American Water Resources Association
2009 SPRING SPECIALTY CONFERENCE
Managing Water Resources Development in a Changing Climate
May 4-6, 2009
Anchorage, AK

Monday, May 4
10:30 AM – 12:00 Noon
Session 3: Transboundary and International Water Management I

1. Geospatial Mapping and Analysis of Water Availability-Demand-Use within The Mara River Basin - Christina Hoffman, The Baldwin Group at NOAA Coastal Services Center, Oakland, CA (co-authors: Assefa Melesse, Michael McClain)

Climate change impacts on water resources is a global concern. This research focuses on the Mara River Basin (MRB), an international river basin between the bordering countries of Kenya and Tanzania in Eastern Africa. The study area encompasses the Masai Mara National Reserve and a portion of the Serengeti National Park, a UNESCO World Heritage site. Rainfall is the main driving force that supports life within the MRB; however, rainfall within the basin is erratic, varying across seasons as well as annually. During dry periods, insufficient rainfall severely threatens water supply within the basin. Furthermore, escalating water demands, as well as deforestation, changing land-use patterns, and poor management of water abstractions add to the challenges that water resource managers must face.

This study looks at several consumptive water-use factors that exist within the basin, as well as established environmental flow requirements, and quantifies the amount of water demanded. Subsequently, this quantity is compared to existing records of surface water availability for the dry season months of December through March. Hydrologic records, site interviews, population census data, and spatial datasets were used in combination with a geographic information system to determine water demand. Six consumptive water use factors were analyzed within the basin, including large-scale irrigation farms, human, livestock and wildlife populations, large-scale mining operations, and lodges and tent camps. Results show that surface water resources in the MRB are severely threatened during periods of drought flow. During such times, surface water supply is insufficient to meet both environmental flow requirements and consumptive water needs. Furthermore, during times of normal flow, surface water supply barely eclipses demand (environmental flow requirement and consumptive water use) for January and February, and does not meet requirements during March.

An increased understanding of the water supply and demand dynamics within the MRB allows managers and stakeholders to better manage their water resources. By realizing periods of insufficient flows, steps can be taken to limit abstractions during periods of low flow and efforts can be made to identify alternative water sources.

2. Water Resources in Sudan - Maria E. Milanes-Murcia, McGeorge School of Law, Sacramento, CA

Fresh water resources in Sudan are surface and groundwater. Surface water is the principal source for domestic use. Groundwater is used only in very limited areas. The environmental conditions and the political situation in the country create “Sudan’s lack of effort in the sustainable development of its groundwater resources.” From one region to another the water resource situation varies largely. The access to clean water sources is limited to twenty six percent of the population while in other rural areas it is sixty four percent. Today, the lack of an appropriate international water resource management and an efficient institutional framework is one of the principal problems that confront Sudan. The inappropriate infrastructure and a conflict inside the country are some of the reasons for increasing the difficult access to water resources. Sudan is characterized for being one of the ten riparian countries in the Nile Basin. Water from the Nile represents the most important source of water for Sudan covering the 79.0 percent of the country. The history of the Nile is directly associated with the history of Sudan. The principal feature of all basins in Sudan is transboundary. Surface water and groundwater are mostly shared with neighboring countries. As an example the largest groundwater aquifer, the Nubian Sandstone system, is shared with Chad, the Libyan Arab Jamahiriya and Egypt. Moreover, Sudan has signed few agreements to allocate water between the different countries such as the 1959 treaty between Sudan and Egypt to share Nile waters and the 2000 groundwater agreement to sharer information from the Nubian Sandstone Aquifer. Today, the lack of treaties

makes an equitable and reasonable allocation of water in Sudan more difficult. The first stage addressed is the history of Sudan and the Nile to understand the political situation and the conflict that is suffering Sudan in this moment. Also, the physical and geographical characteristics of Sudan are analyzed. The goal of this paper is to show the uses, problems and legal issues of each resource, as well as an overview of the international framework. The conclusion provides solutions to improve water management in Sudan.

3. Addressing Climate Change in Outflow Management Studies of the Great Lakes - Anthony Eberhardt, U.S. Army Corps of Engineers., Alexandria, VA

Over the last two decades, studies conducted by the International Joint Commission have considered how interests would be impacted if climate change were to occur substantially modifying levels and outflows. The Great Lakes Levels Reference Study was conducted in the late 1980s in response to the extremely high water levels which were occurring at the time. The study considered revisions to the management plans of the two lakes with outflow control, Lakes Superior and Ontario, and also addressed new controls and management plans for the remaining unregulated lakes, Michigan-Huron and Erie. Climate change scenarios were used to test the robustness of the management options. The International Lake Ontario-St. Lawrence River Study, a five year study which was completed in 2006, considered climate change scenarios suggested by the Intergovernmental Panel on Climate Change when testing management options for Lake Ontario. The International Upper Great Lakes Study, another five year study which began in 2007, is determining how climate change and variability may be resulting in presently declining upper Great Lakes levels. It will also consider how such hydrologic conditions will be incorporated in new Lake Superior regulation management plan development. Triggers will be identified which will lead to modifications to the proposed optional plans in concert with possible adaptive management procedures that can be used by the International Lake Superior Control Board and by responsible agencies and industries around the Great Lakes. This presentation will describe each of these studies and how climate change and variability was addressed and the impacts estimated to occur on interests around the Great Lakes. It will also describe the procedures envisioned for the International Upper Great Lakes Study.

4. Sustainable Planning and Management of Water Resources in an Irrigation District in the Yaqui River, Mexico - Jose Luis Minjares Lugo, Comision Nacional del Agua, Ciudad Obregon, Son, Mexico (co-authors: Juan B. Valdes, Roberto F. Salmon Castelo, Lucas Antonio Oroz Ramos)

The Yaqui River Irrigation District No. 041, in Northwest Mexico, has been affected by an unsustainable agricultural development; a long drought combined with intensive agricultural practices collapsed the system in 2003. The objective of this research is to develop a multiyear simulation-optimization model that allows for the creation of a quantitative and transferable methodology that promotes and drives better and sustainable practices in the activities of the irrigation district. Furthermore, it defines indices that explain the most important sustainable attributes of the system. The results obtained from this study are expected to determine at each decision level how these sustainable practices will be performed and who will be charged with them. The annual model developed by Minjares et. al (2008) is extended to a multi-year model. Sustainable criteria like productivity, reliability, resilience, vulnerability and equity are incorporated into the long-term model to control the relationship between the decisions taken in the present and their long-term consequences. According to the results, the model can be used for elaborating the annual irrigation plan for the irrigation district under different management scenarios in the long-term framework, and to identify possible practices or decisions that can put the sustainability of the system at risk. In addition, the model can be used to evaluate water management practices and decisions that have been taken in the past and possible conflicts for water in the future.