ENVIRONMENTAL CONSIDERATIONS FOR EVALUATING INTERBASIN WATER TRANSFERS IN GEORGIA

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Abstract. Maximizing water returns to river basins by managing interbasin transfers is one of several major objectives guiding the ongoing development of Georgia's first Comprehensive State-wide Water Management Plan. Interbasin water transfers currently play a significant role in meeting water supply needs throughout the metropolitan Atlanta area. Continuing population growth across northern Georgia has heightened concern over the continuing use of interbasin transfers as a primary water management tool because of potentially negative environmental and economic impacts to the river basin of origin.

This paper investigates the availability and quality of relevant environmental information for assessing the potential adverse environmental effects of interbasin transfers to river basins of origin in Georgia. Existing information describing environmental attributes of 14 sub-basins in seven river basins is compiled using GIS, and sub-basins are ranked and analyzed with respect to natural resource values, common trends, data gaps, and its ability to support water planning efforts and decisions regarding interbasin transfers.

INTRODUCTION

Background

The Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (DNR) is developing a state-wide water management plan to fulfill the objectives of the 2004 Comprehensive State-wide Water Management Planning Act. Maximizing returns of water to basins of origin is one of four major objectives of the planning process because maintaining adequate stream flows is essential to protecting designated uses and meeting present and future needs of downstream water users.

Managing interbasin transfers is considered a primary means of maximizing returns to Georgia's rivers (EPD, 2006a; Carl Vinson Institute of Government, 2006). Existing interbasin transfers play a crucial role in meeting the water supply needs of metropolitan Atlanta, as indicated in Figure 1 and Table 1. These interbasin transfers are consumptive uses of water when they result in a net loss of water from the basin of origin, such as in the Chattahoochee, Coosa, and Flint Rivers. As water demands increase across northern Georgia, interbasin transfers are projected to increase in the 16-county Metropolitan North Georgia Water Planning District (District), especially from the Coosa River basin (JJG, 2003). Interbasin transfers also are being considered beyond the District in northern Georgia, such as in the Savannah River basin.

Interest surrounding interbasin transfers in Georgia has intensified in recent years. Currently, there are several proposed interbasin transfer bills in the 2007 General Assembly session. Analyses of the topic have dealt mainly with the pros and cons of policy positions for regulating interbasin transfers. Myszewski (2003) recommended changes in Georgia policy on interbasin transfers, including basin-of-origin protection against negative environmental and economic impacts. Draper (2005) suggested specific basin-of-origin protection measures and identified

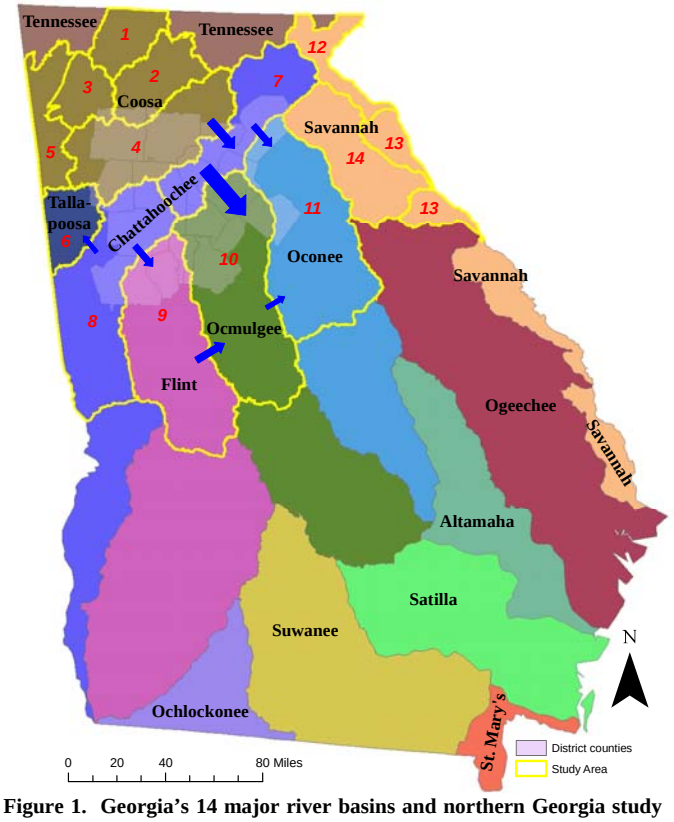

Figure 1. Georgia's 14 major river basins and northern Georgia study area. Size of arrow represents relative size of existing interbasin transfers. Study area sub-basins are highlighted. Numbered sub-basins correspond to data provided in Table 2.

Table 1. Interbasin transfers in Georgia

Basin	Water loss (MGD)	Water gain (MGD)	Net loss (MGD)
Chattahoochee	73.6	23.1	50.5
Coosa	23.1	–	23.1
Flint	16.9	4.6	12.4
Ocmulgee	1.1	77.1	(76.0)
Oconee	–	7.6	(7.6)
Tallapoosa	–	2.3	(2.3)

Source: Georgia EPD, 2006

the need for credible knowledge about the harms that may be inflicted upon basins of origin. The Georgia Water Coalition (2005) recommended stricter regulation of new and existing interbasin transfers, including less reliance by the District on interbasin transfers. The Georgia Public Policy Foundation (Dodd, 2006) suggested the importance of maintaining interbasin transfers in Georgia for infrastructure cost savings to local government.

However, few analyses have applied any existing site-specific information on natural resource values in Georgia's rivers toward understanding the potential for adverse environmental effects (to basins of origin) resulting from interbasin transfers.

Objective

The purpose of this paper is to initiate a sound-science approach to evaluating interbasin transfer as a management tool in Georgia. We compiled existing, reasonably available data characterizing natural resource values of Georgia rivers, including water quality, aquatic biodiversity, federal and state protected aquatic species, regulated vs. non-regulated streams, and recreation and aesthetics, into a geographic information system (GIS) database for river basins in northern Georgia upstream of the Fall Line. We focused on these watersheds because surface waters are the primary supply source, high population growth continues to drive increasing water supply demand, and most existing and proposed interbasin transfers occur in this part of the state. The data compiled highlight relative differences in natural resource values between 14 sub-basins in seven river basins, and may be useful in identifying data gaps and focusing research efforts and funding toward key additional data needs for sub-basin planning. Incorporating relevant environmental information into water planning will lead to better decisions regarding the use of interbasin transfer as a management tool.

POTENTIAL IMPACTS TO BASINS OF ORIGIN

Interbasin transfers affect both the basin of origin and the receiving basin. Potential impacts to the basin of origin as a result of reduced stream flow may include changes to the natural flow regime, with special concern for low-flow conditions; water quality and the ability of the source waterbody to assimilate pollutants; habitat for native aquatic communities of fish and wildlife; habitat for rare, threatened, and endangered species; wetlands and riparian habitat; water-based recreation activities; and visual aesthetic qualities. How do we quantify these changes and how do we determine if these changes are significant? Are they beneficial or harmful?

METHODS

To investigate the availability and quality of relevant site-specific environmental resource information for evaluating interbasin transfers in Georgia, existing sources of data were reviewed and compiled in GIS with respect to 8-digit hydrologic unit codes (HUCs) in the study area. Note that potential impacts to downstream communities such as available water supply, waste assimilation, and flood protection are not addressed in this paper.

There are many types of data that are potentially useful in examining the environmental concerns associated with interbasin transfers. Our aim was to assemble readily available data from a variety of sources and to evaluate them concurrently for each sub-basin. Information and data were gathered using internet searches, GIS database searches, data requests from state agencies, and literature searches. Figure 1 shows the study area highlighted in yellow. The following section describes the environmental attribute data gathered for each sub-basin.

ENVIRONMENTAL ATTRIBUTES

Water Use Attainment Status

EPD identifies impaired waters not meeting their designated uses pursuant to Section 303(d) of the Clean Water Act. The status of a given waterbody is a reflection of its natural assimilative capacity to dilute pollutants and prevent harmful effects. Waters listed as "not supporting" their designated uses may be vulnerable to further degradation by a decrease in volume from interbasin transfers. Likewise, waters supporting their designated uses may warrant protection to ensure maintenance of current and future uses. Total stream miles not supporting designated uses are listed by sub-basin in Table 2. Stream miles listed solely for violations of fecal coliform were excluded because of questions concerning the efficacy of the current fecal coliform standard as an indicator of human pathogens. GIS coverage of the Draft 2004 305b/303d list was obtained from EPD's Watershed Protection Branch. It contains the location of waterbodies not meeting their designated uses and the source(s) of impairment. The

2006 305b/303d list is currently available; however, an updated GIS coverage is not yet available (EPD, 2006b).

Aquatic Biodiversity

High priority waters were selected by DNR as areas to focus efforts on the protection of aquatic biodiversity (DNR, 2006). This information synthesizes a variety of sources including areas identified by the Wildlife Comprehensive Conservation Strategy and Index of Biotic Integrity (IBI) data gathered by the DNR Stream Survey Team. This GIS coverage contains the location of the high priority streams and watersheds (WRD, 2005).

Additionally, WRD provided GIS coverage of primary trout water designations, as listed in the Georgia Rules and Regulations for Water Quality Control (Ch. 391-3-6). Trout water designation is an indirect indication of high quality cold water capable of supporting natural reproduction of trout (WRD, 2006a).

DNR's Natural Heritage Program tracks known records of occurrence of rare, threatened, and endangered species in Georgia. Their lists include species of concern, that while not accorded federal or state protected status, are of significant interest due to their state or global rarity. We enumerated aquatic species of concern by HUC unit as a further indicator of native aquatic biodiversity.

Rare, Threatened, and Endangered Species

The occurrence of federal and state listed threatened and endangered species can play a significant role in water planning decisions such as interbasin transfers. The GIS coverage of all known locations of these species was obtained and the number of aquatic species was tabulated by sub-basin (WRD, 2006b).

Additionally, "critical habitat" for federally threatened and endangered species of freshwater mussels, as designated by USFWS, was obtained from the Code of Federal Regulations (50 CFR § 17.95) and digitized to examine its location in relation to other sets of data.

Regulated vs. Non-regulated Streams

The status of the flow regime in a waterbody, regulated by a dam or free-flowing, is another significant factor affecting the waterbody's flow regime, habitat availability, recreational opportunities, riparian wetlands, aesthetics, and other resource values. A highly regulated waterbody may be less affected by interbasin transfers due to its impoundment and ability to re-regulate downstream flows. The Georgia Inventory of Dams was used to locate all dams in the state, which were then screened by the size of the impoundment (EPA, 1998). The total acreage of impounded waters (>100 acres in size) within each sub-basin is listed in Table 2.

Recreation and Aesthetics

Rivers, streams, and impoundments represent a significant source of recreational activities in Georgia. These activities in rivers and streams are dependent on the flow regime within the waterbody.

We considered recreational opportunities and aesthetic values of relatively undisturbed watersheds in Georgia by compiling information on miles of river included in the National Wild and Scenic Rivers System and area of watershed lands designated as a wilderness area under the federal Wilderness Act.

RESULTS

Table 2 shows the values of the 10 environmental attributes by sub-basin. Sub-basins were ranked for each attribute (across rows) in order of increasing resource value from 1 (lowest) to 14 (highest). Ranks were summed for each sub-basin (down columns) to yield a sum-of-ranks score, with higher scores indicating higher relative natural resource value potentially relevant to basin-of-origin impacts. Sum-of-ranks scores ranged from 12 (upper Savannah) to 110 (Conasauga). These scores indicated the following relative order of sub-basins from highest natural resource value to lowest natural resource value for the attributes examined: 1-Conasauga; 2-Coosawattee; 3-Oostanaula; 4-upper Coosa; 5-Etowah; 6-upper Flint; 7-Tugaloo; 8-upper Tallapoosa; 9-upper Chattahoochee; 10-Broad; 11-middle Chattahoochee; 12-upper Ocmulgee; 13-upper Oconee; 14-upper Savannah.

The Conasauga sub-basin of the upper Coosa River received the highest natural resource score of all sub-basins (Table 2; Figure 1). The Conasauga sub-basin supports the highest number of special concern species (indicative of native biodiversity), the highest numbers of federal and state protected aquatic species, the longest reach of free-flowing river designated as critical habitat for federally listed mussel species, and the greatest acreage of federal Wilderness Area. The top five sub-basins all were located in the Coosa River basin, indicating generally higher biodiversity, higher numbers of protected species, and/or greater lengths of unimpounded mainstem rivers (with some exceptions) than other sub-basins in northern Georgia. These characteristics signal a higher potential for adverse environmental effects as a basin of origin for interbasin transfer, depending on the point and volume of water withdrawal with respect to sensitive species habitat. Within the Coosa River basin, the Etowah Habitat Conservation Plan is being implemented to protect endangered darter (fish) species. The policy requirements implemented by this plan could affect interbasin transfer decisions.

The upper Savannah sub-basin of the Savannah River received the lowest composite natural resource score for

Table 2. Environmental attributes for 14 sub-basins in northern Georgia

	Coosa					Tallapoosa	Chattahoochee		Flint	Ocmulgee	Oconee	Savannah		
Attribute	Conasauga (1)	Coosawattee (2)	Oostanaula (3)	Etowah (4)	Upper Coosa (5)	Upper Tallapoosa (6)	Upper Chattahoochee (7)	Middle Chattahoochee (8)	Upper Flint (9)	Upper Ocmulgee (10)	Upper Oconee (11)	Tugaloo (12)	Upper Savannah (13)	Broad (14)
Water Use Attainment														
Stream miles "Not Supporting" [a]	37	0	63	127	97	10	3	74	29	56	14	159	117	2
Rank	***8***	***14***	***6***	***2***	***4***	***11***	***12***	***5***	***9***	***7***	***10***	***1***	***3***	***13***
Aquatic biodiversity														
Miles of high priority streams	330	260	230	443	171	232	142	156	623	457	336	48	0	157
Rank	***10***	***9***	***7***	***12***	***6***	***8***	***3***	***4***	***14***	***13***	***11***	***2***	***1***	***5***
Miles of primary strout streams	165	390	6	282	21	0	458	0	0	0	0	455	0	10
Rank	***10***	***12***	***7***	***11***	***9***	***1***	***14***	***1***	***1***	***1***	***1***	***13***	***1***	***8***
"Special concern" aquatic species [b]	40	23	32	27	22	13	10	20	37	6	4	10	0	7
Rank	***14***	***10***	***12***	***11***	***9***	***7***	***5***	***8***	***13***	***3***	***2***	***5***	***1***	***4***
Protected Species														
Federally protected aquatic species [b]	12	3	9	4	9	1	1	3	6	0	0	1	0	0
Rank	***14***	***8***	***12***	***10***	***12***	***5***	***5***	***8***	***11***	***1***	***1***	***5***	***1***	***1***
State protected aquatic species [b]	20	5	13	9	12	8	3	6	11	2	2	4	0	2
Rank	***14***	***7***	***13***	***10***	***12***	***9***	***5***	***8***	***11***	***2***	***2***	***6***	***1***	***2***
Miles of critical mussel habitat	80	18	50	2	5	49	0	0	0	0	0	0	0	0
Rank	***14***	***11***	***13***	***9***	***10***	***12***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
Regulated Streams														
Acreage of impounded waters [c]	623	4,216	210	20,509	258	1,398	48,055	32,503	3,959	17,702	38,984	4,107	82,603	213
Rank	***11***	***7***	***14***	***5***	***12***	***10***	***2***	***4***	***9***	***6***	***3***	***8***	***1***	***13***
Recreation and Aesthetics														
Miles of Wild and Scenic Rivers	0	0	0	0	0	0	0	0	0	0	0	37	0	0
Rank	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***14***	***1***	***1***
Wilderness Area acreage	32,646	7,929	0	0	0	0	24,325	0	0	0	0	11,313	0	0
Rank	***14***	***11***	***1***	***1***	***1***	***1***	***13***	***1***	***1***	***1***	***1***	***12***	***1***	***1***
Sum of Ranks	**110**	**90**	**86**	**72**	**76**	**65**	**61**	**41**	**71**	**36**	**33**	**67**	**12**	**49**
Sub-basin Ranking [d]	***1***	***2***	***3***	***5***	***4***	***8***	***9***	***11***	***6***	***12***	***13***	***7***	***14***	***10***
HUC-8 designation	*03150101*	*03150102*	*03150103*	*03150104*	*3150105*	*03150108*	*03130001*	*03130002*	*03130005*	*03070103*	*03070101*	*03060102*	*03060103*	*03060104*
Basin size *(square miles)*	605	860	561	1,861	741	646	1,579	2,478	2,621	2,990	2,920	563	655	1,510
Sum of all streams in basin *(miles)*	1,195	1,409	1,014	2,719	1,735	1,140	2,079	3,585	3,647	3,738	3,939	1,385	1,310	2,053

Notes:

Sub-basin numbering corresponds to numbers shown on Figure 1.

[a] Excludes segments listed for fecal coliform violations only.

[b] Aquatic species refers to aquatic-dependent fauna.

[c] Includes only impoundments greater than 100 acres.

[d] Sub-basin ranking from 1 (highest resource value) to 14 (lowest resource value).

the attributes examined (Table 2; Figure 1). Large impoundments cover 82,603 acres, or about 20 percent, of the total sub-basin area. This sub-basin achieved the lowest rank for nine of 10 environmental attributes, suggesting lower potential for adverse environmental impacts as a basin-of-origin for interbasin transfer. However, these data do not address downstream and interstate constraints to water withdrawal in the Savannah River basin.

Other sub-basins with low composite scores were the upper Oconee and upper Ocmulgee sub-basins, both in the headwaters of the Altamaha River (Table 2; Figure 1). These sub-basins ranked high in terms of miles of high priority waters for protecting aquatic biodiversity but they naturally lack trout waters and support fewer species of concern and protected species than many other sub-basins.

IMPLICATIONS FOR WATER MANAGEMENT PLANNING

The site-specific nature of environmental constraints, even within sub-basins, is important to assessing the potential impacts of interbasin transfer to basins of origin. For instance, the upper Chattahoochee sub-basin includes over 48,000 acres of large impoundments, a characteristic generally favorable to meeting water supply demands, yet the sub-basin also has the longest segments of primary trout waters (Table 2), it contains about 24,000 acres of federal Wilderness area, and it includes the 48-mile Chattahoochee River National Recreation Area in metropolitan Atlanta. This wide range of variability within a sub-basin suggests the desirability of gathering and managing resource data at a smaller scale, such as the HUC-10 watershed level. For example, there are 166 HUC-10 watersheds in the study area compared to the 14 HUC-8 watersheds examined herein.

Data gaps suggested by this analysis include a general lack of readily available information on: water-based recreational use, such as canoeing, kayaking, and boat- and wade-fishing (e.g., upper Oconee sub-basin); the distribution and quality of riparian wetlands associated with river and stream floodplains; and instream flow needs of representative habitat-use guilds or important riverine species of fish and mussels. These and other types of environmental baseline data may be needed to assist future decisions regarding interbasin transfers and other aspects of water planning at the sub-basin level.

When combined with analyses of economic impacts and other factors, relevant environmental resource data collected at an appropriate geographic scale are essential to effectively implementing a sound-science approach to water planning.

The concepts introduced by this paper are intended to assist future statewide comprehensive planning efforts and regulatory policy considerations. We introduce an approach for more fully integrating scientific knowledge of detrimental or beneficial environmental and cumulative impacts of proposed interbasin transfers. It can be expanded to incorporate and address existing and future water uses, need for water, and other economic considerations. The concepts may indirectly help to guide planning concerning policies and management tools appropriate to specific sub-basins, use of existing or expanded watershed impoundments for local government water supply, protection of surface waters not yet impaired, prioritizing sub-basins for additional data collection and research, enhancing monitoring programs, evaluating whether interbasin transfers in specific sub-basins would be consistent with the public interest, and other management practices.

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