

INVESTIGATING TRANSECTORAL AND TRANSBOUNDARY WATER  
ALLOCATION: THE RIO GRANDE AND JORDAN RIVER  
CASE STUDIES

AFAMIA CARLO EL-NAKAT  
Environmental Science and Engineering

APPROVED:

---

Charles D. Turner, Ph.D., Chair

---

Russell R. Chianelli, Ph.D.

---

Irasema Coronado, Ph.D.

---

Jorge Gardea-Torresdey, Ph.D.

---

Charles H. Ambler, Ph.D.  
Dean of Graduate School

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PREVIEW

*To Mom and Dad, Analy, Auga, special Abraham and Juan Daniel.  
I am blessed to have you in my life.  
Thank you and I love you.*

INVESTIGATING TRANSECTORAL AND TRANSBOUNDARY WATER  
ALLOCATION: THE RIO GRANDE AND JORDAN RIVER  
CASE STUDIES

by

AFAMIA CARLO EL-NAKAT, B.S., M.S.

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## ABSTRACT

Global water scarcity is rapidly increasing especially in arid countries such as Jordan and Israel. Under such conditions, local, state and national governments are facing the challenge of negotiating water allocation among different parties. This study focuses on the use of Symmetrical Triangular Fuzzy Linear Regression and Least Squares Linear Regression to facilitate the process of water allocation. Two case studies are presented, the international water allocation of the Jordan River and the intersectoral allocation of water in El Paso County. The study also emphasizes the need of treating water as an economic good in order to ensure sustainability and improve efficiency in all sectors.

The Jordan River case study was limited by data availability; the analyses performed are general and focus on providing peaceful solutions to ongoing disputes. Four water distribution scenarios and their effects on Israel's economy are provided. The scenarios portray that cooperation among different states can be more beneficial to their economy and environment. The study recommends treating the Jordan River as an economic good to better achieve "Equitable Utilization" as described by International Surface Water Law.

The scenarios presented in the El Paso case study are based on municipal and agricultural water consumption and revenue data over the last 20 years. Several water transfer scenarios are analyzed. Gross crop-income values are calculated for the main crops. The study demonstrates that pima cotton has historically consumed the greatest quantities of water while generating the least revenue to farmers (average income over 20

years equals \$300/Acre-Foot of water); peppers and onions are more profitable (\$980/Acre-Foot and \$1,260/Acre-Foot respectively). The study also indicates how equal amounts of water generate higher revenues in the municipal sector versus the agricultural sector. In 1999, 90,000 Million Gallons of water would have generated 175,000,000 dollars in the municipal sector in comparison to 90,000,000 dollars in the agricultural sector. Finally, an “El Paso Water Transfer Center” is proposed to create a water market in El Paso County and dictate water prices based on supply/demand interactions. The water transfer center will also insure that farmers receive monetary incentives for the water they conserve and transfer to the municipal sector.

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PREVIEW

## **CHAPTER 1. INTRODUCTION AND PROBLEM STATEMENT**

This introductory chapter consists of three main sections.

The first section provides a general description of the factors compelling this study and the different components involved. The second section, set forth the problem statement and unveils more detailed information



regarding the Jordan River Basin and El Paso County to describe the need for this particular research. Finally, the third section categorizes relevant literature reviewed and shows how this study can fill the lacunae encountered in past publications and contribute to the available literature. The introductory chapter is supported by an extensive review of numerous articles, books and reports from various organizations.

### **1.1. The Study:**

Water availability has decreased throughout the region of the Jordan River Basin (Figure 1 and 2). The rising water scarcity in Jordan, Israel, Syria and Lebanon has been widely discussed as a source of conflicts in the Middle East. Fueled by increasing populations, degradation of natural and water resources and past and ongoing historical and political conflicts, these countries find themselves in a situation where cooperation is needed to address water allocation issues. However, the ghost of past conflicts is still a barricade to cooperation among these countries.

Water issues for countries sharing the same borders are diverse and complex. A multidisciplinary approach can aid in resolving the different uncertainties present. Even though this can increase the complexity of proposed solutions, a multidisciplinary method can give scientists and policy makers a more structured approach to problem solving strategies.

In this study, a multidisciplinary approach is taken to provide answers to the issues that have hindered water allocation and distribution in the Jordan River Basin. The political issues faced in that region have also negatively affected the water supplies and environmental quality of riparian countries. Treating water as an economic good and not just as a natural resource will be the main principle driving this research. The chapters are laid out in a logical and organized framework to be used as guidance to policymakers, leaders and engineers when proposing further actions regarding water allocation in the Jordan River Basin or any other transboundary water location.

Following this introductory chapter, chapter two describes the Jordan River Basin in terms of physical characteristics, geographic information and location. Chapter three then focuses on main conflicts that have been documented in the region that are closely related to water issues. Chapter three also discusses how international surface water law has failed in the past, how the law is deficient and how in the future, water allocation plans will rely on international surface water law principles to solve such transboundary water problems (Wollumuth, J. and J. Eheart., 2000)

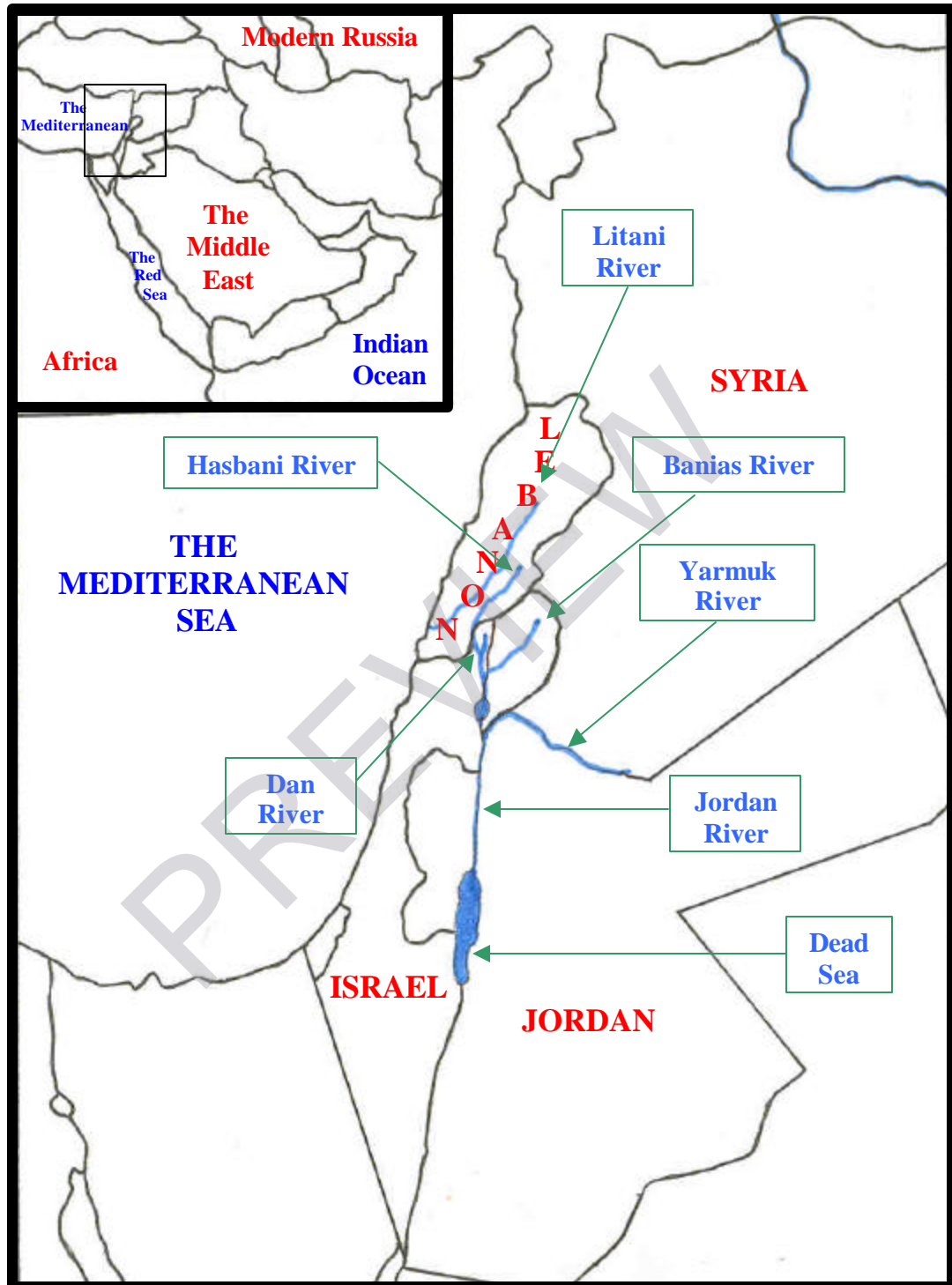


Figure 1. Location Map