radio 1
10/18/01	Afghanistan, Tajikistan	1	Tajikistan conducts talks with UN humanitarian aid and political strategy coordinator for Afghanistan.	Security	Paris AFP (Domestic Service)
10/20/01	Afghanistan, Tajikistan	0	Germany emphasises Tajikistan role in delivering humanitarian aid to Afghanistan, and assistance in opposing terror.	Security	Dushanbe Tajik Radio 2

10/31/01	Afghanistan, Tajikistan	0	Tajikistan paper expresses disapproval of military action against Afghanistan.	Security	Soghd Varorud News Agency
11/22/01	Afghanistan, Uzbekistan	1	Uzbekistan radio/television officials meet with Afghan counterparts to discuss future cooperation.	Cooperation	Dushanbe Tajik Radio 1
11/23/01	Afghanistan, Tajikistan	1	Tajikistan talks with US on passing humanitarian aid for Afghanistan through Tajikistan.	Cooperation	Mazar-e Sharif Balkh Radio
11/26/01	Tajikistan, Uzbekistan	-5	Local governments report Uzbekistan siezing Tajikistan land and planting mines; increases in calls for border delineation negotiations.	Security	Khujand Leninabads kaya Pravda
11/29/01	Afghanistan, Uzbekistan	-4	Uzbekistan allows use of airbases for US troop transport to Afghanistan.	Cooperation	Dushanbe Tajik Radio 1
12/5/01	Afghanistan, Tajikistan	-4	Tajikistan allows use of airfields for French troop transport to Afghanistan.		Dushanbe Asia-Plus
12/8/01	Afghanistan, Uzbekistan	3	Uzbekistan opens border crossing with Afghanistan.	Cooperation	Dushanbe Asia-Plus (Internet Version-WWW)
12/21/01	Afghanistan, Tajikistan	1	Tajikistan supports UN peacekeeping efforts in Afghanistan to implement Bonn agreement.	Economic Cooperation	Mazar-e Sharif Radio Voice of Shari'ah of Balkh Province
12/21/01	Tajikistan, Uzbekistan	1	Tajikistan and Uzbekistan conducts talks on Uzbek gas supplies to Tajikistan.	Cooperation	Dushanbe Asia-Plus
1/13/02	Afghanistan, Turkmenistan	1	Government representatives conduct talks on trade, transit, transport.	cooperation	Soghd Varorud News Agency
1/13/02	Tajikistan, Uzbekistan	2	Governments sign agreement to create 16 border checkpoints to facilitate transit of people and cargo between TJK UZB. Foreign nationals allowed access to 7 of these.	Cooperation	Turkmen State News Service
1/13/02	Tajikistan, Uzbekistan	5	Working group established to discuss and enable mine clearing activities on the border.	Economic Cooperation	Turkmen State News Service
2/1/02	Afghanistan, Uzbekistan	3	Uzbekistan introduces preferential duty rates for transport of cargo to Afghanistan.	Cooperation	Tashkent Uzbek Radio 1
2/8/02	Afghanistan, Uzbekistan	4	Afghanistan and Uzbekistan customs officials meet and sign protocol covering a wide range of customs related issues between the countries, and Uzbekistan agrees to provide customs procedures training to Afghanistan government.	Cooperation	Mazar-e Sharif Radio Voice of Shari'ah of Balkh Province
2/10/02	Afghanistan, Tajikistan	0	Afghanistan arrests former United Tajik Opposition leader and six bodyguards.	Cooperation	Kabul Afghanistan Television

3/2/02	Afghanistan, Uzbekistan	1	Afghanistan and Uzbekistan officials meet to discuss resumption of rail service between the countries.	Cooperation	Mazar-e Sharif Balkh Television
4/30/02	Afghanistan, Tajikistan	1	Afghanistan and Tajikistan agriculture officials meet to discuss agricultural cooperation between the countries.	Cooperation	Dushanbe Khovar (Internet Version- WWW)
5/26/02	Afghanistan, Tajikistan	5	Afghanistan and Tajikistan sign letters of intent for military technical assistance regarding training of Afghan military by Tajikistan military forces.		Dushanbe Tajikistan.tajnet.com WWW
5/31/02	Afghanistan, Uzbekistan	1	Government officials meet to discuss strengthening of bilateral ties.	Security	Moscow ITAR-TASS
6/14/02	Afghanistan, Turkmenistan	2	Turkmenistan president announces support of Afghan interim President appointment, and supports further development of bilateral cooperation and regional projects.	Cooperation	Dushanbe Tajik Radio 1
6/15/02	Afghanistan, Tajikistan	2	Tajikistan President offers official support to interim Afghan President Karzai, and pledges to support reconstruction efforts.	Cooperation	Ashgabat Neytralnyy Turkmenistan
6/28/02	Tajikistan, Uzbekistan	1	Tajik government reiterates Uzbek gas supply policy, announces further talks on negotiation of Uzbek gas supplies.	Security	Dushanbe Asia-Plus
7/26/02	Afghanistan, Tajikistan	-1	21 Tajikistan citizens held by Afghan drug lords for failing to pay debts, \$3000 ransom demanded. Tajik border official released.	Cooperation	Ashgabat Turkmenistan.ru WWW
8/5/02	Afghanistan, Tajikistan	3	Tajikistan delegation goes to Afghanistan to sign agreement on cooperation in air service between the countries.	Security	Khujand Varorud
9/17/02	Afghanistan, Turkmenistan	2	Afghanistan and Turkmenistan presidents discuss strengthening cooperative ties.	Cooperation	Kabul Bakhtar News
9/18/02	Afghanistan, Turkmenistan	2	Afghan president vows to establish stronger cooperative links with Turkmenistan.	Economic Cooperation	Dushanbe Asia-Plus
9/18/02	Tajikistan, Uzbekistan	-1	Tajik paper describes deceptive Uzbek response to charges of mines laid by Uzbekistan along the Uzbek-Tajik border are injuring and killing innocent civilians.	Security	Dushanbe Asia-Plus
9/30/02	Afghanistan, Tajikistan	-1	24 Tajikistan citizens held by Afghan drug lords for failing to pay debts.	Economic Cooperation	Dushanbe Asia-Plus
11/29/02	Turkmenistan, Uzbekistan	1	Uzbekistan President offers condolences and support to Turkmenistan President on behalf of Uzbekistan following assassination attempt, and extends full cooperation in fighting terrorism.	Cooperation	Moscow ITAR-TASS

12/7/02	Afghanistan, Tajikistan	0	Tajikistan expresses cooperation with France on reconstruction in Afghanistan.	Cooperation	Turkmenistan.ru WWW
12/22/02	Turkmenistan, Uzbekistan	-2	Uzbekistani ambassador to Turkmenistan recalled for consultations amid rising interstate tensions.	Cooperation	Mazar-e Sharif Balkh Radio
12/23/02	Tajikistan, Uzbekistan	0	Tajikistani border guards find weapons cache on Tajik-Uzbek border, suspect it belongs to Tajik insurgents who staged coup attempt in 1998.	Security	Moscow ITAR- TASS
12/25/02	Afghanistan, Uzbekistan	1	Northern Afghanistan military commander meets with Uzbek delegation receives Uzbek intentions to strengthen relations between the countries and provide Uzbek assistance with reconstruction.		Kabul Afghanistan Television
12/25/02	Afghanistan, Tajikistan	3	Tajikistani embassy opens in Afghan capita.	Economic Cooperation	Mazar-e Sharif Balkh Radio
12/26/02	Afghanistan, Tajikistan	1	Tajikistani Interior Minister receives Northeastern Afghan army commander. Discuss mutual cooperation against terrorism, drugs, organized crime and other violations of law.	Security	Soghd Varorud News Agency
2/7/03	Afghanistan, Tajikistan	1	Tajikistan government sponsors commerce group talks with Afghanistan government on building economic cooperation and business ties between the countries.	Economic Cooperation	Tashkent Narodnoye Slovo
2/20/03	Tajikistan, Turkmenistan, Uzbekistan	0	Uzbekistan and Turkmenistan temporarily suspend gas deliveries to Tajikistan in order to conduct gas line repair and replacement.	Economic Cooperation	Tashkent Pravda Vostoka
2/26/03	Afghanistan, Uzbekistan	1	Afghanistan, Northern Balkh Province's Hayratan town: Uzbekistan releases 36 Afghan nationals held prisoner in Uzbekistan on various charges back to Afghanistan government control in accordance with Uzbek presidential decree, and subsequently released to return to their provinces.	Economic Cooperation	Soghd Varorud News Agency
2/26/03	Afghanistan, Uzbekistan	1	Northern Provinces leadership council officials meet with Uzbek consul-general to discuss cooperative bilateral relations.	Economic Cooperation	Mazar-e Sharif Balkh Radio
4/3/03	Afghanistan, Tajikistan	1	Afghanistan and Tajikistan presidents discuss bilateral cooperation, its positive direction, and prospects for future development.	Security	Moscow Agentstvo Voyennykh Novostey WWW
4/8/03	Afghanistan, Uzbekistan	1	Afghanistan and Uzbekistan border officials meet to discuss cooperation over border issues.	Economic Cooperation	Moscow ITAR- TASS

5/6/03	Afghanistan, Tajikistan	4	Tajikistan restores electrical energy supply to six Northern Afghanistan villages, negotiates competitive electrical supply and rates.	Economic Cooperation	Kabul Radio Afghanistan
5/16/03	Afghanistan, Tajikistan	3	Afghanistan Consulate General opens in Eastern Tajikistan.	Economic Cooperation	Kabul Radio Afghanistan
5/21/03	Afghanistan, Tajikistan	3	Tajikistan and Afghanistan militaries join forces for counter-narcotics mission; announce it as a priority for military cooperation.	Cooperation	Mazar-e Sharif Balkh Television
6/2/03	Afghanistan, Tajikistan	2	Tajikistan government official warns UN and world of increasing drug production and smuggling in Afghanistan, supports international aid and assistance to Afghanistan to combat its drug problem.	Cooperation	Dushanbe Tajik Radio 1
7/5/03	Afghanistan, Uzbekistan	1	Uzbek Deputy foreign minister visits northern Afghan city of Herat, meets with the Herat-province Governor to discuss relations and issues of interest between the countries.	Cooperation	Moscow ITAR-TASS
7/23/03	Afghanistan, Tajikistan	3	Afghanistan Defense minister meets with Tajik counterpart to propose closer military-technical ties, and to discuss other security issues.	Cooperation	Herat Television
7/29/03	Afghanistan, Turkmenistan	4	Turkmenistan installs electrical power substation to supply electricity to Afghanistan.	Economic Cooperation	Herat Television
9/1/03	Tajikistan, Uzbekistan	2	Tajik president congratulates Uzbek president on Uzbek independence date, offers official affirmation of cooperative relationship between the countries, and affirms desire for expansion of relationships.	Security	Moscow ITAR-TASS
11/11/03	Afghanistan, Uzbekistan	1	Afghan Balkh province acting governor meets with other Afghan officials to discuss the reopening of the Hayratan border with Uzbekistan.	Security	Moscow ITAR-TASS
12/8/03	Afghanistan, Uzbekistan	1	The Afghanistan deputy head of state meets the Uzbek foreign minister and talks about strengthening of bilateral ties and expansion of trade relations between the two countries.	Cooperation	Asia-Plus
12/9/03	Afghanistan, Uzbekistan	2	Uzbekistan signs trade, transit and transport contract with Afghanistan.	Economic Cooperation	Moscow ITAR-TASS
12/24/03	Tajikistan, Uzbekistan	1	Tajik and Uzbek presidents exchange confirmation of satisfaction over bilateral economic cooperation, and will seek to settle remaining issues over the next year.	Security	Mazar-e Sharif Balkh Television

1/21/04	Afghanistan, Tajikistan	-4	Border post No 4, stationed in Bodju village of Ishkoshim District in MBAR: 3 Tajik soldiers killed by unidentified gunmen from Afghanistan.	Cooperation	Dushanbe Khovar (Internet Version- WWW)
3/31/04	Tajikistan, Uzbekistan	1	Tajikistan backs away from border reinforcement in response to Uzbek internal security situation, security forces of both countries in contact and communicating on actions regarding security.	Cooperation	Mazar-e Sharif Balkh Radio
4/22/04	Tajikistan, Uzbekistan	-3	Uzbekistan suspends gas to Tajikistan pending repayment of debt, and prepayment for future deliveries.	Cooperation	Mazar-e Sharif Balkh Radio
5/6/04	Tajikistan, Uzbekistan	1	Countries meet to discuss television show exchange, and reach verbal agreement on Uzbek technical training in broadcast production.	Economic Cooperation	Moscow ITAR- TASS
5/21/04	Afghanistan, Uzbekistan	1	Afghan Information Minister conducts talks on bilateral cooperation between the countries.	Economic Cooperation	Dushanbe Asia-Plus
6/24/04	Tajikistan, Uzbekistan	3	Tajikistanis hail Uzbek willingness to de-mine border, will provide support and assistance in the effort.	Cooperation	Ashgabat Neytralnyy Turkmenistan
7/6/04	Afghanistan, Uzbekistan	3	Uzbek delegation meets with Afghan Finance Minister in Northern Afghanistan to sign agreement on reconstruction of the Andkhoy - Herat highway.	Cooperation	Dushanbe Tajik Radio 1
7/19/04	Afghanistan, Tajikistan	0	In talks with UK Envoy, Tajikistani leader calls for strengthening regional assistance to Afghanistan for reconstruction and counter narcotics.	Cooperation	Dushanbe Tajik Radio 1
7/26/04	Afghanistan, Tajikistan	1	Tajikistan's Mountainous Badakhshon [Autonomous Region] and Badakhshan Province of Afghanistan: Cooperative news and information bulletin published as part of civic-business effort to increase cross-border trade between the regions.	Economic Cooperation	Dushanbe Khovar (Internet Version- WWW)
11/4/04	Afghanistan, Tajikistan	2	Tajikistan President congratulates Afghan President-elect, pledges continued cooperation on Afghanistan's restoration and development.	Cooperation	Mazar-e Sharif Balkh Television
11/20/04	Turkmenistan, Uzbekistan	3	Turkmenistan and Uzbekistan sign friendship accord.	Cooperation	Dushanbe Tajik Avesta (WWW- Text)
3/27/05	Afghanistan, Tajikistan	1	"The leadership of Tajikistan's [southern] Khatlon Region and Afghanistan's [northern] Konduz Province has discussed drafting a cooperation agreement between the two countries' regions."	Cooperation	Mazar-e Sharif Balkh Television
4/11/05	Afghanistan, Turkmenistan	4	Turkmenistan builds road to Northern Afghanistan.	Cooperation	Dushanbe Asia-Plus

4/14/05	Afghanistan, Tajikistan	6	Tajikistan counter drug agency seizes major drug shipments with cooperation of Tajik and Afghan security services.	Economic Cooperation	Dushanbe Asia-Plus
5/13/05	Tajikistan, Uzbekistan	0	Tajik officials express concern over unrest in Uzbekistan's Andijon region; urge quick and peaceful resolution.	Cooperation	Dushanbe Asia-Plus
5/16/05	Tajikistan, Uzbekistan	1	Tajik and Uzbek railway officials meet to discuss bilateral cooperation on rail issues, including desire to develop and sign formal agreements on technical, operational, and financial cooperation for rail operations between the countries.	Economic Cooperation	Dushanbe Asia-Plus
5/17/05	Tajikistan, Uzbekistan	-3	Northern Sogdiisk district area: Uzbek officials close border in response to Andijon rebellion in Uzbekistan. Population on both sides of border unhappy, and prices for certain goods and services rising in Tajik settlements in the border area.		Dushanbe Asia-Plus
6/18/05	Afghanistan, Tajikistan	3	Tajik and Afghan presidents meet to discuss bilateral relations, security and cooperation.	Economic Cooperation	Dushanbe Asia-Plus
7/2/05	Afghanistan, Tajikistan	6	Tajik and Afghan security services conduct joint operation to arrest suspected two individuals suspected of drug smuggling and connections with international terrorist organizations.	Security	Moscow ITAR-TASS
8/24/05	Tajikistan, Uzbekistan	0	Tajik president sends official congratulations to Uzbek president on the Uzbek independence day, and affirms Tajikistan's support and desire for further cooperation and friendly relations with Uzbekistan.	Cooperation	Ozbekiston Ovozi
9/2/05	Afghanistan, Tajikistan	1	Tajik and Afghan border guard's officials meet to discuss bilateral cooperation on a variety of border control issues, and sign protocol for discussions leading to the expected signing of a formal cooperation agreement between the two services.	Security	Dushanbe Asia-Plus (Internet Version- WWW)
9/29/05	Afghanistan, Tajikistan	4	Tajik and Afghan border police set up special units to combat illicit drug trade between the countries; set up technical training, and establish additional border check points and center for bilateral cooperation to support counter-narcotics efforts.	Security	Dushanbe Avesta WWW
10/8/05	Tajikistan, Uzbekistan	-1	Tajikistanis demand compensation for injury from antipersonnel mines on the Tajik-Uzbek border.	Cooperation	Dushanbe Avesta WWW

10/13/05	Tajikistan, Uzbekistan	1	Surxondaryo Region's Uzun, Denov and Sariosiyo Districts: Uzbek government establishes commission to study Tajik aluminum plant's negative impacts on the region's environment.	Cooperation	Dushanbe Khovar (Internet Version- WWW)
10/23/05	Afghanistan, Tajikistan	1	Farkhor sector of the Tajikistani-Afghan border: Afghan drug runner arrested crossing into Tajikistan during cooperative operation between the countries' border police.	Security	Dushanbe Avesta WWW
12/5/05	Afghanistan, Tajikistan	1	Tajikistan officials attend regional trade forum in Kabul, Afghanistan designed to promote cooperation and economic development.	Cooperation	Dushanbe Avesta WWW
12/12/05	Tajikistan, Uzbekistan	0	New Uzbek envoy presents credentials to Tajik government official.	Economic Cooperation	Dushanbe Asia-Plus (Internet Version- WWW)
3/6/06	Afghanistan, Turkmenistan	3	ISA President meets with Turkmenistan President for talks on economic and regional cooperation.	Security	Moscow ITAR-TASS
7/16/06	Afghanistan, Tajikistan	-3	Tajik government issues statement protesting AFG military reinforcement of border, and support to Tajik Opposition forces; closes all points of trade on TJK-AFG border. Badakhshan sector was specifically noted for military activity.	Security	Moscow ITAR-TASS
8/23/06	Afghanistan, Tajikistan	2	Shughnan District, AFG; Khorog, TJK. Heads of mission meet to lay out cooperative border security agreements, including establishment of 2-3km security zone in Shughnan along AFG border.	Economic Cooperation	Neytralnyy Turkmenistan
11/2/06	Tajikistan, Uzbekistan	-1	During meeting between border services, Tajik border guard Chief warns counterpart to not emplace mines on border, which Tajikistan considers a violation of Geneva Convention requirements.	Security	Dushanbe Asia-Plus
10/13/07	Afghanistan, Tajikistan	1	Tajik National Reconciliation Commission proposes talks with AFG on return of Tajik opposition fighters from AFG, as well as TJK refugees from AFG.	Cooperation	Dushanbe Avesta WWW

Source: Format modeled after Shira B. Yoffe, "Basins at Risk: Conflict and Cooperation Over International Freshwater Resources," (Ph.D. diss., Department of Geosciences, Oregon State University, 2002) 135. Data in the table is collected from the OSC (Open Source Center) [database on-line]; available from <http://www.opensource.gov>.

APPENDIX B

EVENT DATABASE FOR WATER RELATIONS

Date	Countries Involved	BAR Scale	Event Summary	Issue Type	Source
1/16/1996	Turkmenistan, Uzbekistan	4	Visit by President of TKM at invitation of UZB President to discuss ratification of 21 interstate and intergovernmental agreements, including equal sharing of the Amu Darya river water.	Joint Management	Tashkent Radio Mashal
3/17/1998	Turkmenistan, Uzbekistan	4	Uzbekistan negotiates \$24 million 1997 debt repayment mechanism to Turkmenistan, for rail and communications services and rental for Uzbekistan controlled Amu Darya water handling facilities on Turkmenistan territory.	Economic Development	ITAR-TASS
11/9/1999	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Uzbekistan receives \$600 million in economic development, including setting up drainage system on the Amu Darya river.	Water Quality	ITAR-TASS
12/7/2000	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Uzbekistan negotiates further World Bank financing for water development, including Karshi pumping station chain supplying Amu Darya water to irrigate the 400K ha Kashkadarya Region, total World Bank input is \$161.5 million.	Irrigation	Tashkent Biznes Vestnik Vostoka

11/17/2000	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Uzbekistan diverts 100m som of Amu Darya river water into the Pachkamar canal for drought relief to the Guzar District.	Irrigation	Tashkent Narodnoye Slovo
8/21/2000	Turkmenistan, Uzbekistan	4	Settlement of Uzbekistan debts for use of Turkmenistan water intake facilities on the Amu Darya.	Economic Development	Turkmen State News Service
5/30/2000	Tajikistan, Uzbekistan	1	Intergovernmental talks on possibility of agreement over shared water resources.	Water Quantity	Tashkent Uzbek Television First Channel
3/16/2000	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	1	Deputy Director of the Hydrometeorology Research Center, Republic of Uzbekistan discusses flooding from overflow of Lake Sarez, potential control measures, and need for AFG, TJK, TKM, UZB cooperation on solutions to problem.	Flood Control/Relief	Tashkent Qishoq Hayote
2/26/2000	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Completion of drainage project for Amu Darya wastewater in Karakalpakstan (part 1 of 3). This is the partial completion of World Bank funded initiative in W19992.	Water Quality	Tashkent Narodnoye Slovo
4/18/2001	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Lebap water construction production association completes 370km of Amu Darya river bank dam reinforcements for flood control.	Flood Control/Relief	Turkmen Radio 1
3/31/2001	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	0	TKM plans to increase number of Garagum canal (fed by Amu Darya) reservoirs to 21, and capacity to 9.7bn cu.m. by 2002. Notes 95% of TKM water comes from Amu Darya.	Water Quantity	Watan Ashkhabad newspaper

3/30/2001	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	0	Discusses water development projects including flood control and water quantity from the Amu Darya. No indication of bilateral discussion of projects.	Water Quantity, Irrigation, Flood Control	Turkmenistan
2/15/2001	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	0	Discusses continuation of Amu Darya wastewater drainage project funded through World Bank, including monitoring facilities for the Amu Darya.	Water Quality	Pravda Vostoka
10/31/2002	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Technical assistance for the Amy-Zang irrigation system in Surkhandarya Region rehabilitation project, including 3 pumping stations on Amu Darya. Financed by Italian government and Asian Development Bank.	Irrigation	Tashkent Biznes Vestnik Vostoka
4/11/2002	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Serdarabat District flood control project; Amu Darya river bed rebuilt, banks strengthened, and dam built along 5km of river approaching district by the Lebap water management production association.	Flood Control/Relief	Neytralnyy Turkmenistan newspaper
3/27/2002	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Darganata District; construction of 15km long flood control dam on the Amu Darya.	Flood Control/Relief	Turkmen Television First
1/31/2002	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Farap District, Satlyk Canal (Amu Darya river) water pumps provided electricity to allow proper utilization.	Water Quantity	Turkmen Television First
1/10/2002	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Lebap Region; construction to enable Zeyit reservoir capacity increase to 3.6bn cu.m. from 1bn cu.m. Controls Amu Darya flow into the Karakum canal. The reservoir is tied to overall land reclamation for	Irrigation	Turkmen State News Service

			agriculture in TKM.		
12/24/2003	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-1	US Ambassador meets with Loya Jerga representatives and pledges US construction of canals drawing water from the Amu Darya into Northern Afghanistan.	Water Quantity	Kabul Hindokash
9/5/2003	Afghanistan, Tajikistan	1	Tajik Energy Minister and Afghan Deputy Minister of Water and Power discuss bilateral cooperation on joint use of the Amu Darya and Panj river waters.	Joint Management	Asia-Plus
7/10/2003	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	World Bank approves \$60 million for irrigation and drainage repair and improvement in the Amu Darya river basin area of Karakalpakstan.	Irrigation	Bankovskiye Vedomosti
5/6/2003	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	0	Darganata District; Lebap water management production association completes 88km of flood control structures along Amu Darya river.	Flood Control/Relief	Turkmen Television First
10/1/2004	Turkmenistan, Uzbekistan	1	Qashqadaryo Region, Qashi canal. TKM and UZB defense ministers meet to discuss improving bilateral cooperation and security in the border regions; specifically mentioned was TKM refusal to allow UZB personnel managing Qashi canal pumping stations on the Amu Darya freedom of access to manage the pumps; incident involved holding of 100 plus UZB personnel on TKM territory.	Irrigation	Tashkent Harakat WWW

2/27/2004	Turkmenistan, Uzbekistan	0	Yapac-Nerezim steppe, Uzbekistan's Bukhara Region: TKM build 15km 5 cu.m.s canal to carry Amu Darya water for irrigation. Project in conjunction with expanded agricultural settlement in the region.	Irrigation	Turkmen Television First
2/15/2004	Afghanistan, Uzbekistan	-1	Shortepa District, Balkh Province, AFG: Construction of bank reinforcements to control flooding on the Amu Darya river, as well as control wake damage from UZB river patrol boats begins. Provincial governor requests official action with UZB regarding patrol boat activity which is damaging river side homes and villages in Shortepa District.	Flood Control/Relief	Mazar-e Sharif Balkh Television
10/3/2005	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Lebap Region; new dam construction on Zeyit reservoir completed, bringing TKM closer to achieving reservoir capacity to 1.5bn cu.m., which will be drawn from the Amu Darya river.	Water Quantity	Turkmen Television First
8/6/2005	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	-3	Lebap Region. Lake Turkmen construction continues, designed to move saline water from the Amu Darya river to the artificial lake via canals. Goals are prevention of mineral salts discharge into the Amu Darya, and increase in irrigation capacity.	Water Quality, Water Quantity	Turkmen Television First

5/7/1999	Kazakhstan-- Kyrgyz Republic-- Tajikistan-- Uzbekistan	6	Between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of Tajikistan, and the Government of the Republic of Uzbekistan on Cooperation in the Area of Environment and Rational Nature Use	Water Quality	TFDD
3/17/1998	Kazakhstan-- Kyrgyz Republic-- Tajikistan-- Uzbekistan	6	Agreement Between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, [the Government of Tajikistan], and the Government of the Republic of Uzbekistan on Cooperation in the Area of Environment and Rational Nature Use	Water Quality	TFDD
6/7/2000	Kazakhstan-- Kyrgyzstan-- Tajikistan-- Turkmenistan-- Uzbekistan	1	Some progress in water issues was made at a recent meeting of 5 deputy water ministers in Nukus, city in Uzbekistan located near the dying Aral Sea. See F1027/F1047, F1048, & F1049 for related information.	Water Quality	TFDD: Eurasianet on-line "environment" article (www.eurasianet.org)
4/9/1999	Kazakhstan-- Kyrgyzstan-- Tajikistan-- Turkmenistan-- Uzbekistan	1	A summit meeting was held between the Presidents of the 5 Central Asian states devoted to the problems of Aral Sea. At the summit on Friday, the 5 states called on conflicting sides in Afghanistan to actively continue political settlement process.	Joint Management	TFDD: Moscow ITAR-TASS World Service

6/7/2000	OSCE-- Turkmenistan-- Uzbekistan	1	The Presidents of Turkmenistan & Uzbekistan said they prefer to handle [water] problem on bilateral basis & rejected the multilateral approach proposed by the OSCE (Organization for Security & Cooperation in Europe). See F1027/F1047, F1049, & F1050 for related information.	Water Quantity	TFDD: Eurasianet on-line "environment" article (www.eurasianet.org)
3/31/2000	Turkmenistan-- Uzbekistan	1	During talks held on 3/31, Uzbekistan President Karimov & Turkmenistan counterpart Niyazov described water issue as "most pressing topic of current time." Niyazov also rejected OSCE initiative in late March to convene international conference to discuss water issue. He believes that states should rely on "own potential" & work at bilateral level.	Water Quantity	TFDD: Eurasianet on-line "environment" article (www.eurasianet.org)
2/4/1998	Tajikistan-- Uzbekistan	1	Tajikistan President Rakhmonov & Uzbekistan Prime Minister Sultanov agreed at a meeting on 2/4 to reschedule repayment of Dushanbe's debt to Tashkent. Rakhmonov sees 1st visit of Uzbekistan government delegation since Tajikistan gained independence following agreements the countries reached in Tashkent on 1/4, Rakhmonov's spokesman said. They also discussed measures to develop cooperation in areas of transportation, communications, joint development of energy & water	Joint Management	TFDD: Moscow Interfax

			resources, environmental protection & agriculture.		
2/5/1998	Tajikistan-- Uzbekistan	4	The delegation from Uzbekistan headed by the Republic's Prime Minister Sultonov has ended its working visit to Tajikistan by signing package of documents on bilateral cooperation. Talks dealt with restructuring Tajikistan's debts to Uzbekistan. The agreement provides for beneficial conditions in the 1st 3 years, starting in 1999, when Tajikistan will pay only 2.8%. The sides also signed intergovernmental agreements on cooperation on rational use of water & energy resources, on legal aid & cooperation between prosecutor generals of 2 countries, on cooperation & mutual assistance between the Minister of Security & Uzbekistan's National Security Service, on combating crime, etc., etc.	Joint Management	TFDD: Moscow ITAR- TASS World Service

3/3/1995	Kazakstan-- Kyrgyzstan-- Tajikistan-- Turkmenistan-- Uzbekistan	3	Presidents of the former Soviet Central Asian Republics met on Friday to discuss environmental problems of the Aral Sea & surrounding area. The presidents, decided to set up a special bank "Aral Ecobank" to keep money allocated for joint projects., which include measures to fight mud slides & ensure more economical uses of water from the Amu & Syr Rivers. The presidents also considered ways of raising money for the International Foundation for the Aral Sea, instituted earlier, & re-elected Kazakhstan President Nazarbayev its president. The next Central Asian summit is due to be held in Nukus, Uzbekistan on 9/18-20 & is expected to be attended by representatives from the other countries, including US's Al Gore. Recently, Israel expressed the desire to join the Central Asian body coordinating Aral Sea projects & promised to pay an entrance fee of million. Earlier, International Foundation member states, ex-Soviet republics of Turkmenistan, Uzbekistan, Kyrgistan, Tajikistan, & Kazakhstan, agreed to spend 1% of their national income on joint Aral Sea projects.	Water Quality	TFDD: Moscow Interfax
----------	---	---	---	---------------	-----------------------

2/28/1997	Kazakhstan-- Kyrgystan-- Tajikistan-- Turkmenistan-- Uzbekistan--World Bank	1	Presidents meet in Almaty on 2/28/97 to discuss problems of the Aral Sea. The deputy prime ministers will meet with World Bank Vice in Almaty today. The presidents will discuss efforts to save the Aral Sea. The summit will also consider issues in forming of Aral Rescue Fund budget & determining status of Interstate Council on Problems of Aral Region.	Water Quantity	TFDD: Moscow Interfax (2/27/97) + Rossiyskaya Gazeta
3/26/1993	Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Turkmenistan	6	Agreement on joint activities in addressing the Aral Sea and the zone around the Sea crisis, improving the environment, and ensuring the social and economic development of the Aral Sea region	Water Quality	TFDD Intl Treaties Db

Source: Format modeled after Shira B. Yoffe, “Basins at Risk: Conflict and Cooperation Over International Freshwater Resources,” (Ph.D. diss., Department of Geosciences, Oregon State University, 2002) Data labeled “TFDD” in the “Source” column of the table comes from Oregon State University, “Transboundary Freshwater Dispute Database” [database online];available from <http://www.transboundarywaters.orst.edu>. All other data collected is from the OSC (Open Source Center) [database online]; available from <http://www.opensource.gov>.

APPENDIX C

SUMMARY OF STATISTICAL INFORMATION

This appendix provides additional information to the correlation analysis illustrated in tables 5-8 in Chapter 4.

Table 5 Information

AFG – Afghanistan
TJK – Tajikistan
TKM – Turkmenistan
UZB – Uzbekistan
(P) – Primary Country
Correlations (Pearson)

Conflict/Cooperation Correlation Set 1 AFG (P)

Correlation of AFG TJK and AFG TKM = 0.703, P-Value = 0.016
Correlation of AFG TJK and AFG UZB = 0.135, P-Value = 0.692
Correlation of AFG TKM and AFG UZB = -0.161, P-Value = 0.635

Conflict/Cooperation Correlation Set 2 TJK (P)

Correlation of AFG TJK and TJK TKM = -0.182, P-Value = 0.591
Correlation of AFG TJK and TJK UZB = -0.094, P-Value = 0.783
Correlation of TJK TKM and TJK UZB = -0.037, P-Value = 0.914

Conflict/Cooperation Correlation Set 3 TKM (P)

Correlation of AFG TKM and TJK TKM = -0.303, P-Value = 0.365
Correlation of AFG TKM and TKM UZB = -0.238, P-Value = 0.481
Correlation of TJK TKM and TKM UZB = -0.184, P-Value = 0.588

Conflict/Cooperation Correlation Set 4 UZB (P)

Correlation of AFG UZB and TJK UZB = 0.175, P-Value = 0.606
Correlation of AFG UZB and TKM UZB = -0.020, P-Value = 0.954
Correlation of TJK UZB and TKM UZB = 0.358, P-Value = 0.279

Table 5 Descriptive Statistics

Variable	N	Mean	Median	TrMean	StDev	SE Mean
AFG TJK	11	1.96	-5.61	-1.75	17.70	5.34
AFG TKM	11	11.78	1.93	9.59	16.95	5.11
AFG UZB	11	2.49	0.00	1.52	6.98	2.10
TJK TKM	11	0.352	0.000	0.111	0.886	0.267
TJK UZB	11	5.95	0.60	4.59	17.27	5.21
TKM UZB	11	5.81	0.00	5.21	9.31	2.81

Variable	Minimum	Maximum	Q1	Q3
AFG TJK	-11.52	48.77	-8.88	11.10
AFG TKM	0.00	43.30	0.00	19.80
AFG UZB	-4.50	18.23	0.00	2.40
TJK TKM	0.000	2.867	0.000	0.000
TJK UZB	-19.10	43.30	-2.69	17.36
TKM UZB	-2.80	19.80	0.00	19.80

Table 6 Information

AFG – Afghanistan

TJK – Tajikistan

TKM – Turkmenistan

UZB – Uzbekistan

(P) – Primary Country

Correlations (Pearson)

Average Conflict/Cooperation and Water Conflict/Cooperation by Country Correlation

Average Conflict/Cooperation and Water Conflict/Cooperation Set 1 AFG (P)

Correlation of Avg AFG FH and Avg AFG WFH = -0.727, P-Value = 0.011

Average Conflict/Cooperation and Water Conflict/Cooperation Set 2 TJK (P)

Correlation of Avg TJK FH and Avg TJK WFH = -0.387, P-Value = 0.240

Average Conflict/Cooperation and Water Conflict/Cooperation Set 3 TKM (P)

Correlation of Avg TKM FH and Avg TKM WFH = -0.325, P-Value = 0.329

Average Conflict/Cooperation and Water Conflict/Cooperation Set 4 UZB (P)

Correlation of Avg UZB FH and Avg UZB WFH = 0.079, P-Value = 0.818

Table 6 Descriptive Statistics

Variable	N	Mean	Median	TrMean	StDev	SE Mean
Avg AFG	11	5.41	2.14	3.67	10.89	3.28
Avg AFG	11	-2.97	-2.20	-2.53	3.42	1.03
Avg TJK	11	2.75	3.62	2.57	7.80	2.35
Avg TJK	11	4.82	0.17	3.42	8.45	2.55
Avg TKM	11	5.98	5.03	5.67	5.65	1.70
Avg TKM	11	2.32	0.67	0.78	13.57	4.09
Avg UZB	11	4.75	5.47	4.34	8.09	2.44
Avg UZB	11	6.15	0.26	4.86	15.31	4.62

Variable	Minimum	Maximum	Q1	Q3
Avg AFG	-4.15	30.69	-2.50	12.22
Avg AFG	9.90	0.00	-6.43	0.00
Avg TJK	-8.24	15.36	-2.90	9.55
Avg TJK	0.00	22.23	0.00	9.90
Avg TKM	0.33	14.43	0.80	13.20
Avg TKM	-13.20	31.63	-9.90	14.43
Avg UZB	-7.87	21.03	-0.90	10.29
Avg UZB	-9.90	33.84	-6.60	18.93

Table 7 Information

AFG – Afghanistan

TJK – Tajikistan

TKM – Turkmenistan

UZB – Uzbekistan

(P) – Primary Country

Correlations (Pearson)

Overall Conflict/Cooperation vs. Water Conflict/Cooperation Levels

AFG TJK Conflict/Cooperation vs. AFG TJK Water Conflict/Cooperation Levels

Correlation of AFG TJK FH and AFG TJK WFH = 0.171, P-Value = 0.614

AFG TKM Conflict/Cooperation vs. AFG TKM Water Conflict/Cooperation Levels

Correlation of AFG TKM FH and AFG TKM WFH = -0.610, P-Value = 0.046

AFG UZB Conflict/Cooperation vs. AFG UZB Water Conflict/Cooperation Levels

Correlation of AFG UZB FH and AFG UZB WFH = -0.346, P-Value = 0.297

TJK TKM Conflict/Cooperation vs. TJK TKM Water Conflict/Cooperation Levels

Correlation of TJK TKM FH and TJK TKM WFH = 0.932, P-Value = 0.000

TJK UZB Conflict/Cooperation vs. TJK UZB Water Conflict/Cooperation Levels

Correlation of TJK UZB FH and TJK UZB WFH = -0.139, P-Value = 0.684

TKM UZB Conflict/Cooperation vs. TKM UZB Water Conflict/Cooperation Levels

Correlation of TKM UZB FH and TKM UZB WFH = 0.214, P-Value = 0.527

Table 7 Descriptive Statistics

Variable	N	Mean	Median	TrMean	StDev	SE Mean
AFG TJK	11	1.96	-5.61	-1.75	17.70	5.34
AFG TJK	11	0.0455	0.0000	0.0000	0.1508	0.0455
AFG TKMF	11	11.78	1.93	9.59	16.95	5.11
AFG TKM	11	-5.10	0.00	-4.03	8.00	2.41
AFG UZB	11	2.49	0.00	1.52	6.98	2.10
AFG UZB	11	-3.86	0.00	-3.41	5.20	1.57
TJK TKM	11	0.352	0.000	0.111	0.886	0.267
TJK TKM	11	2.07	0.00	0.33	5.90	1.78
TJK UZB	11	5.95	0.60	4.59	17.27	5.21
TJK UZB	11	12.35	0.00	7.79	24.76	7.47
TKM UZB	11	5.81	0.00	5.21	9.31	2.81
TKM UZB	11	9.98	1.00	6.05	31.06	9.37

Variable	Minimum	Maximum	Q1	Q3
AFG TJK	-11.52	48.77	-8.88	11.10
AFG TJK	0.0000	0.5000	0.0000	0.0000
AFG TKMF	0.00	43.30	0.00	19.80
AFG TKM	-19.80	0.00	-9.90	0.00
AFG UZB	-4.50	18.23	0.00	2.40
AFG UZB	-11.80	0.00	-9.90	0.00
TJK TKM	0.000	2.867	0.000	0.000
TJK TKM	0.00	19.80	0.00	1.00
TJK UZB	-19.10	43.30	-2.69	17.36
TJK UZB	0.00	65.70	0.00	9.90
TKM UZB	-2.80	19.80	0.00	19.80
TKM UZB	-19.80	75.10	-19.80	43.30

Table 8 Information

AFG – Afghanistan
TJK – Tajikistan
TKM – Turkmenistan
UZB – Uzbekistan
(P) – Primary Country
Correlations (Pearson)

Water-Related Conflict and Cooperation Between Primary and Secondary Country Pairs

AFG (P)

Correlation of AFG TJK and AFG TKM = -0.199, P-Value = 0.557
 Correlation of AFG TJK and AFG UZB = -0.385, P-Value = 0.242
 Correlation of AFG TKM and AFG UZB = 0.186, P-Value = 0.584

TJK (P)

Correlation of AFG TJK and TJK TKM = -0.117, P-Value = 0.733
 Correlation of AFG TJK and TJK UZB = -0.165, P-Value = 0.627
 Correlation of TJK TKM and TJK UZB = -0.012, P-Value = 0.972

TKM (P)

Correlation of AFG TKM and TJK TKM = 0.247, P-Value = 0.465
 Correlation of AFG TKM and TKM UZB = 0.637, P-Value = 0.035
 Correlation of TJK TKM and TKM UZB = 0.695, P-Value = 0.018

UZB (P)

Correlation of AFG UZB and TJK UZB = -0.107, P-Value = 0.755
 Correlation of AFG UZB and TKM UZB = 0.415, P-Value = 0.205
 Correlation of TJK UZB and TKM UZB = 0.258, P-Value = 0.443

Table 8 Descriptive Statistics

Variable	N	Mean	Median	TrMean	StDev	SE Mean
AFG TJK	11	1.96	-5.61	-1.75	17.70	5.34
AFG TKM	11	11.78	1.93	9.59	16.95	5.11
AFG UZB	11	2.49	0.00	1.52	6.98	2.10
TJK TKM	11	0.352	0.000	0.111	0.886	0.267
TJK UZB	11	5.95	0.60	4.59	17.27	5.21
TKM UZB	11	5.81	0.00	5.21	9.31	2.81

Variable	Minimum	Maximum	Q1	Q3
AFG TJK	-11.52	48.77	-8.88	11.10
AFG TKM	0.00	43.30	0.00	19.80
AFG UZB	-4.50	18.23	0.00	2.40
TJK TKM	0.000	2.867	0.000	0.000
TJK UZB	-19.10	43.30	-2.69	17.36
TKM UZB	-2.80	19.80	0.00	19.80

BIBLIOGRAPHY

- Adams, Alison. "Analysis of Regional Water Conflicts: The Case Study Approach." Ph.D. Dissertation, Colorado State University, 1998.
- AIMS (Afghanistan Information Management Service). 2006. Available from <http://www.aims.org.af/>.
- Alam, Undala Z. "Questioning the Water Wars Rationale: A Case Study of the Indus Waters Treaty." *The Geographical Journal* 168, no. 4 (2002): 341-53.
- Allan, Tony. "Watersheds and Problemsheds: Explaining the Absence of Armed Conflict Over Water in the Middle East," *Middle East Review of International Affairs* (MERIA) no. 5 (March 1998), [article online]. Available from http://www.ciaonet.org/olj/meria/meria398_allan.html
- Ahmadd, Masood, and Mahwash Masiq. *Water Resource Development in Northern Afghanistan and Its Implications for Amu Darya Basin*. Washington, DC: The World Bank, 2004.
- ArcGIS 9: ArcView and Extensions, ESRI, 2005.
- Azar, Edward E. *Conflict and Peace Data Bank (COPDAB), 1948-1978*. [Computer file]. 3rd release. (1993). College Park, MD: University of Maryland, Center for International Development and Conflict Management [producer], 1993. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor]. Available from <http://www.icpsr.umich.edu/>.
- Butts, Kent Hughes. "The Strategic Importance of Water." *Parameters* Spring 27, no. 1 (1997): 65-83.
- ESRI: Environmental Systems Research Institute, available from <http://www.esri.com/>.
- Fekete, Balazs M, Charles J. Vörösmarty and Wolfgang Grabs. "Global Composite Runoff Fields Based on Observed River Discharge and Simulated Water Balances." 2000. Database on-line. Available from <http://www.grdc.sr.unh.edu>.
- Fradchuk, Artyom. "Tajikistan's Energy Dilemma." IWPR (Institute for War and Peace Reporting), 2006. Available from <http://www.iwpr.net>.
- Giordano, Meridith, Mark Giordano, and Aaron Wolf. "The Geography of Water Conflict and Cooperation: Internal Pressures and International Manifestations." *The Geographical Journal* 168, no. 4 (2002): 293-312.
- Glantz, Michael H. "Water, Climate, and Development Issues in the Amudarya Basin," *Mitigation and Adaptation Strategies for Global Change* 10 (2005): 23-50.

- Gleick, Peter H. "Water and Conflict: Fresh Water Resources and International Security." *International Security* 18, no. 1 (1993): 79-112.
- Hirsch, Moshe. "Game Theory, International Law, and Future Environmental Cooperation in the Middle East." *Denver Journal of International Law and Policy* 27, no. 1 (1998): 1-30.
- Homer-Dixon, Thomas F. "On the Threshold: Environmental Changes As Causes of Acute Conflict." *International Security* 16, no. 2 (1991): 76-116.
- Lowe, Miriam R. "Bridging the Divide: Transboundary Resource Disputes and the Case of West Bank Water." *International Security* 18, no. 1 (1993): 114-38.
- MacQuarrie, Patrick. "Water Security in the Middle East: Growing Conflict Over Development in the Euphrates-Tigris Basin." M.Phil, Trinity College, 2004.
- Maloney, Sean M. "Afghanistan Four Years On: An Assessment." *Parameters*. Autumn 35, no. 3 (August 2005), 23. Available from <http://www.carlisle.army.mil/usawc/Parameters/05autumn/maloney.htm>.
- Marshall, Monty G., Ted Robert Gurr, Victor Asal, Barbara Harff, Deepa Khosla, Amy Pate. *Peace and Conflict 2005: A Global Survey of Armed Conflicts, Self-Determination Movements, and Democracy*. 85.CIDCM, University of Maryland, College Park. available from <http://www.cidcm.umd.edu/inscr/mar/>.
- Minorities at Risk Project (2005) College Park, MD: Center for International Development and Conflict Management. 2006. Available from <http://www.cidcm.umd.edu/inscr/mar/>.
- MS Office 2003, Microsoft Corporation, Redmond, Wash., 2003.
- National Program for Reconstruction Report*, December 2002. Article on-line. Available from: http://www.export.gov/afghanistan/bus_climate/construction.html.
- Oak Ridge National Laboratory. "LandScan Global Population Database." Database on-line. Available from <http://www.ornl.gov/landscan/>.
- Oregon State University. "Transboundary Freshwater Dispute Database." 2006 Database on-line. Available at <http://www.transboundarywaters.orst.edu/>.
- OSC (Open Source Center). 2006. Database on-line. Available from <http://www.opensource.gov>.
- Random.org. 2006. Available from <http://www.random.org>.
- Sample Size Calculator, MaCorr, 2006.

- Trottier, Julie. "Water and the Challenge of Palestinian Institution Building." *Journal of Palestine Studies* 29, no. 2 (2000): 35-50.
- United States Department of Defense. 2006. Available from <http://www.defenselink.mil/>.
- UNDP (United Nations Development Program) Afghanistan. 2006. Available from <http://www.undp.org.af/default.htm>.
- United Nations Development Program (UNDP) Afghanistan. 2006. Available from http://www.undp.org.af/media_room/archives/key_docs/key_docs.htm.
- Unrepresented Nations and Peoples Organization (UNPO). 2002. Available from <http://www.unpo.org>.
- USGS EROS. "HYDRO1k Elevation Derivative Database." Database on-line. 2006 Available from <http://edc.usgs.gov/products/elevation/gtopo30/hydro/index.html>.
- USGS GTOPO30 (Global 30 Arc-Second Elevation Data set) Database on-line. 2006. Available from <http://eros.usgs.gov/products/elevation/gtopo30.html>.
- Votrin, Valery. "Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential." M.A. Thesis, Vrije Universiteit Brussel, 2002.
- Wolf, Aaron, ed. *Conflict Prevention and Resolution in Water Systems, The Management of Water Resources*. Cheltenham, UK: Elgar, 2002.
- Wolf, Aaron T., Annika Kramer, Alexander Carius, and Geoffrey D. Dabelko, "Chapter 5: Managing Water Conflict and Cooperation," in *State of the World 2005: Redefining Global Security*. The WorldWatch Institute. Washington, D.C. 81-82.
- Wolf, Aaron T, Jeffrey A. Natharius, Jeffrey J. Danielson, Brian S. Ward, Jan K. Pender. 1999. "International River Basins of the World." *International Journal of Water Resources Development* 15 (4); available from <http://www.transboundarywaters.orst.edu/>.
- World Bank. 2000. Available from www.worldbank.org/data 32.
- Yoffe, Shira B. "Basins at Risk: Conflict and Cooperation Over International Freshwater Resources." Ph.D. diss., Oregon State University, 2001.

INITIAL DISTRIBUTION LIST

Combined Arms Research Library
US Army Command and General Staff College
250 Gibbon Ave.
Fort Leavenworth, KS 66027-2314

Defense Technical Information Center/OCA
825 John J. Kingman Rd., Suite 944
Fort Belvoir, VA 22060-6218

Dr. Judith Jones
DJMO
USACGSC
1 Reynolds Ave.
Fort Leavenworth, KS 66027-1352

Mr. Alan Lowe
DJMO
USACGSC
1 Reynolds Ave.
Fort Leavenworth, KS 66027-1352

Mr. Kevin Freese
FMSO
USACGSC
1 Reynolds Ave.
Fort Leavenworth, KS 66027-1352

CERTIFICATION FOR MMAS DISTRIBUTION STATEMENT

1. Certification Date: 16 June 2006
2. Thesis Author: MAJ Joseph A. DiPasquale
3. Thesis Title: Assessing Water Security in the Amu Darya River Basin, Afghanistan

4. Thesis Committee Members: _____

Signatures: _____

5. Distribution Statement: See distribution statements A-X on reverse, then circle appropriate distribution statement letter code below:

(A) B C D E F X SEE EXPLANATION OF CODES ON REVERSE

If your thesis does not fit into any of the above categories or is classified, you must coordinate with the classified section at CARL.

6. Justification: Justification is required for any distribution other than described in Distribution Statement A. All or part of a thesis may justify distribution limitation. See limitation justification statements 1-10 on reverse, then list, below, the statement(s) that applies (apply) to your thesis and corresponding chapters/sections and pages. Follow sample format shown below:

EXAMPLE

<u>Limitation Justification Statement</u>	/	<u>Chapter/Section</u>	/	<u>Page(s)</u>
Direct Military Support (10)	/	Chapter 3	/	12
Critical Technology (3)	/	Section 4	/	31
Administrative Operational Use (7)	/	Chapter 2	/	13-32

Fill in limitation justification for your thesis below:

<u>Limitation Justification Statement</u>	/	<u>Chapter/Section</u>	/	<u>Page(s)</u>
_____	/	_____	/	_____
_____	/	_____	/	_____
_____	/	_____	/	_____
_____	/	_____	/	_____
_____	/	_____	/	_____

7. MMAS Thesis Author's Signature: _____

STATEMENT A: Approved for public release; distribution is unlimited. (Documents with this statement may be made available or sold to the general public and foreign nationals).

STATEMENT B: Distribution authorized to US Government agencies only (insert reason and date ON REVERSE OF THIS FORM). Currently used reasons for imposing this statement include the following:

1. Foreign Government Information. Protection of foreign information.
2. Proprietary Information. Protection of proprietary information not owned by the US Government.
3. Critical Technology. Protection and control of critical technology including technical data with potential military application.
4. Test and Evaluation. Protection of test and evaluation of commercial production or military hardware.
5. Contractor Performance Evaluation. Protection of information involving contractor performance evaluation.
6. Premature Dissemination. Protection of information involving systems or hardware from premature dissemination.
7. Administrative/Operational Use. Protection of information restricted to official use or for administrative or operational purposes.
8. Software Documentation. Protection of software documentation - release only in accordance with the provisions of DoD Instruction 7930.2.
9. Specific Authority. Protection of information required by a specific authority.
10. Direct Military Support. To protect export-controlled technical data of such military significance that release for purposes other than direct support of DoD-approved activities may jeopardize a US military advantage.

STATEMENT C: Distribution authorized to US Government agencies and their contractors: (REASON AND DATE). Currently most used reasons are 1, 3, 7, 8, and 9 above.

STATEMENT D: Distribution authorized to DoD and US DoD contractors only; (REASON AND DATE). Currently most reasons are 1, 3, 7, 8, and 9 above.

STATEMENT E: Distribution authorized to DoD only; (REASON AND DATE). Currently most used reasons are 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.

STATEMENT F: Further dissemination only as directed by (controlling DoD office and date), or higher DoD authority. Used when the DoD originator determines that information is subject to special dissemination limitation specified by paragraph 4-505, DoD 5200.1-R.

STATEMENT X: Distribution authorized to US Government agencies and private individuals of enterprises eligible to obtain export-controlled technical data in accordance with DoD Directive 5230.25; (date). Controlling DoD office is (insert).