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## **Environmental Governance and Climate Change Adaptation in the Okavango Delta, Botswana**

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### **Theoretical Context of Research**

Increased environmental variability as a result of climate change will continue to intensify in coming decades, with particularly acute consequences for those living in already marginal conditions. The impacts of these biophysical changes require new approaches to environmental governance to facilitate successful forms of climate change adaptation for individuals and communities in changing social-ecological systems. Governance systems must account for not only what is known and predicted about the future, but also for the great uncertainty about what the future will hold. Existing work from adaptive management and related fields has effectively theorized new governance strategies that embrace complexity and are able to effectively respond to changing and uncertain biophysical dynamics. However, these theorizations often lack attention to important on-the-ground realities, including the feasibility of implementation and issues of power within multi-scalar environmental governance systems. In my research, I advance the argument that if adaptive management is to become a viable option for communities in changing environments, more attention must be given to the role of unequal power relations in multi-scalar systems of environmental governance.

Furthermore, the capacity of people to adapt to new levels of environmental variability is determined not just by environmental governance strategies, but also by existing structural vulnerabilities. Indeed, the ability to respond to new environmental dynamics is often established well before such changes occur. Even so, much of the related policy and scholarship continues to frame adaptation as an apolitical process. In my research, I build on a growing body of work that argues for a reconceptualization of climate change adaptation as a set of highly political and often unequal processes to show how investigation of social-ecological vulnerabilities can identify places for transformation of the dynamics that can strengthen adaptive capacity, in advance of the most significant impacts of climate change.

### **The Okavango Delta, Botswana**

Located in Northwest Botswana, the Okavango Delta is characterized by spatially and temporally variable flooding patterns. The water of the Delta originates from rainfall in the highlands of Angola, and to a lesser extent with local precipitation events. Flooding events in the Okavango Delta are generally biannual, but are relatively unpredictable in time and space. The arrival of floodwaters causes the spatial extent of the Delta to expand for several months each year, before it contracts again due to groundwater infiltration and evapotranspiration. As a result, villages can experience changes in their proximity to water, the amount of water present near their homes and agricultural fields, and the timing of the arrival of water, both within and between years. There are three major hydro-ecological zones of the Delta: permanent swamp, seasonal (regularly flooded) floodplains, and occasional floodplains.

Most of the 130,000 residents of this region depend on livelihoods based on natural resources, and many households maintain diverse livelihood portfolios to increase food security under conditions of environmental variability. These livelihoods include floodplain recession farming

(known locally as *molapo* farming), when crops are planted in the moist soil of the seasonally inundated floodplains after floodwaters recede; dryland farming, which depends on precipitation; fishing for both commercial and subsistence purposes; basket weaving; livestock husbandry; and, the collection of dryland and aquatic vegetation. There are ethnic dimensions to livelihood participation, with the Bayei preferring the wetland-based livelihoods of *molapo* farming, fishing, and aquatic plant collection.

My research focuses on the impacts of high flooding events in the years of 2009, 2010, and 2011, which challenged wetland-based livelihoods throughout the region and displaced hundreds of residents from their homes. While flooding variability is an inherent part of Delta system, floods during 2009-2011 brought more water than in many decades and had distinct spatial patterns from previous floods. It is important to note that these floods were the fourth highest on record (kept since 1934 and do not necessarily represent new levels of environmental variability. Indeed, characterizing new levels of variability in the Delta is challenging, given the dearth of long-term climate data for the region. As such, this research project focused on understanding how governance systems responded to these increases in flooding, whether these changes were part of a long-term cycle, represented new levels of variability due to climate change, or were a combination of these dynamics.

Although these flooding events were not necessarily indicative of climate change, it is expected that this region will experience new levels of environmental variability in the future, as a result of climate change. The *Fifth Assessment Report (AR5)* of the Intergovernmental Panel on Climate Change (IPCC) indicates that in the coming decades the region of the Okavango Delta is likely to experience threats to food security, increased risk of diseases, higher temperatures, and increases in extreme weather events such as droughts and floods. The *AR5* reports there are already observed trends toward warmer temperatures and less precipitation in southern Africa, as well as intra-seasonal changes in duration, frequency, and intensity of rainfall. Further, the IPCC forecasts that this area is very likely to experience a significant decrease in precipitation and an increase in severe droughts by the middle of this century. Climate models for the Okavango Delta specifically are inconclusive on future impacts. While the high floods of 2009-2011 may not be tied directly to climate change, they nevertheless present an early opportunity to understand the social-ecological factors that will help determine the adaptive capacities of people in the region to respond to future environmental changes.

### **Summary of Research Findings**

To conduct this research, I use a mixed methods approach, with an emphasis on qualitative data collection. Specifically, I use a combination of household interviews, participant observation sessions, and household surveys. The Okavango Delta is one of the largest and most pristine wetlands in the world and provides a critical source of water for Northwest Botswana. Many of the livelihood strategies used by residents of this rural region are dependent on wetland resources and are designed to respond to some level of environmental variability. This includes the practice of transitioning between dryland and floodplain agriculture (known locally as *molapo* farming) in response to flooding and drought. In 2009-2011, higher than average floods inundated many floodplain fields past the point of production,

causing many *molapo* farmers and others living near the floodplain to transition temporarily to dryland areas. At the same time, the highly-centralized Government of Botswana (GOB) began to enforce stricter regulations over access to wetland resources. Many residents felt that these regulations threatened the viability of their preferred wetland and transitional livelihood practices. This loss of a responsive livelihood strategy is resulting in decreased long-term adaptive capacity for many residents. My findings thus reveal that top-down government responses to flooding variability in this region are undermining adaptive management efforts and are reducing the adaptive capacity of many residents.

Furthermore, these impacts are particularly negative for the water-based Bayei tribe. This group typically subsists from wetland-based livelihoods and has strong cultural ties to the waters of the Delta. There is a strong perception among this group in particular that the (GOB) is pressuring them to relocate their livelihoods permanently to the dryland areas beyond the Delta's floodplains, which would have negative implications for their livelihoods, water-based culture, and capacity to respond to future increases in environmental variability in desired and effective ways. Thus, my research offers suggestions for the development of spatially variable adaptation measures to promote the adaptive capacity of residents of the Okavango Delta broadly, as well as the Bayei specifically.