



Factors influencing local stakeholders' perceptions of Tisza River Basin management: The role of employment sector and education



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ABSTRACT

The complexity associated with achieving sustainable river basin management plans for international, trans-boundary river basins, such as the Tisza River Basin in central Europe, make them an ideal study area for examining the influence of education and experience on stakeholder perception of basin management. This study presents findings from analysis of in-person surveys to examine differences in local stakeholder perceptions and involvement in the Tisza River Basin through analysis of participants' levels of knowledge, experience, and involvement in basin management. The survey was conducted among members of the public in locations across the basin, in which participants were asked to identify and rank their opinions of factors affecting the health of the river basin, to identify observed changes in flood patterns, and to rank their level of interest and participation in basin management activities. To evaluate whether experience affected responses, participants were grouped demographically according to whether they worked in the public or private sector, their level of education (no college, undergraduate, or graduate school), gender and country of residence. Significant differences in stakeholder responses were found between education levels attained among participants in the public versus the private sector, and between the reported levels of environmental concern among participants of different education levels. Participants also reported low levels of participation and monitoring of management activities. These differences and lack of participation support the need for public education in participatory governance structures to support sustainable river basin management efforts.

1. Introduction

Water does not follow political boundaries; where not altered by built infrastructure rivers are constrained only by the watersheds comprised of their natural drainage areas. Activities that occur in the headwater streams of watersheds can affect water quality of the entire system and impact users downstream. Furthermore, because water flows above, across and under the earth's surface in a continual cycle most people are both upstream and downstream of others, and so affected by others' water uses. Therefore, it is important that activities affecting both water quality and quantity be considered in terms of their net impact on the system, as well as the equity of the distributed benefits and costs (Brooks et al., 2013). In recognition of the need for sustainable management that addresses the uncertainties and trans-boundary nature of water, policy has shifted in recent decades toward governance on the watershed scale (Pretty and Ward, 2001; ICPDR, 2011; Milly et al., 2008). In working toward sustainable management, management practices utilizing a watershed-scale approach are being increasingly used worldwide, including in the United States and

European Union (Vári et al., 2003; Sendzimir et al., 2008, 2010; Johnson, 2009; de Castro, 2009; Dimitriou et al., 2011; Vári, Ferencz, and Hochrainer-Stigler 2013).

1.1. Stakeholder participation in watershed management

The complexity of identifying and achieving sustainability requires high degrees of stakeholder trust and participation (Hurlbert and Gupta, 2015). Therefore, a key aspect of sustainable watershed management is stakeholder involvement across multiple levels of governance, including meaningful public involvement (Arnstein, 1969; Shepherd and Bowler, 1997; Leach, 2006; Putnam, 1995b). Since the end of the twentieth century, there has been a shift toward increased community engagement in governance, with the United Nations encouraging the use of participatory policy frameworks (Head, 2007). One reason for this shift is the belief stakeholder knowledge can benefit the planning process through identifying gaps and improving methods to address the uncertainties associated with complex environmental issues (Head, 2007; Pahl-Wostl, 2008; Knol et al., 2010). Stakeholders

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of different backgrounds have differing levels of expert knowledge, which is influenced by many factors, including education and experience (Baker et al., 2006; Knol et al., 2010). Additionally, consensus building among stakeholders can be improved through education and outreach (Shepherd and Bowler, 1997).

The Tisza River Basin (TRB) makes an excellent study area for stakeholder participation in watershed management because it is a prime example of a transboundary watershed spanning multiple scales of governance with varying degrees of social and economic capital across basin countries. Recognizing the role of education and expertise on environmental decision-making, this study included an analysis of local stakeholder education and employment in the TRB of central Europe as part of identifying local knowledge and involvement in watershed management.

2. Background

2.1. The Tisza River Basin

The TRB is the largest sub-basin of central Europe's Danube River Basin. It covers an area of about 157,000 km², spanning portions of five countries: Ukraine (8%), Romania (46%), Slovakia (10%), Hungary (29%), and Serbia (7%). The Tisza River itself is the longest tributary of the Danube River at 966 km long. The river originates in the Carpathian Mountains of southwestern Ukraine and ends at its confluence with the Danube River in Serbia (ICPDR, 2011) (Fig. 1). Approximately 14 million people live in the TRB, and its major economic areas are agriculture, industry (chemical and manufacturing), and mining (ICPDR, 2011).

2.2. Transboundary watershed governance

As the largest sub-basin of the Danube River Basin, transboundary watershed management within the TRB began in 1994 when the five countries became signatories to the Danube River Protection Convention (DRPC), tasked with sustainable management of the Danube River system (ICPDR, 1994). In 1998, the International Commission for Protection of the Danube River (ICPDR) was formed to facilitate among the Danube River Basin countries and the European Union (EU), and aid in the creation of the Danube River Basin Management Plan (ICPDR, 2011). As signatory parties of the DRPC, the TRB countries agreed to follow the policies of the EU as they relate to watershed management, despite Ukraine and Serbia being non-EU members. Watershed planning is therefore largely guided by the EU Water Framework Directive (2000/60/EC) and the European Floods Directive (2007/60/EC) (European Commission, 2000, 2007). With facilitation by the ICPDR, the Tisza countries have developed and implemented a joint TRB Management Plan to address both water quality and quantity, and work toward good ecological and chemical status of all basin waters (surface, ground, coastal). The 2007 Tisza Analysis Report concluded pollution, hydromorphological alterations to the river system, flooding, and drought all present serious threats to the TRB (ICPDR, 2008).

Analysis of waters of the TRB collected during the risk assessment phase of planning estimated that over 60% of the Tisza River was either "at risk" or "possibly at risk" from organic pollution and nutrient pollution, while the entire river is "at risk" or "possibly at risk" from hazardous substances pollution; 70% of the Tisza's tributaries were similarly at risk from pollution (ICPDR, 2011). Significant sources of pollution include organic and nutrient pollution from untreated/



Fig. 1. Survey locations across the Tisza River Basin in Central Europe, the largest sub-basin of the Danube River Basin.

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