Capacity & Conflict on the Upper Chattooga River

An integrated analysis of 2006-2007 reports

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1. Introduction

The 57-mile Chattooga River originates in the mountains of western North Carolina and forms a portion of the border between Georgia and South Carolina (Figure 1). In 1974, the river's "outstandingly remarkable" geology, biology, scenery, recreation, and history values were recognized by Congress through designation of a 15,432-acre corridor as part of the National Wild and Scenic River System. The corridor includes lands in three National Forests (the Nantahala in North Carolina, the Chattahoochee in Georgia, and the Sumter in South Carolina), and passes through about five miles of the 8,724-acre Ellicott Rock Wilderness.

The Chattooga River provides important recreation resources for local, regional, and national visitors, offering high quality fishing, whitewater boating, hiking, swimming, camping, hunting, and related opportunities. The quality of these recreation opportunities has attracted substantial use, which in turn has led to concern about visitor impacts. A recent revision of the Sumter National Forest Land and Resource Management Plan (LRMP or Forest Plan) addressed several recreation issues in the corridor (USFS, 2004a, 2004b); among the management actions, the plan retained a 1976 decision allowing whitewater boating on the lower 36 miles of the Chattooga river and prohibiting boating upstream of Highway 28 (about 21 miles; Figure 2). This boating closure above Highway 28 was later appealed, and the Forest Service agreed to reassess that decision as part of broader examination of visitor capacity issues on the Upper Chattooga. The Decision for Appeal (USFS, 2005) provides the need for this analysis.

The Forest Service is employing a modified "Limits of Acceptable Change" (LAC) planning framework (Stankey et al., 1985) – widely used by the Forest Service and other managing agencies – for evaluating visitor use and potential impacts on the environment. This framework addresses capacity decisions by (1) recognizing different types of recreation opportunities, (2) identifying indicators that represent important resource or social conditions, (3) setting standards that define when impacts are unacceptable (the "limit of acceptable change"), and (4) deciding which management actions will be used to reduce impacts that exceed standards. The framework organizes the collection and analysis of scientific information and encourages public input.

Forest Service planning efforts from Fall 2005 made progress on several steps in the LAC process (e.g., defining concerns and issues, identifying existing and potential recreation opportunities, developing lists of important biophysical and social impacts, developing ways to measure those impacts). The next step is to collect and integrate information about use, opportunities, impacts, and potential actions to address them.

For this step, the Forest Service initiated several complementary information collection methods beginning in Spring 2006, as described in a "Data Collection Implementation Plan" (USFS, 2006a). Detailed findings for specific efforts can be found in a series of separate reports or other output (see list in "sources" below). In this report, we ***highlight and integrate the key findings*** from those efforts. The goal is to provide a ***concise review of capacity issues*** for the LAC process.

The Forest Service will eventually merge the LAC effort into a National Environmental Policy Act (NEPA) environmental review process. This has prescribed steps that include issue scoping, alternative development, impact analysis, and choice of a preferred alternative. Information in the present report will help the NEPA process by identifying important issues; describing existing and potential opportunities, use, and impacts; and reviewing potential actions for addressing impact problems. The Forest Service will use the information in combination with public input to

develop a range of reasonable alternatives (including a “no action” alternative that retains the boating closure on the upper river), analyze the impacts of those alternatives, and choose a preferred alternative.

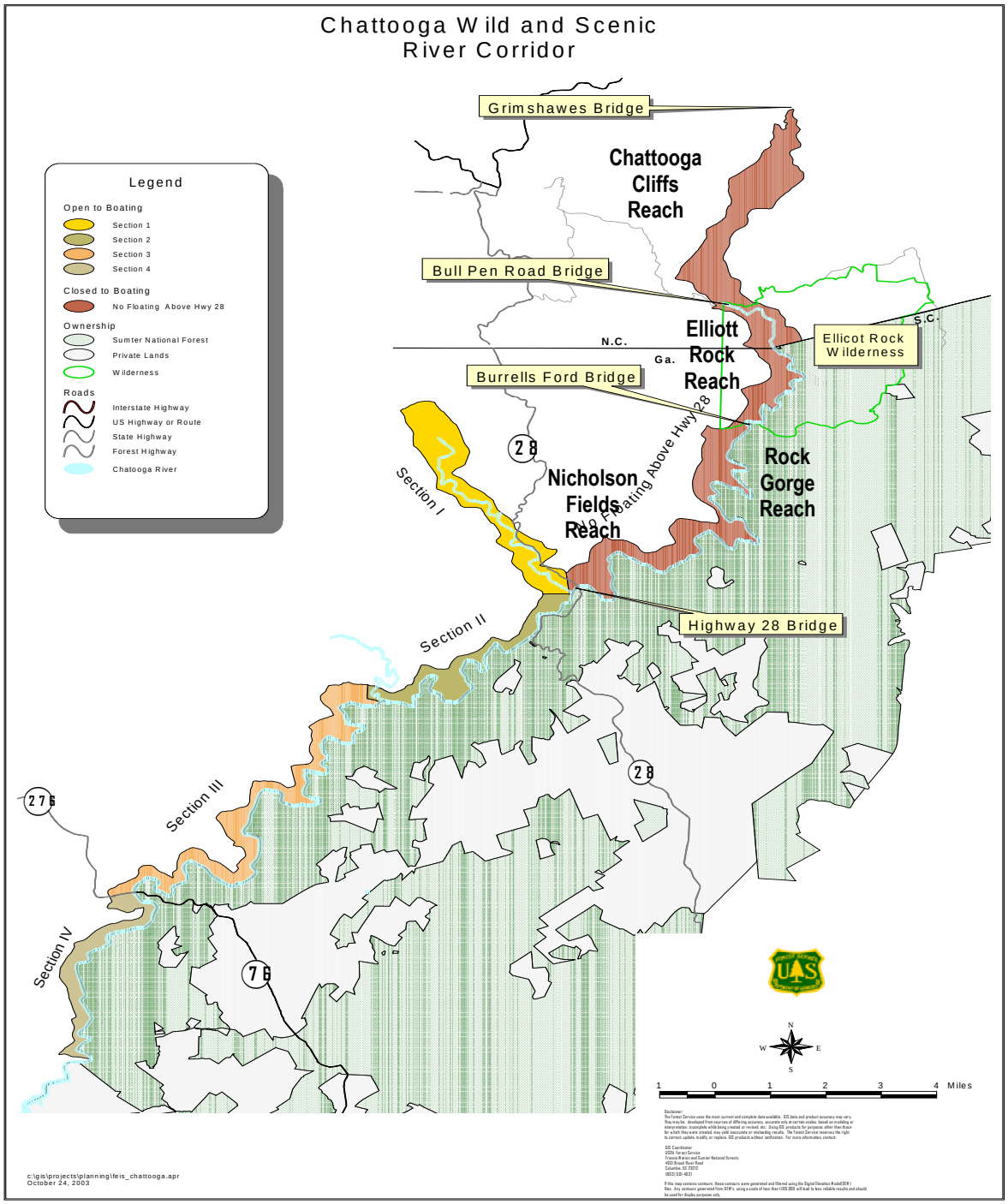

Figure 1. Map of Chattooga River Corridor, 2007.

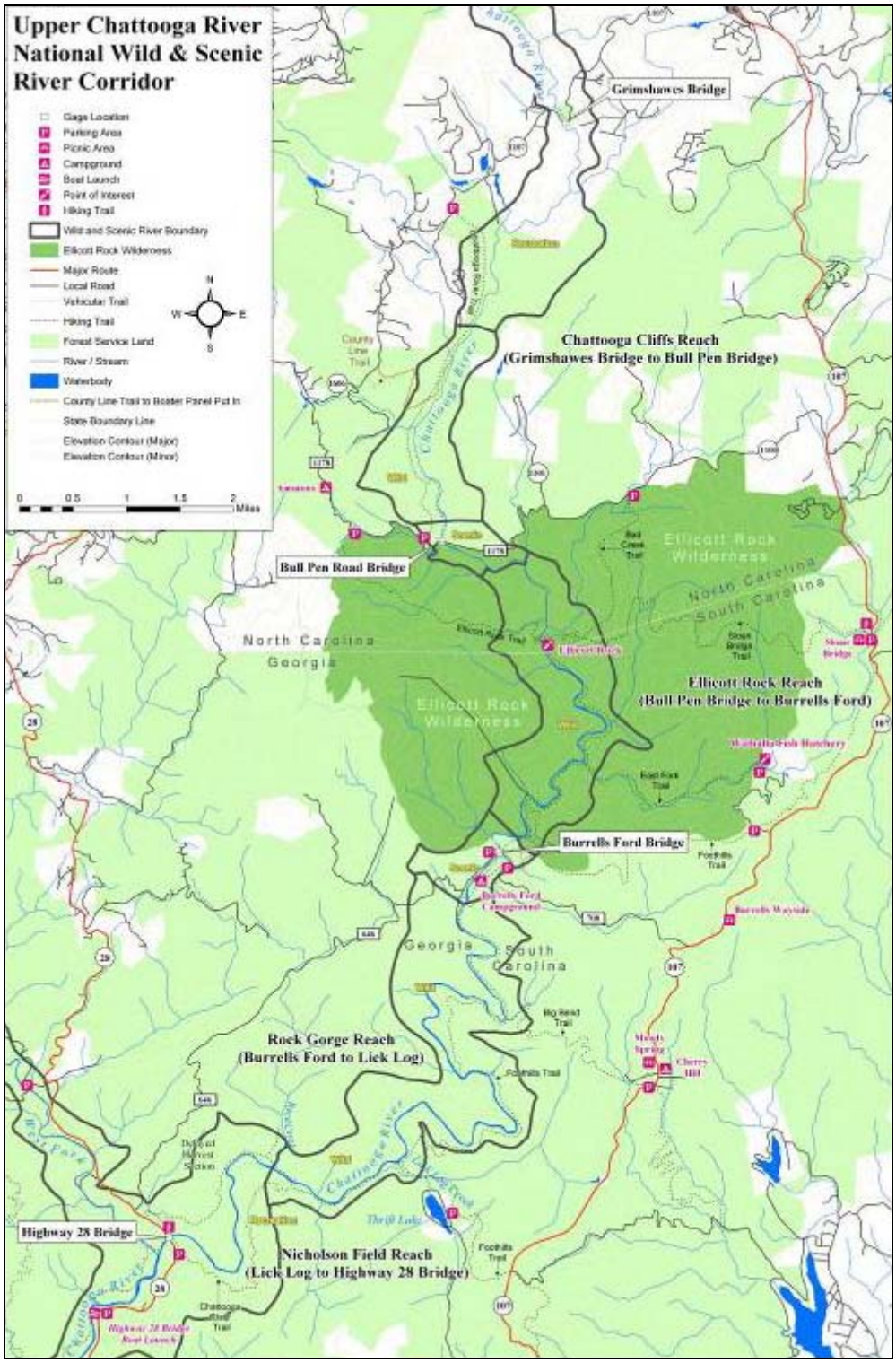

Figure 2. Map of Upper Chattooga River.

Report objectives and organization

The goal of this report is to summarize key findings from specific information collection efforts conducted by the Forest Service or its contractors (see list below), then integrate findings with information from other rivers and the Upper Chattooga River "decision environment."

The report is designed as a reference document. As with an encyclopedia, few readers are likely to read it from start to finish, but when they want information on a particular topic, it should be easy to find. To help readers focus on specific areas of interest, we have organized the document into chapters, which correspond to report objectives:

Chapter:

2. Describe the "***decision environment***" for visitor capacity issues on the Upper Chattooga. This includes legislation (e.g., the Wild and Scenic Rivers Act, Wilderness Act) or agency management guidelines, "lessons" from capacity assessments on other rivers, and findings from a historical review of Chattooga recreation management.
3. Summarize existing and potential ***recreation opportunities*** on the Upper Chattooga. This includes brief reviews of "outstandingly remarkable" values described in agency reports, input from public meetings during the current planning process, and information from field reconnaissance.
4. Summarize information about existing ***use levels*** for current opportunities and describe use levels or trends for existing and potential opportunities.
5. Review potential ***biophysical impacts*** related to existing or potential recreation uses. For each type of impact, describe (1) the range of possible impacts on the Upper Chattooga (if known), (2) potential standards to consider in the LAC / NEPA process, and (3) ways that recreation planners have addressed those impacts on other rivers.
6. Review potential ***social impacts*** related to existing or potential recreation uses. For each type of impact, describe (1) the range of possible impacts (if known), (2) potential standards that may be considered in the LAC / NEPA process, and (3) ways those impacts have been addressed on other rivers.
7. Assess ***flow requirements*** for fishing, boating or other flow-dependent recreation opportunities, and apply ***hydrology information*** to assess the frequency of days with those opportunities. This will help assess potential impacts of different types of use.
8. Review specific ***management actions*** that might be used to address specific "impact problems" or conflicts on the Upper Chattooga. For each action, the review will discuss the impacts it addresses and keys to successful implementation. The chapter also includes a review of recreation capacity and conflict concepts.
9. Provide a brief discussion on ***proceeding with planning and decision-making*** on the Upper Chattooga, including a review of additional information options.

Information sources

Information in this report is based on several sources. Primary sources included reports or other information developed during the specific data collection efforts described in the Implementation Plan (USFS, 2006a). Those efforts and associated outputs are listed below:

- Chattooga River history project: Literature review and interview summary. Summary report (Tetra Tech, 2006).
- Capacities on other Wild and Scenic Rivers: Seven case studies. Summary report (IWSRCC, 2007).
- Use estimation workshop summary. Tables, graphs, and notes (Berger and CRC, 2007).
- Limited use monitoring summary, September 2006-February 2007. Tables, graphs, and notes (Berger, 2007a) from an on-going program expected to be complete in Aug. 2007.
- "Proxy river" information. Summary tables and notes (USFS 2007a).
- Biophysical monitoring information for the Chattooga River. Summary tables, graphs, and maps (USFS, 2007c).
- Hydrology issues on the Upper Chattooga River. Summary discussion, tables, graphs, and analyses (USFS, 2007d).
- Literature review report. Summary report (Louis Berger, 2007b) with four sub-sections on (1) recreation-related impacts and standards; (2) recreation-related trail/site impacts; (3) recreation-related wildlife impacts; and (4) recreation-related flow preferences.
- Expert panel field assessment report. Summary report (Louis Berger, 2007c).

In addition to these sources, the present report incorporates additional information from:

- Fieldwork in the Upper Chattooga corridor in March 2006, July 2006, and January 2007, including hiking on several trails, camping at Burrells Ford, and accompanying boaters and anglers during "expert panel" field reconnaissance trips.
- Informal discussions with public and stakeholders during fieldwork, via phone calls or emails, and at public meetings in July 2006.
- Review of public or stakeholder comments to the Forest Service or on public message boards (e.g, Northern Georgia Trout Online, BoaterTalk) on Upper Chattooga capacity issues. This information was not used to quantify proportions of people with various advocacy positions (because representativeness of the "sample" is problematic), but it helped identify the range of stakeholder concerns and debate.
- Discussions via phone interviews or email with staff from the Forest Service or state agencies, and researchers who have studied or worked on the Chattooga.
- Literature or researcher experience with capacity and conflict studies or planning efforts on other rivers.

Report limitations and caveats

This report is not a "decision document" and does not recommend specific management actions. Instead, it is designed to provide the Forest Service, stakeholders, and the public with information about use, impacts, and trade-offs of different management choices. Additional report limitations or caveats include:

- The report highlights key findings from other data collection efforts and references the primary sources for that information; readers with greater interest can review those sources.
- Despite the large quantity of information about the Upper Chattooga, data for some topics is unavailable or less precise. For example, use data for some opportunities and locations rely primarily on agency staff "expert judgments," and such issues are acknowledged explicitly.
- The report includes a chapter on the Upper Chattooga "decision environment" for capacity decisions. The goal is to clarify misconceptions that sometimes appear in debates about legislative mandates, the appeal decision, the history of Chattooga management, or other issues. However, it is beyond the scope of this report to provide a comprehensive analysis of legislative mandates or how those have been interpreted by the Forest Service, other federal agencies, or the courts.
- The report does not attempt to summarize Forest Service, public, or stakeholder opinion. The report describes studies from the Chattooga (or other rivers) that may suggest likely public or stakeholder reaction to impacts or management actions, but the LAC / NEPA processes (or a potential user survey through additional work) are the appropriate forums for formal public and stakeholder input.
- This report does not pre-judge any decision about allowing, prohibiting, or limiting boating or any other use. The goal is to provide information so the Forest Service and the public can assess these issues. A subsequent NEPA process will develop and assess a range of alternatives for managing recreation use on the Upper Chattooga (including a "no action" alternative).
- Some stakeholder debate has focused on "which group creates more impact" as a criterion for deciding which group deserves "priority" in a given location. In contrast, this report focuses on the range of potential impacts from different uses, and the specific impacts that are likely to be limiting factors for capacity decisions.
- The present report focuses on the Upper Chattooga, as directed by the Forest Service's Decision for Appeal. However, management of the entire corridor is often relevant for context, and may help explain the original upper river boating closure, use and impact patterns, or the acceptability of actions to address problems. Lower Chattooga management actions are not formally reviewed in this report, but some are discussed in the context of Upper Chattooga management.
- This report summarizes information collected so far. As the NEPA analysis and decision-process continues, new data may inform or alter the conclusions presented here.
- Conclusions in this report are made by the authors based on a review of other reports, literature, or their research and planning experience; they are offered for consideration but do not necessarily represent Forest Service positions, conclusions, or policies.

2. The Upper Chattooga "Decision Environment"

This chapter describes the "decision environment" for visitor capacity issues on the Upper Chattooga by (1) highlighting concepts in guiding legislation (e.g., the Wild and Scenic Rivers Act, Wilderness Act) or other agency mandates; (2) examining general decision environment "lessons" from capacity assessments on other rivers; and (3) describing major findings from a review of the history of Chattooga recreation management.

Guiding legislation or other agency mandates

Wild & Scenic Rivers Act

The 1968 Wild and Scenic Rivers (WSR) Act established a national system of rivers to be protected for their free-flowing condition (no dams or other water resource developments that would harm river values), water quality, and "outstandingly remarkable" (OR) values (specific to each designated river). The WSR Act initially designated eight rivers and set procedures for future additions to the system. There are currently 165 designated rivers totaling over 11,500 miles. The Chattooga was the 12th river in the system (first in the southeast) in 1974.

A complete text of the Act is available at rivers.gov/wsract.html. Technical reports from the Interagency Wild and Scenic Rivers Coordinating Council (IWSRCC) are available at rivers.gov/publications.html and describe key concepts and managing guidelines for the system, including:

- OR values are usually identified in a pre-designation study. Agency staff use professional judgments to determine which characteristics are unique, rare or exemplary at a regional or national scale so as to qualify as "outstandingly remarkable" (IWSRCC, 1999, pp. 12-15; IWSRCC, 2006, p. 17).
- For some rivers, OR values identified at designation may not be specific enough for management purposes. In these cases, the pre-designation study, Congressional hearings/reports, and other agency documents help define specific OR values (IWSRCC, 1999, pp. 12-15; IWSRCC, 2007, draft p. 5).
- The Chattooga was authorized by Congress for study in 1968; the study report was forwarded to Congress in 1971 (USFS, 1971). A more recent formal analysis of OR values was conducted in the mid-1990s (USFS, 1996).
- Agencies must develop comprehensive river management plans (CRMPs) for WSRs that address "resource protection, development of lands and facilities, user capacities, and other management practices" to protect free-flowing condition, water quality, and OR values (Section 3(d)(1)). OR values and protection strategies are not uniform, and will vary from river to river. (IWSRCC, 2006, p. 33, 44, 63)
- Section 10(a) of the WSR Act directs management to protect and enhance free-flowing conditions, water quality, and OR values, but allows other uses as long as they do not "substantially interfere with public use and enjoyment of the river's values." Only after the river's free flow condition, water quality, and OR values are protected and enhanced can other uses (e.g., grazing, new recreation development) even be considered under the "substantially interferes" clause (IWSRCC, 2007 – draft p. 3). Congress left the judgment of when a use "substantially interferes" to the discretion of the river managing agency.

- When recreation is an OR value (as on the Chattooga), the IWSRCC recommends protecting regionally or nationally significant recreational attributes while avoiding adverse effects on non-recreation OR values (IWSRCC, 2007, draft p. 5). This recognizes the need to balance recreation with other values through the Comprehensive River Management Plan (CRMP). When two or more types of recreation are defined as part of a broader OR recreation value, the IWSRCC recommends balancing the attributes that made each type regionally or nationally significant (IWSRCC, 2007, draft p. 5). Similar to balancing between OR values, the river-administering agency is required to "address…user capacities" consistent with protecting the desired experience and other non-recreation values.
- WSR managing guidelines require "carrying capacity" analyses "to determine the quantity and mixture of recreation and other public uses which can be permitted" without adversely impacting OR values (USDA and USDOI, 1982). However, WSR designation does not require restrictions on the type or amount of recreation use. When needed, "use restrictions or limitations to protect important resource or social values are developed through planning processes that include extensive local, regional, and national public involvement." (IWSRCC, 2006, p. 37).
- A recent legal case from the Merced River in Yosemite National Park has raised questions about the "capacity" requirement in the WSR Act. Some claim that capacities must specify a limit on the number of visitors in a given area (Haas, 2004). In contrast, NPS (with IWSRCC support, 2007) suggests capacities can be defined through broader visitor management programs (e.g., LAC or similar frameworks) that identify desired recreation and resource conditions through indicators/standards and linked management actions (which may not specify use limits). The case is still being adjudicated (Rylands, 2007).
- When designated, segments of a river are "classified" as "wild," "scenic," or "recreational" depending upon their level of accessibility, land and water resource development, and water quality. "Wild" segments are generally inaccessible except by trail or boat, and "represent vestiges of primitive America." "Scenic" segments may have roads to the river but usually not along it. "Recreational" segments may have roads along them. "Recreational" classification does not establish recreation as an "outstandingly remarkable" value or give it management priority over other uses or protection efforts. Future development levels must be compatible with classification and may limit some management options (e.g., developing a visitor center in a wild segment) to address impact problems. (IWSRCC, 2006, p. 20-21, 38)
- WSR designation does not necessarily restrict any particular type of use in a corridor, including motorized boats, jet skis, hovercraft, or wheeled vehicles. However, such uses must be consistent with the desired conditions and experiences to be offered in a corridor, which link to OR values. In general, types of use and access routes within river corridors at the time of designation receive "grandfather rights" (continued use). However, if an access route or type of use adversely impacts an OR value, it may be closed or regulated. These issues are addressed through management planning that considers "factors such as impacts (positive or negative) on river values, user demand for such motorized recreation, health and safety to users, and acceptability with desired experiences and other values for which the river was designated." (IWSRCC, 2002, pp. 4-6; IWSRCC, 2006 p. 49-50).

Wilderness Act

The Wilderness Act applies to a roughly five mile segment of the Upper Chattooga (Ellicott Rock Wilderness), adding some considerations for this "decision environment:"

- Wildernesses are designed to protect public purposes of "recreational, scenic, scientific, educational, conservation, and historical use," but designation does not identify individual or more specific values (or priorities) for any given wilderness (a major difference from WSRs, where specific values are defined for each river). The overarching concept is to preserve natural conditions and wilderness character.
- The Wilderness Act specifically prohibits some uses and development. With some exceptions, prohibitions include motorized and mechanized vehicles, timber harvest, new grazing and mining activity, or development. These restrictions do not apply to trails and bridges used to access these areas for "wilderness purposes."
- The Wilderness Act specifically identifies "outstanding opportunities for solitude" and "primitive and unconfined type of recreation" as management goals. However, it does not further define these terms.
- The Act also directs wilderness to be managed for "unconfined recreation." One interpretation suggests indirect management actions should be used to limit recreation impacts unless those prove insufficient, in which case direct actions are acceptable (USFS, 1990; section 2323.12).
- Most types of recreational use are allowed in Wilderness, "except those needing mechanical transport or motorized equipment, such as motorboats, cars, trucks, off-road vehicles, bicycles and snowmobiles." Commercial services may be offered for activities "proper for realizing the recreational or other wilderness purposes" (Section 4(d)(5)).

Other legislative guidance

Organic legislation that provides general ***guidance for forest management*** (e.g., 1960 Multiple Use Sustained Yield Act or MUSY; 1976 National Forest Management Act or NFMA) do not overrule more specific direction in the WSR or Wilderness Act. However, these laws provide several complementary management principles, including:

- The "multiple use" concept in MUSY suggests that forests in general cannot be managed for a single purpose, but priorities can be established for sub-areas within a forest.
- The "sustained yield" concept in MUSY requires "achievement and maintenance of a high-level regular output of the renewable resources." Applied to recreation, this generally suggests a non-degradation standard regarding high quality recreation opportunities.
- MUSY by itself does not assign "weights" to specific values or uses, and the mix of uses for any particular area is "left to the sound discretion and expertise of the Forest Service" (Sierra Club v. Hardin, 1971). However, MUSY and NEPA direct agencies to document rationales for decisions so they are not "arbitrary or capricious."
- NFMA recognizes the complexity of managing renewable resources. The law requires periodic monitoring, re-assessment, and planning to determine the best mix of "goods and services" to be produced from the nation's forests, which are understood to change over time.

Congress also has established ***national goals for recreational fishery resources*** (e.g., the 1995 Federal Recreational Fisheries Executive Order 12962) that some state agencies have noted in regard to Chattooga management. This law urges federal agencies, in cooperation with states and tribes, to improve the quantity and productivity of aquatic resources for increased recreational fishing opportunities. While generally addressing potential conflicts between protecting fisheries and providing recreational fishing, this order provides no specific guidance on the management of

recreational fishing (e.g., capacity definitions, addressing conflicts with other recreation uses or between different types of fishing use, etc.).

Other management factors

Conflicts between WSR and Wilderness provisions. If the WSR and Wilderness Act conflict, language in the WSR Act clarifies that the "more restrictive" provisions shall apply (IWSRCC, 2006 p. 51). In general, differences between WSRs and designated Wildernesses include:

- Motors may be allowed on WSRs, but they are generally prohibited in Wilderness.
- Although dams could be authorized in Wilderness, they are incompatible on a WSR.
- Depending on the classification, new rights-of-way, roads, trails, bridges, and recreational facilities (e.g., campgrounds and picnic areas) may be allowed inside WSR corridors, but they are generally prohibited in wilderness.

Integrating state fisheries management goals and authorities. Section 4(d)(8) of the Wilderness Act notes that State jurisdiction has precedence with respect to managing wildlife and fish in the national forests. Except in the case of endangered species and marine mammals, states generally manage fishing and hunting though their own laws and regulations, which are not affected by WSR and Wilderness designations. In general, hunting and fishing are allowed on WSRs, except where agencies might establish no hunting zones for safety or for other reasons in consultation with state fish and wildlife agencies (IWSRCC, 2006, p. 48). In the case of the Chattooga River, recreational trout fisheries have been enhanced through stocking and regulations since the 1930s, and these appear likely to continue through the next forest planning cycle. For this decision environment, the existing stocking and regulation program is assumed (see discussions about stocking and fishing regulations in Chapters 3 and 4), and the report does not evaluate ecological impacts or benefits of stocking programs.

Navigability and private land issues.

WSR status does not change the status of land ownership within or adjacent to the designated WSR corridor. Some believe that public access depends solely upon whether the waterway is legally navigable or state law provides for boat passage. Others believe that WSR status may allow a federal agency to manage the surface of the water (which may include allowing boating or other recreation use) regardless of its navigability or boat passage status. As far as we know, this specific issue has not been adjudicated.

This issue is relevant because segments of the Upper Chattooga WSR in North Carolina are bordered on both sides, and possibly included in, privately-owned property (and has, in some places, been posted "No Trespassing"). However, these segments have not had their navigability or boat passage status legally determined by any court or governmental agency. Local U.S. Corps of Engineers (COE) personnel have communicated informally that they do not consider the Upper Chattooga River navigable. However, the US COE Division Engineer has not published a final determination of navigability for this stretch of the river under **33 CFR Part 329.14 - Determination of Navigability.** Similarly, we are not aware of any formal NC Attorney General opinion or State Court ruling as to whether or not the Upper Chattooga River in North Carolina is considered to be "navigable in fact" and therefore subject to public trust rights under state law. If it were declared legally navigable pursuant to the Public Trust Doctrine, the state holds in trust for the public the right to use the waterway for a variety of recreational purposes, subject to lawful regulation by the federal and/or state and local government. (IWSRCC, 2006 p. 41; 58).

A broad "advisory" opinion (not specific to the Chattooga) by the North Carolina attorney general's office suggested that waters "capable of use" by canoes and kayaks were likely to be determined navigable if adjudicated (Oakley & Jernigan, 1998). However, they also noted that several pending state court cases (at the time) might affect that opinion and its application for boaters. One segment flowing through private property has a 20 to 25 foot waterfall (Corkscrew Falls), and the feasibility of boating the falls (or portaging/scouting without trespassing) may be an important question. It was beyond the scope of this analysis to provide information for such a determination, and access to the reach was not provided by landowners during fieldwork in any case.

Forest Service response to AW appeal

American Whitewater (AW; a boater advocacy group) appealed the "no boating" decision in the Sumter National Forest Plan on several grounds (AW, 2004). The response to that appeal (USFS 2005) by the Chief of the Forest Service reviewed WSR and Wilderness legislation and agency guidelines, and added other language specific to the Chattooga "decision environment." The appeal response addressed many issues and readers are encouraged to review it in its entirety, but important excerpts are provided below:

> *As Recreation is identified as one of the Chattooga River's OR [outstandingly remarkable] values in the pre-designation study (Wild and Scenic River Study Report: Chattooga River, p. 66) and the FEIS (FEIS, p. 3-301, Appendix H, p. H-4), whitewater boating (canoeing and rafting) is specifically recognized as one of the recreational opportunities available in this generally remote river setting (Chattooga WSR Classification, Boundaries, and Development Plan (41 FR 11830, March 22, 1976)).*
>
> *Specific to recreation as an OR value, the Interagency Guidelines direct public use "to be regulated and distributed where necessary to protect and enhance…the resource values of the river area." Agency policy (FSM 2354.41) identifies factors to consider in developing direction for recreation visitor use in a wild and scenic river (WSR) corridor including the capability of the physical environment, desires of present and potential users, diversity of recreation opportunities within the geographic area, and budgetary, personnel and technical considerations. If it becomes necessary to limit use ,"ensure that all potential users have a fair and equitable chance to obtain access to the river."*
>
> *The Forest Service manual further requires that limitation and distribution of visitor use should be based on "periodic estimates of capacity in the forest plan" (FSM 2323.14). The Regional Forester, based on the authorities listed above, can limit or restrict use within a WSR or Wilderness area. To protect the Chattooga River's OR values and Ellicott Rock Wilderness resources, the Regional Forester may:*
>
> - *Disallow or restrict the number of (private/commercial) on-river and in-corridor recreation users,*
> - *Determine the type of recreation use, or*
> - *Dictate the timing of such use.*
>
> *This authority should be exercised only with adequate evidence of the need for such restrictions. The Sumter National Forest RLRMP record, however, is deficient in substantiating the need to continue the ban on boating to protect recreation as an ORV or to protect the wilderness resource. No capacity analysis is provided to support restrictions or a ban on recreation use or any type of recreation user. While there are multiple references in the record to resource impacts and*

decreasing solitude, these concerns apply to all users and do not provide the basis for excluding boaters without any limits on other users.

In addition, there is no basis in law, regulation or policy to exclude a type of wilderness-conforming recreation use [boating] due to concerns relative to safety, and search and rescue.

Lessons from other rivers

Managers of several other Wild and Scenic rivers have addressed capacity and conflict issues; examining those cases may be relevant for the Upper Chattooga. Oustandingly remarkable values and protection strategies vary from one river to another, so decisions on other rivers do not necessarily set precedents for the Chattooga (or any other river). The seven case studies were developed to examine the ***range*** of ways that agencies with WSRs have interpreted laws and mandates, assessed river values and impacts, and chosen management actions to protect those values (IWSRCC, 2007). The list was developed with Chattooga issues in mind, but its larger purpose is to inform managers from all agencies with WSRs. Specific examples of rivers with management issues, approaches, and actions similar to the Chattooga are discussed in later chapters of this report.

The seven case studies discussed here also do not imply knowledge of the frequency with which particular management actions have been used on WSRs. For example, including a river with use limits does not imply that ***most*** rivers have use limits (in fact, most do not). The case studies also did not evaluate the "success" of management actions for particular rivers. With these case studies, the report does not advocate particular actions as "good management," but it identifies actions that have been accepted in plans (and sometimes survived legal challenges).

Case study rivers

Case study rivers were chosen to represent diversity by geography, use levels, types of impact issues, and types of management actions. Rivers are listed below, with brief summaries of recreation management issues and capacity-related actions. Readers with more interest in these case studies should consult the original report (IWSRCC, 2007).

- ***Kern River, California.*** 151 miles on two forks, with use levels ranging from low to high on different segments. Major issues include managing for the appropriate mix of trail vs. boating use, private vs. commercial boating use, and camping vs. day use. Actions include group size limits, a full (private and commercial) boater use limit system on one segment, commercial boating limits on others, and overnight use limits in one Wilderness area.
- ***Metolius River, Oregon.*** 29 miles with moderate fishing and boating use. Major issues include appropriate mix of fishing, boating, and hiking/camping use in corridor, site impacts at day use and fishing locations, and maintaining ecological integrity with moderate recreation use. Actions include group size limits, designated dispersed camping sites, no motorized boating, "resting" sites in developed campgrounds, and boating registration (but no limits).
- ***North Umpqua, Oregon.*** 34 miles on renown steelhead stream, which also has moderate whitewater boating and campground use along a scenic highway. Major issues include boating-fishing interaction and conflict, and site impacts on ecological and cultural resources. Actions include site reorganization, limiting commercial boating, and recommended (advisory only) no boating hours and 5-mile "no boating" segment during steelhead season.

- ***Pecos River, New Mexico***. 21 miles, with about 13 classified wild. Major issues include dispersed camping impacts and site/social impacts at concentrated day use locations. Actions include designating dispersed camping sites, a ban on off-road vehicles, and reorganization of day use sites. Boating use is rare due to limited flows; this example was included as an example for its non-boating use issues.
- ***Snake River in Hells Canyon, Idaho/Oregon.*** 68 miles below Hells Canyon Dam. Major issues include the mix of motorized and non-motorized use, and social/biophysical impacts from boating use in general. Actions include camp length of stay limits, limits on private/commercial and motorized/non-motorized boating, and human waste and fire pan regulations. The Forest Service's use limit "balance" was challenged in court by both motor and non-motor advocates, but was upheld.
- ***Upper Rogue, Oregon.*** 40 miles, with most along a scenic highway. Recreation is not an OR value, but recreation opportunities are explicitly managed. Major issues include site impacts at road-accessible day use and campground locations, and interpretation development at geological features. Management actions included site planning and re-organization (with road and trail closings), and a boating closure on the headwaters segment (primarily due to features such as lava tubes and a steep log-filled gorge).
- ***Wilson Creek, North Carolina.*** 23 miles, most classified recreational and along a heavily visited highway. Major issues include site impacts from a variety of day use (hikers, picnickers, whitewater boaters when flows allow), crowding, and parking congestion. Actions include limiting commercial uses (angling, whitewater boating), reorganizing parking areas and establishing capacities, closing trails to off-road vehicles or bicycles, and creation of designated dispersed camping sites.

"Decision environment" findings from case studies

Taken together, the seven case study rivers suggest several general findings about how other WSRs have addressed capacity or other visitor impact issues:

- ***Management issues and actions have generally been linked to OR values.*** The WSR Act requires this link, although management plans have not always explicitly tied standards and actions to those values. For example, the recreation OR values for the Forks of the Kern River identify solitude as a management goal, and both group size limits and permit systems (for boating and overnight use) address this goal, but without quantitative standards for particular impacts or conditions such as encounters. In contrast, the Snake through Hells Canyon has limits on the number of float and motorized trips during the prime summer/fall season to protect OR values associated with overall recreation quality, for which it has identified and monitored specific encounter standards.
- ***Multiple actions are commonly used to address a diversity of impacts.*** Few river capacity issues have been addressed with a single management action; most rivers employ several. Management tools to address the impacts of recreation use may include: 1) facility infrastructure or site/trail improvements to concentrate use to more durable areas or accommodate the volume of use; 2) education efforts to encourage appropriate recreation behaviors that minimize impacts; 3) regulations that affect the type of use or user behaviors that cause impacts; or, 4) use limits or restrictions that specify how much use it too much (or what types of uses are acceptable through zoning in space or time).
- ***It is useful to distinguish between direct and indirect management actions.*** On the Snake through Hells Canyon, use limits and non-motorized use periods (certain days of the week)

are used to directly address encounter and conflict issues. On the Pecos, Metolius, Upper Rogue, and Wilson Creek, crowding and encounters are addressed indirectly by managing the size and function of parking areas and by designating dispersed campsites. The North Umpqua's voluntary boating closures (by season, segment, and time of day) to separate anglers and boaters during steelhead season "walks the line" between direct and indirect, with "recommendations" rather than formal regulations. Decisions about direct or indirect actions appear to depend on impact severity, likely effectiveness of indirect actions, and acceptability among stakeholders and the public.

- ***Searching for "balance" among potentially conflicting/competing groups.*** Several rivers have identifiable user groups that may compete for camps, space on the river, or otherwise have impacts on the quality of one another's trips. The Snake through Hells Canyon is perhaps the best illustration, with use limits and motorized use restrictions in the wild segment designed to provide different types of recreation opportunities. The allocation of days and segments among these groups went through several formal appeal processes, an adjudication in district court, and a circuit court appeal (with advocacy groups on both sides opposing the Forest Service balance). Ultimately, the courts upheld the agency's position after the agency conducted an analysis of impacts. Other rivers with recreation user group "balancing" include the Metolius (campers, anglers, and boaters), North Umpqua (anglers and boaters), and Kern (commercial and non-commercial boaters).

History of Chattooga River recreation management

Documentation of the basis for the 1976 boating closure and historic management of other recreation use on the Upper Chattooga is limited. Such documentation (NEPA, etc.) was often less systematic in the 1970s, and its absence makes it hard to "settle" stakeholder debate about several capacity/conflict-related issues such as the extent of boater-angler conflicts or the initial rationale behind the boating closure.

The Forest Service contracted consultants to review documents and interview former agency staff to help provide additional information about these issues (Tetra Tech, 2006). This documentation of previous decisions is not intended to suggest their validity under current conditions. However, it may help frame issues in the current analysis, or correct misunderstandings in stakeholder debate.

Readers interested in the details of this effort are encouraged to read the report (TetraTech, 2006), which includes a list of studies, other management documentation, and a timeline for major Chattooga events and management decisions. Key findings from the history review (or other sources, as cited) are summarized below:

- In the late 1960s, recreation use on the Chattooga was generally light and largely "local," with most use associated with fishing and camping at several road-accessible locations.
- The Chattooga was identified as a study river in the 1968 Wild and Scenic Rivers Act. The study began in 1969, included public meetings in 1969 and 1970, and was completed in 1971 (before substantial boating use had occurred).
- The study report recommended closing several roads along or to the river's edge, generally to create a more "primitive" river corridor. The Forest Service began to close roads after WSR designation in 1974. This adversely affected some types of "local" recreation use, particularly recreation dependent on vehicle-based access. Some forest arson incidents (especially in 1975) and repeated vandalism to Forest Service gates were attributed to

dissatisfaction over the new policies and Wild & Scenic designation (Culp, 2007). These incidents apparently did not continue past the end of the decade.

- Use on the river began to increase dramatically after the study was completed, but it was also catalyzed by the 1972 movie *Deliverance* (which was partially filmed on the Chattooga). The highest use increases came from boaters (initially private boaters, but eventually commercial rafting use grew larger). Boating use levels increased from an estimated 800 floaters per year in 1971 to over 20,000 by 1975 (Craig & Lindenboom, 1979). In recent years, the number of boaters on the Lower Chattooga is about 50,000 per year, a decrease from peaks about 80,000 in the mid-1990s (Vagias, 2006).
- Most of the boating use increases occurred on Sections II, III, and IV, which had more reliable boatable flows and less challenging rapids than reaches upstream of Highway 28. Some higher skilled kayakers and canoeists apparently ran Upper Chattooga reaches on the occasional days when flows were favorable, but this use was very low. Some less skilled (and possibly uninformed) boaters had occasionally started trips from Burrells Ford, and some apparently walked-out after arriving at challenging rapids near Big Bend Falls (similar incidents have occurred in recent years as well; Hedden, 2007). A few boaters and tubers also apparently took trips on the Class I-II Nicholson Fields segment, which had better access before the road closures were completed, and could be boated at lower (more frequent) flows. (Culp, 2007)
- Some local users, particularly anglers, appear to have had conflicts with, or became displaced by, increased boating use on the lower river. Evidence for this is anecdotal (i.e., no studies or agency reports explicitly documented specific conflict incidents or angler use shifts), but some Forest Service personnel recalled or reported knowledge of conflict incidents (TetraTech, 2006; Culp, 2007; Howard, 2007). A 1980 manual for rafting guides also cautioned about the potential for "harassment" from local anglers (Wildwater, 1980). When specific enough, these recollections suggest anglers were upset with boaters rather than the converse (Culp, 2007; Howard, 2007).
- Recollected conflicts apparently occurred on the lower river, particularly at access points on Section II and III. These segments had higher private boating use and easier rapids that required less experience/skill; Section II also traditionally had higher fishing use than downstream reaches (USFS, 1971). Although there may have been incidents on the Nicholson Fields segment just upstream of Highway 28 (Culp, 2007), boating use above Highway 28 was low, so conflicts probably were too.
- Increased boating in the early 1970s coincided with increased in-river fatalities and other safety-related incidents, averaging 3 per year between 1970 and 1975 (Forest Service, 2007). All fatalities occurred on the lower river, and about one-third involved non-boaters; they also diminished substantially by the 1980s (averaging 0.7 per year since 1975). However, Forest Service staff knew that some segments upstream from Highway 28 (Chattooga Cliffs, between Bull Pen Bridge and Ellicott Rock, and from Big Bend Falls through the Rock Gorge) were more difficult than the lower river, and generally discouraged inexperienced boaters from using them (Culp, 2007).
- Trout fishing on the Chattooga has historically been better upstream of Highway 28 (USFS, 1971, p. 20-21). Wading-based angling is easier higher in the basin (with its generally lower flows), and due to geography and elevation, water temperatures in summer are more favorable for fish.
- Trout stocking was generally heavier on the upper compared to the lower river, although stocking occurred from the headwaters down to Highway 76 into the early 1970s. The

stocking pattern was altered as road closures limited where stocking trucks could access the river, but the Forest Service also requested the elimination of stocking below Long Bottom Ford, consistent with the WSR study recommendations (USFS, 1971). This request may also have been part of a general effort to reduce boater-angler conflicts (Culp, 2007). Irrespective of the basis, stocking below Long Bottom Ford was eliminated by the mid-1970s.

- Upper Chattooga stocking was also eliminated in the Wilderness area after it was designated in 1975, and stocking was reduced due to road closures on other upper river segments. The advent and then increase in helicopter stocking by the late 1970s eventually supplemented road-based stocking on the upper river and continues today (Durniak, 2007). Chapter 3 provides additional information about current stocking patterns.
- Forest Service staff report considering a spectrum of recreation settings and opportunities when developing the 1976 river management plan that included the boating closure (Culp, 2007). By this time, staff were apparently discouraging inexperienced boaters from using the more challenging upper river as part of a broad safety initiative, they believed the number of boaters capable of safely running the upper segments was small, and boatable flows were relatively infrequent in any case. Road closures made stocking the lower river difficult, and warmer water temperatures were marginal for developing a wild fishery there, while the upper river was better suited for stocking and fishing. New trails were being planned to open additional land-based access to the upper river, and managers were concerned that increasing boater use and conflicts might "migrate" upstream with them. Taken together, this led them to an overarching management concept that encouraged boating (among other uses) on the lower river and encouraged angling and hiking (among other uses) on the upper river (Culp, 2007).
- The 1976 plan did not clearly explain this overarching management concept, although it did mention three rationales for the boating closure: boating safety, lack of reliable boating flows, and the "detrimental effect" of increasing boating use "on the fishing experience." However, it also failed to provide data or analysis to support those assertions, and did not indicate the relative importance of any rationale. A subsequent report appears to indicate that the primary reason was to allow people to "fish and hike without encountering boating traffic" (Craig & Lindenboom, 1979). Reducing the impact of boats on anglers was further discussed in the 1985 forest plan revision, which noted that the boating closure helped provide "high quality trout fishing experiences" (USFS, 1985).

"Decision environment" conclusions

As summarized in previous sections, information about guiding legislation, case studies of other rivers, and the history of Chattooga management suggest several "lessons" for future planning:

- ***Link management objectives and actions to OR and Wilderness values.*** Guiding legislation indicates that OR and Wilderness values should direct visitor impact management decisions, although case studies show varying degrees of specificity. The Chattooga has pre-designation and post-management plan documentation of the river's values, but subsequent management decisions were not always explicitly linked to them. To avoid future confusion and challenges concerning visitor management, the current planning effort should provide more clear linkages than in the past.
- ***Agency discretion is a component of the decision-making process.*** The Wilderness Act provides direction about some recreation management issues (e.g., no motors or development allowed), but otherwise leaves interpretation of its general guidelines to agencies. The WSR Act provides explicit direction that river values (free-flow, water quality, and OR values)

must be protected and, to the extent possible, enhanced. The WSR anticipates (and the case studies show) that specific OR values and the actions used to protect them vary from river to river based on existing and desired conditions, so professional judgments about impacts, standards, and management actions are appropriate and important. These judgments are best understood if they are made "transparent."

- ***Decisions require rationales and documentation of evidence/analysis.*** Agency discretion in defining OR values, choosing actions to protect them, or determining whether other uses would "substantially interfere" requires evidence, analysis, and documentation (Feldman, McLaughlin, and Hill, 2005). Plans that rely on incomplete data and analyses have been overturned (Riverhawks v. Zepeda, 2002; Friends of Boundary Waters Wilderness v. Bosworth, 2004).
- ***Trade-offs, legislation, and management solutions.*** Visitor management decisions often involve trade-offs among the types, quantity, and quality of recreation opportunities. Legislation such as the WSR or wilderness acts provide a protective framework for management, but these acts do not, absent specific direction, decide specific priorities. Resource managers generally try to develop solutions that balance the interests of multiple groups by considering resource characteristics, use patterns, or other variables. When this is not possible, decisions should be explicit about what is to be provided (and what is foregone). Such decisions may not please all groups, but they are made "by design" rather than "by default."

3. Recreation Opportunities

This chapter summarizes existing and potential recreation opportunities on the Upper Chattooga. This includes the "outstandingly remarkable" (OR) recreation values described in the pre-designation Wild and Scenic Study Report (USFS 1971), a 1996 analysis of OR values (USFS, 1996), and integrates information about recreation attributes from 2005 public meetings and recreation fieldwork. For boating and fishing opportunities, it includes assessments of recreation attributes from the 2007 expert panel fieldwork.

Existing opportunities

The following list describes the major recreation opportunities provided in the Upper Chattooga corridor at the present time. Although some users may participate in more than one activity during a trip; the goal here is to characterize distinct opportunities.

General frontcountry recreation at four bridges

Four major roads/highways cross the Upper Chattooga, offering access to "general frontcountry riverside recreation" opportunities that may include vehicle-based sightseeing, short walks, swimming, or picnicking. By definition for this analysis, frontcountry recreation occurs within ¼ mile of the access roads/bridges. These types of recreation activities were mentioned in the 1971 study report and the 1996 analysis of OR values, but neither provided details.

- Sliding Rock near Grimshawes Bridge provides swimming opportunities during warmer months; the site is particularly popular with family groups. Important features include water quality, scenery, a functioning "sliding rock," the pool below the cascade, and small beaches for relaxing. In general, this is a "social recreation" setting, and solitude is less important.
- The Bull Pen Bridge provides road-based views of the cascades at the bridge; scenic viewing is probably the main frontcountry attraction of this area. There are several swimming holes and sunning/relaxation sites accessible during warm and low water periods (reached by scrambling down to the river from the designated trail, or by traveling in-channel). This location is more remote than Sliding Rock, and solitude is probably more important.
- The Burrells Ford area features an array of frontcountry recreation opportunities, including picnicking, sunning/relaxing, swimming (during warmer months), and short walks. Key attributes include water quality, scenery, and the availability of upland sites near wading/swimming or angling locations. Camping, hiking, and angling opportunities from this site are discussed below. In warmer months when use is higher, this area offers more of a "social recreation" setting, with solitude probably less important.
- The Highway 28 Bridge area is used less than the others for general frontcountry recreation; this area is more popular for frontcountry angling or as the starting point for backcountry angling and hiking. The bridge offers scenic views of this lower gradient reach and there are some swimming holes (one has a rope swing) popular in summer months.

Frontcountry angling at four bridge areas

By definition for this analysis, frontcountry angling occurs within ¼ mile of the four bridges. The 1971 study report and 1996 analysis of OR values discuss the importance of trout and warm-water fisheries on the Chattooga (a biologic OR value), and well as angling for those species (a recreation OR value). Neither report provides detailed information about frontcountry fishing,

although the 1996 analysis notes that some frontcountry angling opportunities were lost when roads to the river were closed in the mid-1970s.

- Sliding Rock near Grimshawes Bridge provides a limited fishing opportunity. This NC reach is no longer stocked, and swimmers are often present from mid-morning through late-afternoon in summer. However, the area can be fished during cooler months or at dawn/dusk during summer. The remaining rainbow and brown trout (now a reproducing population managed as a wild fishery) are fished using flies, spinners, or bait.
- Frontcountry fishing is also limited near Bull Pen Bridge, which has more rapids and cascades than fishable pools and runs, particularly at high water. This NC reach is no longer stocked; remaining rainbow and brown trout populations are managed as a wild fishery.
- Burrells Ford probably provides the best frontcountry fishing opportunities on the river. This scenic reach is wide and shallow at most flows, with fishable runs and pools between riffles. Bait and spin anglers are more common here (fly anglers are more likely to travel farther than ¼ mile from the bridge); some anglers wade, while others fish from the bank.
- The area immediately upstream of Highway 28 provides a frontcountry fishing opportunity. This location has a more alluvial channel (lower gradient, fewer boulders and rapids) and features more "pastoral" scenery than the steeper forested landscapes upstream. Bait and spin angling occurs here; most fly anglers fish upstream. All bait and spin fishing in this reach occurs by regulation from May 15 through October 31st. The rest of the year falls under "Delayed Harvest" (DH) regulations (catch and release fishing) as discussed under "backcountry fishing" below.
- The frontcountry angling opportunities at Burrells Ford and Highway 28 depend on an active trout stocking program coordinated between the Georgia and South Carolina DNRs. "Put & take" trout fisheries have been developed on the river since the 1930s, although actual numbers of stocked fish (species, size, and locations) have varied. Since the late 1960s, the number of stocked trout has ranged from 25,000 (1973) to 194,000 (1986), with roughly similar proportions of rainbow and brown trout (Durniak, 1989).
- In recent years, South Carolina DNR truck stocking each May to October places roughly 40,000 rainbow and brown trout adults (9 to 12 inches in length) into the Chattooga at Burrells Ford, the mouth of Reed Creek to Hwy 28, and between Highway 28 and Long Bottom Ford. Georgia DNR and SCDNR work cooperatively with USFS to stock an additional 32,000 sub-adult rainbow and brown trout into the backcountry area from Burrells Ford downstream to the mouth of Reed Creek (see backcountry fishing below). Taken together, over 70,000 trout are stocked into the Chattooga River. (Rankin, 2007)
- Stocking has included rainbow and brown trout, but sampling shows that brown trout are more abundant. However, creel data suggest most caught fish (>70%) are rainbows, highlighting "conventional wisdom" that browns are harder to catch, and that rainbow provide the primary fishery for most anglers (Rankin, 2007).
- Compared to backcountry angling, frontcountry angling depends to a greater degree on catch-rates and harvest, while the scenery and social setting may be less important. However, no specific studies have assessed frontcountry/backcountry angler differences for the Chattooga.

Backcountry angling

By definition for this analysis, backcountry angling occurs on reaches farther than ¼ mile from the bridges. The 1971 study report and 1996 analysis of OR values describe its importance as a recreation opportunity, but provides few specific details.

- Backcountry anglers tend to target larger trout and are generally less interested in harvest than frontcountry anglers. Many practice catch and release fishing; higher proportions wade rather than fish from the bank, and use flies rather than spinning gear or bait. Some backcountry anglers specifically target larger wild brown trout (which are generally harder to catch).
- Important attributes include water quality and clarity, scenery, insect hatches, and a fishery with higher proportions of "wild" or "naturalized" fish (trout that have lived in the river for months or years, rather than recently stocked adults). Anglers who fish the Upper Chattooga backcountry also comment about its width, depth, and variety of fishable water (including riffles, runs, pocket water, and shoals). Most fishing on the Upper Chattooga appears to be flow-dependent, with ideal wading-based angling at low to medium flows. Chapter 7 provides additional discussion of flows and angling.
- Backcountry anglers tend to fish in small groups (1 to 4 anglers) and are generally interested in solitude (avoiding competition or encounters with other angling groups or other users) and a sense of remoteness (USFS, 1971). As with other backcountry users, they also value an environment with few signs of human use.
- Backcountry anglers usually hike along the river via designated trails, then drop down to fishing locations on "user trails." User trails sometimes follow the river; anglers occasionally travel short distances in the channel.
- Most backcountry anglers take day trips, but a few camp at dispersed sites along the river or at Burrells Ford.
- The fishery from the ***headwaters to Big Bend Falls*** is managed as a "wild" trout fishery, although some stocking occurs at Burrells Ford downstream. The reproducing brown and rainbow trout in this reach are descendents of introduced fisheries (brook trout are the native trout in the basin, but exist only on smaller tributaries today). Helicopter stocking from Ellicott Rock (the end of North Carolina management) to Burrells Ford ended in 1975 with designation of the Ellicott Wilderness Area. Relatively fewer anglers target these waters (except at Burrells Ford itself) compared to downstream reaches.
- The fishery from ***Burrells Ford downstream to Reed Creek*** relies largely on helicopter stocking. Georgia DNR and SCDNR work cooperatively with USFS to stock 16,000 sub-adult (under 7 inches) rainbow and 16,000 sub-adult brown trout into this backcountry area (Rankin, 2007). About 1,000 of each species are over 12 inches.
- The fishery from ***Reed Creek to Highway 28*** (about 2.5 miles) is managed as a delayed harvest (DH) reach. From November 1st to May 15th, anglers must practice catch and release fishing with a single hook and artificial lure. DH stocking (part of the roughly 40,000 stocked for frontcountry angling, as discussed above) occurs just before the DH season, and stocked fish remain unharvested until the following summer. The stocked fish "naturalize" through the winter and become more challenging to catch.
- DH regulations attract more specialized trout anglers than summer stocking programs; the Upper Chattooga DH reach is one of five in Georgia, one of two in South Carolina, and one of 19 in North Carolina.
- Backcountry angling can occur year-round, but is best in spring, early summer, and fall. The DH reach is consistently used through the winter, even when temperatures approach freezing.

Day hiking

Hiking is a major recreation use in the Upper Chattooga corridor; this opportunity includes wildlife viewers, photographers, or others who use the trails for day trips. The 1971 study report documented some hiking use, but the only designated trail in the corridor at the time was 4 miles from Burrells Ford to Ellicott Rock. The 1976 plan included plans to develop additional hiking trails; some were conversions of old roads, while others were new trails (see Figure 2 on page 3). The 1996 analysis provided few additional details about these hiking opportunities.

- A network of designated trails in generally good condition provides access to a diversity of terrain and attractions in the corridor. Hikers can travel from near the headwaters (Whiteside Cove Road) to Highway 28, and the Bartram Trail continues along the river (or its ridges) downstream as far as Highway 76. There are 11 trailheads providing access to the upper river, allowing loop routes or visits to particular parts of the corridor. The highest use trailheads appear to be at Bull Pen Bridge, Burrells Ford, East Fork, and Highway 28.
- The most heavily used trails are from Burrells Ford to Ellicott Rock, the East Fork trail to the river from the fish hatchery, and the Foothills Trail from Burrells Ford to Highway 28. In total, there are 35.0 miles of designated trails in the Upper Chattooga WSR corridor.
- A network of user-created spur trails that are connected to designated trails provide access to fishing, picnicking, camping, or other recreation sites. There are currently about 19.3 miles of these user-created trails in the Upper Chattooga WSR corridor..
- Important hiking attributes include a sense of remoteness and spectacular scenery that includes forested ridges, rocky outcrops, mature forests, waterfalls and cascades in the river and on tributaries, birds and other wildlife, plants and wildflowers, and archeological sites (e.g., old home sites). Most hikers probably value the lack of motorized, mountain bike, and horse use on these trails (as specified in the existing plan).
- Hiking can occur year-round, but is more popular in spring, summer, and fall.
- Day hikers tend to travel in small groups (less than eight), although some larger “organized groups” (e.g., hiking clubs, boy scouts) sometimes visit. Most appear to prefer some solitude and a sense of remoteness, but higher densities on more popular trail segments can occur on weekends in summer and during fall color.

Backpacking/camping

Backpacking / camping is distinguished from day hiking by overnight use, but utilizes the same trail system. This was a minor use prior to the 1976 plan and subsequent trail development, although vehicle-based and more remote camping certainly occurred.

- Backpackers use the same trail system described above. In addition, the Bartram Trail connects to other trail networks in the region for long distance “through hiking.”
- There are 127 documented backcountry campsites in the upper river, with the greatest concentrations in the segments from East Fork to Burrells Ford and from Burrells Ford to Lick Log Creek. Chapter 5 provides additional information about the trail system and campsites.
- This total includes approximately 30 walk-in frontcountry campsites at Burrells Ford. This semi-developed campground (with pit toilets and water) once had electricity and was accessible by vehicles, but was converted to walk-in use after WSR designation.

- Backpackers enjoy attributes similar to those listed above for day hikers, but are probably more interested in solitude and a sense of remoteness, particularly at destinations (e.g., camps, fishing areas, or swimming holes). In general, they prefer to camp out of sight and sound of others.
- Campers at Burrells Ford appear more tolerant of higher density "social recreation" settings and commonly camp in sight or sound of several other parties (Cavin, 2004; see discussion of camp encounters in Chapter 6).
- Backpackers probably value few signs of human use or development, and the lack of motorized, mountain bike, and horse use.
- Backpacking occurs in seasons similar to day hiking, but may have even lower winter use.

Hunting

Hunting occurs in the Upper Chattooga corridor during a defined fall season, but use is apparently light and probably occurs along user-created rather than designated trails. Bear, deer, hog, and turkey are available game species, but none are thought to be abundant. Hunters are probably interested in solitude and the availability of game, as well as the remote and scenic setting. They are unlikely to interact with most other users.

Potential opportunities

Boating was allowed on the Upper Chattooga before 1976 (although use was rare), and it is considered a potential future opportunity for this analysis. The 1971 WSR study reported a Forest Service reconnaissance trip in a small raft from Grimshawes Bridge downstream to Highway 28, noting that boating provides the "best" access to some remote parts of the river (particularly because since many trails were undeveloped). The 1996 analysis of OR values did not provide specific information about boating in the upper river (which was and remains closed). The following provides additional information about boating opportunities based on existing documents and studies, fieldwork, and the expert panel fieldwork in January 2007. It distinguishes two types of potential boating opportunities:

- ***Whitewater-oriented boating*** refers to Class IV-V whitewater kayaking, canoeing, or rafting on the Upper Chattooga's steeper segments by highly skilled boaters.
- ***Scenic-oriented boating*** refers to Class I-II opportunities on the lower gradient reaches that may be used for access to the area, boat- or tube-based fishing, or during "water play."

Whitewater-oriented boating

This is the type of boating most likely to occur on the Upper Chattooga. Every bridge-to-bridge segment includes at least some Class IV-V rapids that require highly skilled boaters and specialized equipment. Some parts of these reaches can be described as "creek boating runs," with gradients over 100 feet per mile and constricted rapids. On other segments, the boating is less creek-like, with multiple route options and a wider river. .

- The 1971 WSR report noted that boating on the upper river could be arduous, with numerous portages. The fieldwork for that study was apparently conducted in a small "rubber raft" because participants did not feel that kayaks or canoes of the day were appropriate for the challenging rapids. Whitewater boats and skill levels have improved dramatically in the intervening years, and recent expert panel fieldwork suggests that several different craft could

be used on these reaches with sufficient flow, including hard shell kayaks, decked canoes, open canoes with floatation, multi-chamber inflatable kayaks, and small rafts and catarafts (generally under 12 feet long, paddled by 1 or 2 people). The boater panel did not believe the river would be runnable in larger rafts or rafts with more than two people.

- There are three potential whitewater-oriented boating reaches on the Upper Chattooga: (1) ***Chattooga Cliffs*** from Grimshawes Bridge or Norton Mill Creek confluence to Bull Pen Bridge; (2) ***Ellicott Rock*** from Bull Pen Bridge to Burrells Ford; and (3) ***Rock Gorge*** from Burrells Ford to Lick Log Creek confluence or Highway 28. The expert panel report (Berger 2007) provides descriptions of each reach. In general, Chattooga Cliffs provides the most creek-like whitewater boating opportunity (steeper gradient, more technical rapids), while the Ellicott Rock reach offers the most whitewater for its length. The Rock Gorge offers a longer trip with several good Class IV-V rapids, but also has longer stretches of flat water (and many Rock Gorge trips would include travel through the Class I Nicholson Fields reach too).
- Whitewater-oriented boating is a flow-dependent activity and generally requires moderately high flows on these reaches. With an unregulated flow regime (no dams or diversions), days with higher flows occur infrequently and on short-notice, generally in winter and spring. The expert panel report (Berger, 2007c) and Chapter 7 provide additional information about the frequency and timing of boatable flows.
- Most boaters are unlikely to camp on their trips and would probably not boat all three reaches in a single day (although this has apparently been done). During the expert panels, the Rock Gorge / Nicholson Fields reaches took a full day, while Chattooga Cliffs and Ellicott Rock were run on the same day.
- Based on information about lower river boaters (Townsend, 1982; Dye & Burnett, 1994; Moore & Siderelis, 2003) boaters value the same attributes as other upper river users: a sense of remoteness, spectacular scenery, and few traces of human use. In addition, they are focused on the challenge of running whitewater.
- For some whitewater-oriented boaters, solitude is likely to be important; for others, high quality boating can occur in a more "social" (higher density) setting. Boaters are generally likely to travel in small groups of 2 to 5 (based on use data from the Lower Chattooga).

Scenic-oriented boating / tubing

It is possible for less skilled boaters using open canoes, tubes, or other craft to run some segments of the Upper Chattooga that lack more challenging rapids. For example, the 1971 study report noted that the lower gradient reach from Lick Log Creek to Highway 28 was "easy for the inexperienced canoeist" (USFS, 1971, p. 75). Other short segments have similar characteristics, although all have access challenges.

- The roughly 4 mile Nicholson Fields reach from Lick Log confluence to Highway 28 is probably the most likely scenic-oriented boating trip. It is accessible by trail from the Thrift Lake trailhead (about 0.75 miles, all downhill) with a take-out at Highway 28 or the Section II boat launch, about a mile and half downstream.
- There are 2.1 miles of Class I-II water from the East Fork confluence to Burrells Ford, but this involves a substantial carry to the put-in (2.5 miles downhill from the Walhalla hatchery or 2.1 miles up from Burrells Ford). This is likely to limit use to inflatable kayaks or "pack rafts" (only the former are common in the Southeast U.S. at this time).

- Boaters could put-in at Burrells Ford and float about two miles to the start of the rapids above Big Bend Falls and then walk back. This is also likely to limit use to boaters with lightweight craft and a willingness to carry their boats back to the put-in.
- Scenic-oriented boating on these lower gradient segments is probably possible at lower flows than whitewater-oriented boating, and would be available more frequently through the year. Chapter 7 has additional information about flows and boating.
- Important attributes of scenic-oriented boating trips would likely be similar to those of other backcountry opportunities – a sense of remoteness, scenery, lack of signs of human use, etc. Running challenging whitewater is probably less important to these boaters (although Class I-II rapids may be challenging in carry-in craft), while solitude may be important for some.
- All three low gradient segments described above might be used for boat-based fishing (if allowed), but because the Upper Chattooga is generally wadeable, a boat is not necessary to access fishable water. Inflatable kayaks, pack rafts, "fish cats," or float tubes are potential craft for this use.
- If boating were allowed on the Upper Chattooga, some people might be interested in tubing short reaches of the river in summer. Candidate locations include very short segments on either side of Burrells Ford (e.g., within a mile or so), or the segment just upstream from Highway 28. All have low gradients and some longer runs and pools that would provide good tubing if there was sufficient flow (and tubing were allowed).
- Family groups at Sliding Rock and Burrells Ford occasionally use water mattresses and similar "waterplay" toys that could technically be considered boats (but are usually used at a single location). For the purposes of this analysis, these opportunities have been included with general frontcountry recreation.
- Scenic boating use of these short segments raises a management concern if some users mistakenly continue their trips into the more challenging whitewater reaches. A pair of tubers in 2005 apparently started a trip on a tributary to the Upper Chattooga believing it was Section 1, and they had to be rescued. Inexperienced boating groups have also occasionally launched from Burrells Ford without realizing they would encounter Class IV-V rapids; they have had to portage their boats back out upon reaching Big Bend Falls (Hedden, 2007). These events indicate that some users can make errors even with a well-publicized boating closure; allowing experienced boaters to use the reaches could conceivably exacerbate this problem.

Other potential opportunities

There are other potential opportunities that could occur in the Upper Chattooga corridor. Some are currently prohibited (e.g., horse riding, mountain biking, ATV riding) and have not been contested during the recent Sumter Forest Plan revision. Others have not yet become popular in the region (e.g., "canyoneering") and are unlikely to become a major issue for Chattooga management during the current planning cycle. We have mentioned these for completeness, but they are not a focus of additional analysis.

Opportunity "importance"

Stakeholder discussion has occasionally examined the relative "importance" of one type of opportunity vs. another on the Upper Chattooga by highlighting their relative demand, scarcity, or

number of potential substitutes in the basin or the region. Some data from specific studies or input from stakeholders or the public have partially addressed these issues.

- A pair of studies explored "substitutability," "involvement," and "place attachment" for Chattooga non-commercial whitewater boaters (on the lower river) and trout anglers (who might use the entire river, but probably focus on the upper river) (Backlund, 2002; Hammitt et al., 2004; Bixler & Backlund, 2002). Additional analysis compared these two groups on several demographic and place attachment variables (Vagias, Powell, & Haynie, 2006).

  Majorities of both groups reported the river was important to them and various measures of place attachment were strong. Both groups could identify potential substitutes (boaters listed 37; anglers listed 40), but "similarity rankings" indicated that most were not good substitutes for the Chattooga.

  There were some differences between the two groups. For example, more boaters reported the Chattooga was the best regional river for their activity (64% compared to 23% of trout anglers), and there were statistically significant differences on several "involvement" and "place attachment" dimensions (with boaters generally showing stronger attachment than anglers). There were also some age and experience differences (anglers were generally older but used the Chattooga less often).

  Taken together, results led researchers to conclude that boaters' more frequent use may lead to stronger place bonds (Vagias, Powell, & Haynie, 2006), but we would qualify these findings. One problem is that the two groups were sampled differently (boaters via permits from known visits; anglers via a census of two local Trout Unlimited chapters); because a "wider net" was cast across the angler population, it may have included fewer avid Chattooga anglers. In addition, some of the involvement and place attachment variables were statistically but not substantively different (e.g., 4.39 vs. 4.61 on a five point "importance"). Finally, as noted above, boaters were rating the Lower Chattooga only (because they can't currently boat the Upper Chattooga), and it is unclear whether their assessments would apply to the upper river.

- A comparison study of campers using the walk-in campground at Burrells Ford vs. backpackers in the Ellicott Wilderness (Cavin, 2004) shows little "cross-use" of these locations, different preferences for amenities while camping, and some differences in their motivations (e.g., Ellicott Rock users were more interested in solitude than Burrells Ford users). Taken together, these findings indicate different opportunities with different user populations (even though many reported a willingness to use another site as a substitute when asked directly).

- At the July 2006 public meeting (and on its website), the Forest Service requested stakeholders and the public to provide names of similar rivers to the Upper Chattooga for comparison purposes. While people were able to list multiple streams, many comments highlighted the uniqueness of the Chattooga.

Opportunities conclusions

There are probably differences between users engaging in existing or potential recreation opportunities on the Upper Chattooga, but there are also similarities. For example, most appear to value the natural environment, lack of development, lower density recreation, and opportunities for solitude.

Following from standard recreation management principles (Manning, 1999), it makes more sense to clarify characteristics of higher quality opportunities than to attempt to assess whether one is “better” or more important than another.

High quality versions of most opportunities on the Upper Chattooga are available on other rivers in the region, but this does not diminish the high value that many users place on the Upper Chattooga trips (or potential trips).

There is little specific information about relative demand for different types of recreation opportunities on the Upper Chattooga. Even if such information existed, it would be unlikely to be the “deciding factor” in the current planning process because it does not consider the range of other information available (use patterns, impacts, actions that could be used to mitigate impacts, availability of other resources, etc.).

Most recreation opportunities on the Upper Chattooga have active stakeholders that have become involved in this planning process, so decision makers will need to reckon with multiple groups advocating for their recreation interests.

4. Use Information

This chapter summarizes information about current use levels and trends for existing and potential recreation opportunities. The chapter focuses on the Upper Chattooga, but a summary of Lower Chattooga use information is provided for context.

Concepts and methods

By definition, recreation capacity studies pay attention to use information; carrying capacity is defined as the level of ***use*** beyond which impacts exceed standards (Shelby and Heberlein, 1986). Thirty years of capacity research shows that other factors besides use levels affect impacts, but use levels "drive" many impacts and are an integral part of recreation management.

Most recreation use information is reported for large areas (e.g., for a Wilderness Area) or for long periods of time (e.g., for the entire year), giving little insight about impacts at specific times or locations. For most impacts, it is important to focus on more specific use measures, each of which must specify units (e.g., user days, people, or trips), timing (e.g., at one time, per day, per week, per month, per season), and location (e.g., at a launch area, in the entire segment, at specific attraction sites). For the Upper Chattooga, "at one time" estimates for specific areas are most relevant.

The Forest Service currently monitors boating use on the Lower Chattooga through a mandatory registration system, but until this year had not systematically monitored fishing, hiking, swimming or other uses on either the upper or lower river. DNR-led creel census efforts for the Upper Chattooga (e.g., GA DNR roving creel observations in 1987-1989; SC DNR front country angling surveys in 1999-2000, and GA DNR angler diaries in 2004-2005) provide other useful estimates, but they are limited to angling. To address these information gaps and summarize the overall recreation use situation, the Forest Service initiated four data collection efforts:

- A limited use monitoring program with public volunteer and agency components. These ***spot counts*** focused on "at one time" tallies of vehicles at access areas.
- A review and summary of ***existing use information*** from creel surveys, angler diaries, the lower river boater registration program, and other use information available from previous user surveys.
- A "***use estimation workshop***" to elicit and document "professional judgment" estimates about use levels and patterns from experienced agency staff when other data were not available.
- A review of ***national or regional surveys of recreation use trends*** to anticipate changes in future use levels.

The Data Collection Implementation Plan (or related reports) describes these methods in greater detail; interested readers should review the original sources. The following bullets summarize how use information was collected and analyzed:

- The most reliable upper river use information comes from a systematic ***frontcountry creel survey*** conducted by SC DNR in 1998-99. This is the only "recent" use monitoring program in the upper river, but it is limited to frontcountry angling at Burrells Ford and Highway 28.

- Reliable use information is also available from a roving ***backcountry angling creel survey*** conducted by GA DNR in 1987-89, but it is probably not recent enough for estimating current use levels. In general, we assume this provides a "floor" at best.
- There is no creel or other use information for North Carolina segments; in general, angling use on these segments is thought to be light (Bessler, 2007).
- Various ***studies*** have utilized some on-site sampling that might have been used to estimate use levels, but reports do not provide sufficient information to make this assessment (and the researchers have not provided the sampling data sets). The present report uses these studies to understand user and trip characteristics (e.g., group sizes, trip lengths, proportion of hikers vs. backpackers) rather than use levels.
- The limited use monitoring or ***spot count program*** initiated in August 2006 was a cost-effective effort designed to provide information about more locations and types of use. However, it has several limitations, including: (1) data are only available from August 2006 through January 2007, although the program will continue through July 2007; (2) it generally focuses on vehicle counts at trailheads, and thus has limited ability to describe the number of people (without a reliable "people per car" multiplier); (3) vehicle counts do not provide specific information about where people go (e.g., upstream or downstream at Burrells Ford) or what activities they are doing (e.g., fishing or hiking); (4) it stratified sampling days by weekends (defined as Sat & Sun) and weekdays (defined as Tuesday-Thursday), but offers no information about Mondays and Fridays; the purpose was to examine the range of "at one time" use levels on weekdays and weekends, not to sum estimates across a season or year for cumulative totals.
- The ***use workshop*** estimates were an exercise in "group thinking," where experienced agency resource staff discussed their knowledge and tried to reach consensus on estimates for opportunities and locations. Participants recognized that some estimates were less precise than others, and expect to revise them as spot count or other information becomes available through the remainder of the Chattooga capacity process. In the absence of other information, workshop data describe general use patterns and the relative ranges of use.
- ***Use information has generally not been tallied for a year*** because those time frames are not particularly useful for making capacity decisions in this setting. In general, "at one time" estimates are more useful for understanding critical impacts (encounters, camp occupancy, etc.).
- In general, analysis focuses on ***"people at one time" (PAOT) for frontcountry areas and fishing opportunities***, because that measure appears to drive important impacts (numbers of people in view, competition for fishing space) for those opportunities. However, the analysis focuses on ***"groups at one time" (GAOT) for hiking and backpacking/camping*** because that variable is more relevant for impacts (e.g., campsite occupancy, trail encounters).
- With all methods, the goal is to understand likely ***use patterns, peaks, and general averages***. There is likely to be variation across all estimates, but Upper Chattooga use information is not extensive enough to carefully examine this variation.

Existing use

Grimshawes Bridge / Sliding Rock Area

- Use at this frontcountry site focuses on swimming or relaxing at Sliding Rock. There are distinct summer (especially July and August) and weekend peaks.

- This site probably has the highest concentrated use in the entire corridor. Workshop estimates suggest as many as 70 people may visit at one time on summer weekends, but average summer peaks range from 20 to 40 PAOT.
- In cooler months, workshop data suggest 2 to 15 PAOT may use this site, with smaller differences between weekdays/weekends. Angling use at this site rarely exceeds more than a few anglers. During spot counts from October through January, no more than 6 vehicles have been counted, with the average less than one.
- *Other workshop notes:* Most users appear to be family groups. Length of stay is usually less than a couple of hours in summer (swimming and relaxing) and less than a half hour in cooler months (with viewing the primary activity).

Chattooga Cliffs Segment

- Use in this reach peaks from May through August, and again during fall colors. It also has weekend peaks. Overall, this reach generally sees relatively light use compared to others.
- Workshop estimates suggest as many as 10 groups may use this reach at one time during peak summer weekends, but more common averages are 3 to 6 groups in high use months and 1 to 3 groups in lower use months. The majority of these groups are day hikers, with an occasional "through hiker" backpacking group.
- Spot counts from October to January showed no more than 4 vehicles total at the two trailheads (Chattooga Trail and County Line), and usually 1 or 0. However, some hikers access the reach from Bull Pen Bridge (discussed below).
- Backcountry angling use rarely peaks at more than 3 PAOT, but may average 1 to 2 through much of the year. The highest use for angling is from March through October.
- *Other workshop notes.* There are few campsites in the reach. Hiking group sizes tend to be small (1 to 3 people), but occasionally may include larger or organized groups of 8 to 10. About half of all anglers fly fish. These estimates do not include use on the 1.7 miles of private land in this reach.

Bull Pen Bridge Area

- Frontcountry use in this area peaks in mid-summer and during fall color season. Use is often focused on brief sightseeing visits (from the bridge), which peak on weekends.
- Based on workshop estimates, peak use times in summer may have more than 20 PAOT, but usually average much less. Cooler months will average between 5 and 15 PAOT, but are probably lower from November to February.
- Spot counts from October through January never exceeded 8 vehicles (a weekend in October); on other weekends, counts never exceeded 3, and averages were 1 to 2.
- *Other workshop notes.* This is a well-publicized site on tourist maps for viewing cascades; length of stay is usually less than a half hour. A small proportion of users may fish.

Ellicott Rock Segment

- Use in this reach peaks from May through August, and again during fall color season. It also has a weekend peak.

- This reach generally has the highest day hiking and backpacking use levels on the Upper Chattooga. Workshop estimates suggest as many as 20 day hiking groups and 10 backpacking groups (30 total groups) on a busy summer weekend. However, non-peak summer weekends average less than 10 day hiking groups and 5 backpacking groups (15 total groups). Summer weekday and shoulder season averages are generally less than 4 hiking groups and 2 backpacking groups (6 total groups).
- During winter months (November to February), workshop estimates suggest day hiking use may reach 6 GAOT on a weekend, but will average less than 2. As many as 3 groups may camp over a weekend during winter, but averages are probably closer to 1.
- Backcountry angling use also occurs on the reach. Based on 12 angler diary reports in 2004 and 2005 (most in April and May), an average of 2.3 other anglers were observed in this segment (with a high of 6 and some days with none). Workshop estimates suggest there are seasonal and weekly patterns among backcountry angling, with an average of 4 to 6 PAOT in early summer, but peaks as high as 10 PAOT. During winter months, the number of anglers is generally under 4 PAOT.
- Spot counts from August through January showed no more than 9 vehicles at the Fish Hatchery (trailhead via the East Fork Trail) and no more than 32 at Burrells Ford (the other commonly used trailhead into the Wilderness). More common vehicle counts at trailheads during this period ranged from 2 to 20, with highest use levels on weekends in August. Interpreting these counts for the Ellicott Rock segment is challenging because some users may stay in the Burrells Ford area, and others may be downstream in the Rock Gorge segment.
- A 2003 survey of Ellicott Wilderness backpackers showed group sizes average 5.8 people and trip lengths average 2.5 days (Cavin, 2004).
- A 1994-95 survey of Ellicott Wilderness users (includes hikers, backpackers, and anglers) showed an average group size of 4.5 (Rutlin, 1995). The study showed 62% were day users and only 15% spent more than one night. Among day users, nearly half stayed just a few hours, 42% spent half a day, and only 13% spent the full day.
- The 1994-1995 study reported primary activities for the sample: 45% were primarily day hikers; 30% were campers; 20% were anglers, and 3% were wildlife viewers. Because people engaged in multiple activities, participation rates were higher; about 75% reported day hiking, 45% viewed wildlife, 38% camped, 34% fished, and 4% swam.
- *Other workshop notes.* Most hiking use is focused on the designated trails between Ellicott Rock, Burrells Ford, and up the East Fork to the Fish Hatchery, all of which are relatively close to the river. Off-trail use in the Wilderness is considered light.

Burrells Ford Area

- Frontcountry use in this area peaks in mid-summer and during fall color season. Use is multi-faceted, and includes frontcountry fishing, sightseeing, picnicking, swimming, camping at a walk-in campground, or staging for trips into the Ellicott Rock reach or downstream toward the Rock Gorge.
- Based on workshop estimates, general frontcountry use at this site may average 50 PAOT on summer weekends and 20 PAOT on weekdays, but is considerably lower in the off season (less than 10 on winter weekends and 5 on winter weekdays). This does not include people camping at the campground.

- Workshop estimates suggest the campground may average 25 to 30 groups per night on mid-summer weekends, but 10 to 15 groups on weekdays. In the off-season months (November to May), campground occupancy average 0 to 5 groups on weekdays, and 2 to 8 on weekends.
- Spot counts from September through January never exceeded 32 vehicles (a weekend in October), with less than 15 during September-October and less than 5 from November to January.
- 1998-99 frontcountry creel survey data showed peak angling use at Burrells Ford may peak as high as 38 PAOT in spring and summer, but averages were about 15 in the spring and less than 10 in summer. In the fall, peaks were about 25 but averages were about 11. In winter, peaks were as high as 10, but averages were about 4. Contrary to workshop estimates, data show few differences between weekdays and weekends for frontcountry angling.
- A 2003 survey of Burrells Ford campers (Cavin, 2004) showed a group size average of 5.0 (smaller than Ellicott Wilderness campers) and trip length average of 2.9 days (slightly longer than Wilderness campers). It also showed that 71% reported taking day hikes while 59% reported fishing. Only 5% reported that hiking was their primary activity, while 33% said fishing was their primary activity.

Rock Gorge Segment

- Hiking use in this reach peaks from May to August and during fall color season. It also has a weekend peak. Angling peaks in spring and early summer, but also has a fall season.
- This reach generally has lower use than the Ellicott Rock segment (but higher than Chattooga Cliffs). Workshop estimates suggest as many as 15 day hiking groups and 10 backpacking groups (25 total) may use the reach on a busy summer weekend, but this is a longer reach. Non-peak summer weekends average less than 10 day hiking groups and 5 backpacking groups (15 total). Off-season averages were generally less than 7 hiking groups and 4 backpacking groups on weekends and about half that on weekdays.
- Backcountry angling use also occurs on the reach. Based on 42 angler diary reports in 2004 and 2005 (most from October-May), an average of 2.1 other anglers were observed AOT in this segment, although zero anglers were reported on several days (and three days had unusually high reports of 12 to 15, possibly from counting anglers in the DH segment too).
- Workshop estimates suggest there are seasonal and weekly patterns among backcountry angling, with an average of 3 to 6 PAOT in April and May, but less than 2 PAOT in other months.
- Spot counts from August through January showed no more than 5 vehicles at the Big Bend Falls Trailhead, with an average of less than 1. Vehicle counts at Thrift Lake trailhead exceeded 20 on one November weekend, but averaged about 3 for the rest of the sampling period. Interpretation of counts at Thrift Lake is challenging because some users may using the Nicholson Fields reach.
- *Other workshop notes.* Group sizes are likely to be similar to Ellicott Rock users, but weekday groups tend to be smaller (usually 1 to 2 people compared to 4 or 5). About half of the backcountry anglers use spinners or bait, and half use flies.

Nicholson Fields / DH Segment

- Use in this segment focuses on backcountry fishing, although hikers and backpackers travel through it on their way to other segments. Angling use peaks during the DH season from November through May, and there is also a weekend peak.
- Based on 79 angler diary reports in 2004 and 2005 (all from November to May), an average of 4.1 other anglers were observed in this segment, although no anglers were reported on some days and only 6% of days had more than 10.
- Workshop estimates suggest higher use levels than angler diary information. Based on these, weekend peaks may be as high as 30 PAOT in early fall or late spring, although average weekends are usually less than 15 PAOT. In contrast, weekday peaks rarely exceed 10 PAOT and weekdays average 1 to 5 PAOT (which fits with angler diary reports, which may have over-represented weekdays).
- Spot counts from August through January showed over 30 vehicles at the Highway 28 trailheads on one November weekend, although averages were generally 5 or less.

Highway 28 Area

- Frontcountry use in this area focuses on fishing, although there may be some swimming and picnicking as well.
- 1998-99 frontcountry creel survey data showed that angling use at Highway 28 may peak as high as 15 anglers in spring or summer, but it averaged 4 to 6 PAOT on weekends and 1 to 3 on weekdays in these periods. In fall and winter, peaks were less than 5 and averages ranged from 1 to 2 PAOT.
- Workshop estimates suggest that frontcountry use at Highway 28 may peak about 5 PAOT on summer weekends, but usually averages 2 to 4 PAOT. In spring and fall, frontcountry general recreation use levels are usually less than 3 PAOT.
- As discussed above, spot counts from August through January showed over 30 vehicles at the Highway 28 trailheads on one November weekend (supporting workshop estimates), although averages were generally 5 or less. Most of this use is probably linked to DH rather than frontcountry use (note: counts have not yet occurred outside the DH season).

Lower Chattooga Boating Use

Although this report focuses on the Upper Chattooga, it is useful to briefly review boating use information from the Lower Chattooga for context. A summary of Lower Chattooga boating use from 1988 to 2005 was recently completed (Vagias, 2006). The following are based on findings from that report (with some additional information from the Sumter National Forest Plan).

- The number of boaters on the Lower Chattooga since 1988 has ranged from about 50,000 to 80,000 per year, while the number of trips has ranged from about 4,000 to 8,500. In recent years, annual use has been about 60,000 people and 6,200 trips.
- About 70% of boaters but only 34% of trips are commercial; this is because commercial trips are considerably larger (average: 24) than private trips (average: 4). A third type of trip, “instructional clinics,” represents about 4% of trips and people using the river.
- There is much higher use during summer months. About 63% of boating occurs from May through August. About 8% occurs from November through February.

- About 90% of commercial boaters use rafts. Private boaters use kayaks (66%), canoes (21%), rafts (7%), inner tubes (4%) or other craft (3%).
- Use levels on segments vary, with most trips occurring on Sections 3 (50%) and 4 (38%). Only 2% of trips occur on Section 1 and 10% on Section 2.
- There is little commercial use on Sections 1 and 2, but it comprises 65% of people and 25% of trips on Section 3 and 85% of people and 46% of trips on Section 4.
- Across the 1988 to 2005 period, 120 to 170 commercial boaters and 45 to 50 take private trips per day on Section 3 in peak summer months. The total number of boaters per day on Section 3 averages about 200 in the highest use month.
- On section 4, there are 110 to 175 people commercial boaters and 15 to 25 private boaters per day; the total number of boaters averages about 200 people per day in the highest use month.
- Daily averages across a month can be misleading because there appears to be a substantial weekend peak, particularly for private boaters. A daily analysis of Section 4 private boating use in recent years is provided in a later section on potential Upper Chattooga boating use (see below).
- The current Forest Plan (USFS, 2004) includes limits for commercial use and targets for private use (the latter have generally not been exceeded). The commercial use limits vary by segment, season, weekends/weekdays, and flow levels; private limits vary by segment and weekend/weekdays.
- In general, commercial use limits range from 4 to 7 trips per day on Section 3 and 4 to 6 trips per day on Section 4. There are also "people per day" limits ranging from 160 to 280 people on Section 3 and 160 to 360 on Section 4 (depending upon type of day, season, or flow), although these are less often reached because commercial trips seldom run at the maximum commercial group size limit of 40.
- Private use limits (which have not been exceeded often enough to trigger a limited entry permit system) are 125 people (weekdays) and 175 (weekends) for Section 3; they are 75 (weekdays) and 160 (weekends) on Section 4.

Other Lower Chattooga Use

The spot count program included counts at several lower river locations. During the use estimation workshop, agency staff also made use estimates for non-boating activities on the Lower Chattooga. Some highlights:

- Spot counts at the West Fork parking lots (Section 1 use indicator) showed a maximum of 6 vehicles and an average of less than 2 from August through January. There were slightly higher counts on weekends, but no obvious seasonal pattern. Workshop estimates for frontcountry recreation on the West Fork indicate that as many as 30 PAOT may use this area in peak summer months, although weekend averages are closer to 20 and weekday averages are under 10.
- Spot counts at Earls Ford (start of Section 3) showed a maximum of 6 vehicles and average of 1 to 3 vehicles parked in this area from August through January. There was slightly higher use in November and January, and slightly higher use on weekends.
- Workshop estimates for Section 3 indicate that over 100 PAOT may engage in frontcountry recreation (swimming, relaxing, warm water fishing) on peak summer weekends, but average weekend levels are likely to be about 80 PAOT, with less people on weekdays. For the same

reach, they estimate that trail users (hikers, backpackers, and horseback riders) may peak about 18 PAOT on summer weekends, but average about 10 to 12 on other days.

- Spot counts at Highway 76 (end of Section 3, start of Section 4) showed a maximum of 25 vehicles and averages of 5 to 12 vehicles from August through January. There were higher counts on weekends in some months, but not in others. The highest use month was October.
- Spot counts at Woodall Shoals (in Section 4) showed a maximum of 13 vehicles and averages of 1 to 4 vehicles from August through January. There were higher counts on weekends in some months, but not in others. The highest use month was October.
- Workshop estimates for all of Section 4 indicate that about 30 PAOT may engage in frontcountry recreation (swimming, relaxing, warm water fishing) on peak summer weekends, but average summer levels are likely to be about 10 to 15 PAOT on typical weekdays and weekends, respectively.
- Spot counts at Tugaloo Lake (Take-out for Section 4) showed a maximum of 8 vehicles and averages of 1 to 7 vehicles from August through January. There were higher counts on weekends in October and November, but not in other months. There was a far greater decline in use after October at this site compared to others. Note: Use at this site may also reflect some "downstream" reservoir use, which confounds river estimates.

Estimating potential whitewater boating use

It is challenging to estimate use for recreation opportunities that are not currently provided, but it is possible to define potential ranges based on other similar rivers and specific characteristics of the Upper Chattooga. Information that helps define these ranges for the most likely boating use (whitewater boating for highly skilled boaters) includes:

- There are several variables that affect use levels. A partial list might include proximity of population centers, quality of the boating run, difficulty of the run, quality of the scenery or other setting characteristics, length of the shuttle, availability of facilities (e.g., parking areas, rest rooms, nearby camping), availability of flows, availability of other rivers during the same time period (competing substitutes), crowding, fees, and permit requirements. It is beyond the scope of this analysis to comprehensively assess how these variables may influence potential Upper Chattooga boating use, but we have tried to consider them.
- Section 4 on the Chattooga is the river segment with reliable use data that is most similar to the challenging whitewater reaches on the Upper Chattooga. Section 4 is roughly the same distance from population centers, is commonly boated as a day run, has considerable private use, and requires at least Class IV skill (there is some debate whether rapids are Class IV or V, but they appear to be slightly easier than several Upper Chattooga rapids based on the expert panel report).

  A limitation of this comparison is that Section 4 is predictably boatable year round, although sometimes flows are less than optimal. In contrast, the Upper Chattooga segments may be boatable for less than 31% of the year, with only about 10% of days (34 total) providing higher quality whitewater flows (see Chapter 7). More importantly, boaters must be opportunistic to use the river when rain events provide sufficient flow (they typically occur for only a day or two at a time, and with little "notice").

  An analysis of Section 4 private use from 2003 to 2005 is given in Figure 3. It shows the median number of boaters per day for each month for 2003, 2004, 2005, and for all years

from 1988 to 2005 combined. It also shows the maximum number of boaters per day in each month for 2003-2005.

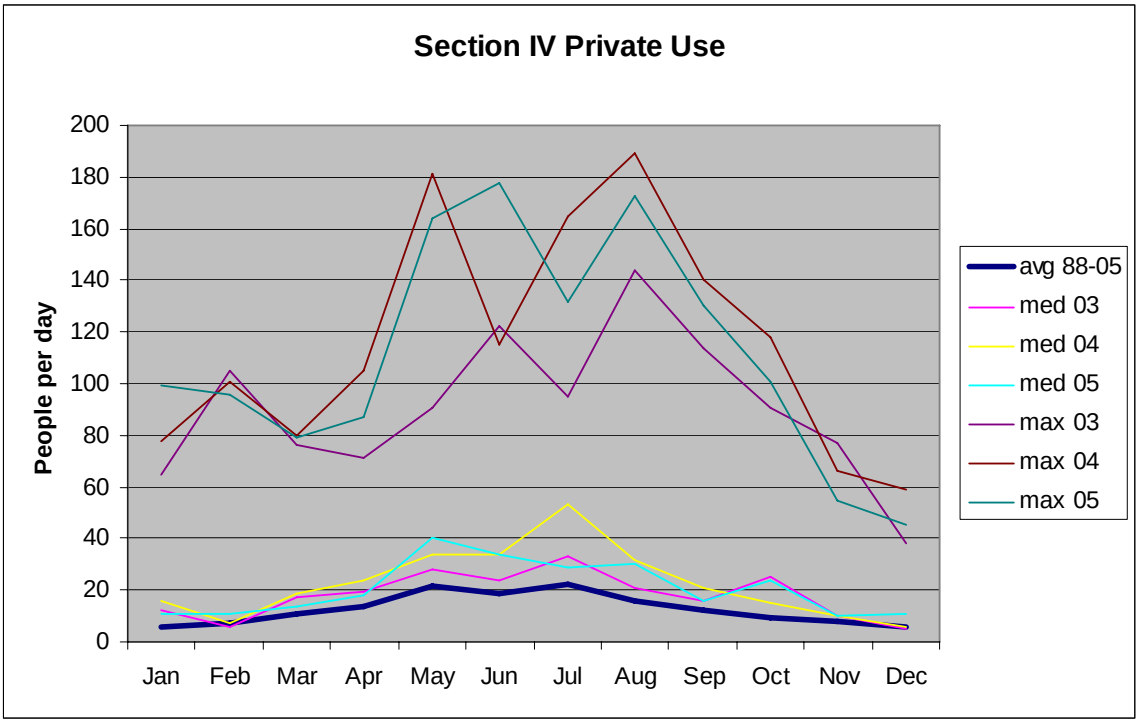

Figure 3. Median and maximum private boaters per day on Section 4 of the Chattooga River.

Maximum use levels in Figure 3 show that private use can exceed 180 boaters on the highest use summer days, and can reach 100 from January through April. These high use days were invariably on weekends or holidays.

Most days have much lower private use levels, typically 30 to 50 boaters per day in late spring and summer, and 10 to 20 in other months. The long-term average from 1988 to 2005 (from Vagias, 2006) appears somewhat lower than from 2003-2005, which suggests that private use levels may be increasing on this reach.

- Overflow Creek, a tributary of the West Fork Chattooga, offers another river for comparison. This "creek" segment appears to be slightly more difficult than Upper Chattooga segments, and may have boatable flows slightly less often, but it is well known for its outstanding whitewater. Boaters carefully watch flow indicators to take advantage of rare boatable flows.

  There is currently no documented information about the number of boaters who run Overflow Creek. The Forest Service recently extended (November 2006) its self-registration system to Overflow, but there have been few boatable days this winter and spring. Anecdotal information from several sources suggests that 30 to 40 boaters per day might boat the reach under "ideal" conditions (predicatable, boatable flows and good weather) but more common use levels are 10 to 20 boaters on the infrequent days when boatable flows occur.

- Wilson Creek, NC, with a short Class IV gorge, offers another comparison river. It has whitewater of similar difficulty to the Upper Chattooga, is about the same distance from population centers, and is boatable about 50 days a year (requiring careful attention to indicator gages and opportunistic trip planning). However, it is unlike the Chattooga because it has easier access (a road along most of its length), some commercial rafting use, and a less

remote setting. While formal use statistics are not available, high use days may peak at 100 private boaters (warm weekends), but more commonly range between 20 and 50 (Hendricks, 2007).

- Estimating boating use on the Upper Chattooga (if it were allowed) are particularly challenging because of potential "latent demand" from the 30 year closure on boating use and the publicity surrounding the current study and planning process. The publicity from the expert panel fieldwork alone led to hundreds of message board postings on boater and angler websites (e.g., BoaterTalk, North Georgia Trout On-Line) debating various issues. Although not all boaters who participated in these internet debates would or could boat the river if it were opened, the amount of attention it has generated is likely to "artificially" increase demand in the short term.
- Stakeholders have debated the length of time for more "typical" boating use patterns to appear (if boating were allowed); it probably depends on how often the river is boatable and what further publicity is generated as initial boaters run the river. Initial flow releases for boating after dam relicensing have attracted hundreds of boaters (e.g., Tallulah, North Fork Feather, Cheoah), but these "events" have planned flow releases and known boatable flows that are not comparable to the situation on the Upper Chattooga (where flows are unregulated and boaters must be opportunistic). We estimate that any "latent demand effect" is likely to diminish substantially after one year if boating were allowed (assuming more than 30 boatable days occurred in that year), but the effect would probably persist for two to three years (if boating were allowed).
- For the sake of discussion, we have tried to "guesstimate" maximum potential use levels for the Upper Chattooga, assuming no use limit and "no latent demand effect" (Table 1). We have assumed use on the Upper Chattooga would be higher than Overflow Creek (which is more difficult and is boatable less often), but lower than Wilson Creek or Section 4 on the Lower Chattooga (which are less difficult and have easier access).
- Estimated numbers of boaters are highest for the Ellicott Rock reach (because it has the highest quality whitewater for the length of the run), lower for Rock Gorge (fewer rapids and more flat water), and lowest for Chattooga Cliffs (with potentially difficult access and more portages). Estimates are made for "ideal conditions" on weekdays and weekend days. "Ideal conditions" refer to optimal standard boating flows (see Chapter 7 for a description), reasonable planning horizons (boatable flows were predictable at least a day or two ahead), and reasonable weather. Less than ideal conditions would probably reduce use below the "ideal weekday" level by about half.

Table 1. "Guesstimated" maximum number of boaters per day on Upper Chattooga segments.

	"Ideal conditions" on a weekend day	"Ideal conditions" on a weekday
Chattooga Cliffs	20	5
Ellicott Rock	70	20
Rock Gorge	40	10

Ideal conditions = Optimal boating flows predictable 2 days in advance, and reasonable weather.

- Considering these numbers and the information from Chapter 7 about flow ranges and boaters' ability to use them, we have "guesstimated" the total number of boaters that might use the Upper Chattooga in an average water year. Assumptions and "guesstimates" are described below.

- About one-half (17) of the 34 days in the optimal range would have predicatable flows that can be used by regional boaters.
- About one-third (6) of those days would occur on weekends and might approach peak weekend maximums in Table 1.
- The remaining 11 "ideal" days might approach weekday maximum use levels.
- The other 17 days in the optimal range (those with less predicatable flows) might have about half the use of ideal weekdays.
- About half the 77 days in the acceptable but not optimal range would have no use; the other half would average about 5 boaters per day.
- Taken together, these assumptions suggest whitewater boating use levels would not exceed 1,500 to 2,000 segment-user days in an average water year. Because some boaters might run more than one reach on a given day, the total number of user days would probably not exceed 1,200. This is about 7% of private boating use (and 2% of all boating use) on the Lower Chattooga in recent years.

Estimating potential scenic boating use

If allowed, scenic-oriented boating could occur on several short reaches (e.g., the Lower part of Ellicott Rock, Burrells Ford to Big Bend area, Nicholson Fields). "Guesstimating" use on for these opportunities is more challenging than for whitewater-oriented opportunities, because there are few similar rivers to use for comparison (most such rivers have road access on either end).

In general, scenic-oriented boaters prefer vehicle access on both ends, so use is likely to be low. However, 1 to 2 small groups (3 to 5 people) per day might float the Nicholson Fields reach when flow levels and weather are favorable (probably fewer than 50 days a year). This is the longest scenic-oriented reach, has the easiest access (although it still involves a ¾ mile carry-in), and might be of interest to some boating-based anglers. On the other reaches, we expect less than ten scenic-oriented trips per year. Taken together, scenic boating is likely to produce less than 300 to 400 user-days per year; this is comparable to boating use on the Lower Chattooga's Section 1 (a similar reach that has good road access).

Future trends among existing and potential uses

Recreation planning requires information about future demand for existing and potential opportunities. For many recreation activities, past use may be a relatively good predictor of future use. However, some activities may be in developing or declining trends, in which case other factors should be considered. Factors that influence trends in recreational activities include population growth, economy, availability of nearby alternatives, free time, diffusion of new technologies and techniques, media and marketing images, availability of instruction, skill development opportunities, weather, fish stocking and regulation changes, equipment, demographics, and an activity's "participation cycle."

It is beyond the scope of the present report to provide detailed analysis of recreation trend information or the influence of factors named above, but we have collected some findings from recent studies or other sources including (1) a demographic profile of the Appalachian region (Pollard, 2005); (2) a summary of natural resource-related information as part of the Southern Appalachian Assessment (USFS, 1998); (3) a national survey of human-powered recreation participation (OIA, 2005); and projections of outdoor recreation participation (Cordell et al.,

1999). At the use estimation workshop, agency staff also assessed recreation use trends for specific types of activities on the Chattooga.

Demographic and visitation trends

- Demographic information suggests that population growth in the Southern Appalachian region has been consistently high in recent years. About one third of regional counties grew 20% or more in the 1990s and 2000-2003 census data suggests this growth is continuing. This is generally a faster population growth rate than the national average. (Pollard, 2005).
- Georgia is the sixth fastest growing state in the country, and it was fueled by 43% growth in the northeast counties in the 1990s. South Carolina's Appalachian counties also grew faster than the rest of the state. Increases in population were due primarily to natural increases, internal migration, and some immigration (particularly in Northern Georgia). (Pollard, 2005).
- Visitation trends on National Forests in the Southern Appalachians increased from about 7 million visitor days in 1970 to 13 million in 1980 (over an 80% increase), but that increase slowed from 1980 to 1990 (16 million, an increase of about 20%), and now appears to be keeping pace with population trends.

Overall recreation participation trends

- A review of recreation use as part of the Southern Appalachian Assessment suggests increased recreation participation in almost all activities except hunting (USFS, 1998, p. 62).
- Older and non-white populations are increasing their participation rates in recreation, and growth rates are above the regional average for these sub-groups (e.g., substantial growth is related to increases in retirees and non-white groups). However, most recreation use days (over two-thirds) are still produced by the "most active" 25% of participants, who are predominately white, male, and under age 60 (USFS, 1998).
- Vacation patterns are shifting nationally and regionally. In general, people are taking more "long weekend trips" in comparison to "traditional 2-week vacations" (USFS, 1998).

Frontcountry recreation

- Frontcountry recreation (e.g., picnicking, sightseeing, swimming, etc.) is likely to increase at slightly greater rates than population increases as more people conduct shorter recreation trips closer to home.
- For example, participation projections estimate that sightseeing in the South will increase at about the population rate of 40% from 2000 to 2020 (Bowker et al., 1999). However, projections estimate that picnicking will increase at a slightly slower rate of 32% by 2020.
- Workshop participants generally reported stable or slow growth for these activities on the Upper Chattooga.

Frontcountry and backcountry angling

- According to the National Survey on Fishing, Hunting and Wildlife-related Recreation (FWS, 2002), the number of anglers nationally declined 3% from 1996 to 2001. Examining state data for Georgia, fishing participation has been flat (rather than in decline) in recent years.

- Participation projections from the National Survey on Recreation and the Environment suggest fishing is likely to grow, but not keep pace with population. In the South, growth is expected about 20% from 2000 to 2020.
- The estimates above include all types of fishing and were not split out for different types of fishing. In contrast to flat or slightly declining participation, fly-fishing appears to be growing based on the OIA annual survey. In 1998, about 13 million people nationwide fly-fish (about 6% of adults) but this had increased to 18 million in 2004 (8%).
- Some workshop participants generally felt regional fishing use had seen considerable growth (particularly frontcountry fishing) from the mid-1970s to the late-1990s, but it appears to have been more stable since that time (Rankin, 2007). Individual segments of the river (particularly the DH segment, established in 2000) have probably seen increased use and are candidates for more growth in the future.
- Angling trends on specific rivers such as the Chattooga also depend on stocking and regulation stability. Major changes in current stocking levels, or regulation changes that favor one type of fishing over another (e.g, extending DH reach), would probably affect future use.

Backpacking

- Backpacking use appears to be flat or declining in recent years, although it saw substantial growth from the mid-1970s through the mid-1990s. From 1972 to 1992, the percentage of people in the South who participated in camping increased from 5% to 13% (USFS, 1998)
- According to the OIA survey, however, backpacking has actually declined from about 16 million participants (8%) in 1998 to 13 million (6%) in 2004.
- Going forward, participation projections estimate that backpacking in the South will increase about 23% by 2020 (Bowker et al., 1999), which would be less than the population increase.
- Group sizes and trip lengths among many backpackers are also apparently decreasing (Roggenbuck, Widner, and Williams 1994).
- Workshop participants believe that backpacking use was generally stable in the Chattooga basin in recent years.

Day hiking

- Day hiking appears to be increasing at or slightly faster than the population rate. Participation projections estimate that hiking in the South will increase about 48% by 2020 (Bowker et al., 1999).
- In contrast, the OIA survey suggests that hiking participation has been relatively stable nationwide from 1998 to 2004 (72.2 million to 75 million, both about 34%).
- Workshop participants believe that hiking has been generally stable in the Chattooga basin in recent years.

Whitewater boating

- Whitewater kayaking is a specialized recreation activity that comprises a small proportion of use in comparison to some other outdoor recreation activities. About 1 to 2% of the national population participates in whitewater kayaking (Whittaker & Shelby, 2002).

- Within whitewater kayaking, the proportion of boaters interested in "creek boating" (on smaller high gradient rivers) or Class IV-V rapids is generally small. In an Oregon study (Whittaker & Shelby, 2002), Class IV-V boaters were estimated to be 10 to 15% of all whitewater kayakers, and the Southern Appalachian region is probably similar.
- According to the OIA survey, whitewater kayaking saw growth in the mid to late 1990s, but that growth has flattened in recent years (OIA, 2005). In 1998, an estimated 4 million people kayaked (2% of adults), and by 2004 this had risen to 10 million (4.6%).
- Use data from the Lower Chattooga showed considerably higher use in the late-1990s, with a drop-off in the first part of this decade (possibly explained by several recent low water years).

Scenic boating

- Boating on less challenging rivers in canoes, tubes, or other small craft has higher participation rates than whitewater boating, and may be increasing at a greater rate.
- About 10% of the national population participates in canoeing (OIA, 2005), and an additional 3% participate in recreational (sit-on-top) kayaking. Not all this use occurs on rivers, but there is probably a larger population of potential users for floating on easy rivers.
- Scenic floating has grown consistently since 1998 (OIA, 2005); however, use of Sections 1 and 2 on the Lower Chattooga (which features scenic floating) has generally declined from peaks in the mid-1990s.

Future use conclusion

Taken together, recreation use trend information suggests that Chattooga use is likely to increase at the rate of population increases for the region, which may exceed 20% over the next decade. Within that general increase, however, some activities may increase at slightly higher rates (e.g., frontcountry recreation, day hiking, whitewater boating, and fly fishing), while others may grow more slowly (e.g., frontcountry fishing, backpacking). The actual distribution of use in the Chattooga corridor or across the seasons is less easy to predict, and may have a large influence on whether use increases create unacceptable impacts.

5. Biophysical Impacts

This chapter examines biophysical impacts from existing or potential recreation uses. For each type of impact, it describes (1) the range of likely impacts on the Upper Chattooga, (2) potential standards to consider in the LAC / NEPA process, and (3) lessons from research or management about addressing these impacts.

Introduction

Biophysical impacts refer to "on the ground" impacts (e.g., trail erosion, bare ground at camps, damaged trees, and litter) as well as impacts on wildlife species (e.g., disturbance events, attraction impacts). Two chapters of the literature review (Berger, 2007b) focus on trail/site and wildlife impacts, reviewing general knowledge, types of impacts, and ways that managers typically address them. Findings for specific impacts are in the sections below. We have also summarized general findings about biophysical impacts from that review (or other sources):

- Recreation use can have direct effects on biophysical resources (e.g., trampling of a plant species) or indirect effects (e.g., erosion that increases sedimentation in a river, which subsequently reduces fish spawning success). It is more difficult to link specific recreation use to longer term, indirect effects.
- Biophysical impacts are often but not always interrelated (e.g., trail impacts may be correlated with camp impacts). Impacts vary with type of use, behavior, and multiple environmental factors (type of vegetation, slope, soil type, etc.), so they need to be assessed on a case by case basis.
- Recreation use usually causes greater changes in biophysical impact levels during "pioneering" (initial) use, with decreasing impact as additional use occurs (Hammitt and Cole, 1998; Leung and Marion, 1996).
- Biophysical impacts can influence perceptions of crowding and the quality of recreation experiences. However, studies suggest that many recreation users are more tolerant of biophysical impacts (e.g., bare ground at camps, size of fire rings) than managers (Martin et al., 1989; Shelby, Vaske, and Harris, 1988; Manning, 1999; Hall et al., 2001).
- Understanding the causes of biophysical impacts (e.g., the types and quantities of recreation use) is important for developing strategies that reduce or mitigate them. The type of use or specific use practices is usually more important than the number of users.
- Multiple biophysical impacts may interact or have greater cumulative consequences than an individual impact (Leung and Marion, 2000; Hammitt and Cole, 1998). However, it is crucial to specify individual impacts before assuming a broader problem.

Estimates of biophysical impacts in the Upper Chattooga corridor are based on recent monitoring conducted in 2006-07 (USFSb, 2007). This included documenting all the designated and user-created trails, amount of litter along trails, the number and condition of campsites (bare ground, cleared area, cut trees, and amount of litter), sites with erosion problems, and the proportion of trail and camps within 20 feet of the river. The monitoring effort covered Forest Service lands in the basin from Grimshawes Bridge to Tugaloo Lake, including the West Fork.

This monitoring effort documents baseline information about biophysical impacts. Comparable information from the time of designation (or the intervening 30 years) is not available.

Trails and trail erosion

Trail impacts are an issue on the Upper Chattooga; the primary concern is that erosion from trails may increase sedimentation and turbidity in the river, which could have additional indirect effects on water quality and aquatic species. Trail impacts also have an aesthetic component; higher impacts associated with poor trail conditions may increase feelings of crowdedness or decrease the sense of remoteness or naturalness.

Existing impacts

USFS monitoring in 2006-07 documented the miles of designated and user-created trails and the number of sites with erosion problems along the Upper Chattooga. Findings are summarized below; more detailed information is available in the Forest Service report (USFS, 2007b).

There are 35.0 miles of designated trails and 19.3 miles of user-created trails in the Upper Chattooga corridor. This compares with 45.2 miles of designated trails and 33.1 miles of user-created trails along the lower river. Miles of each type per segment are given in Figure 4.

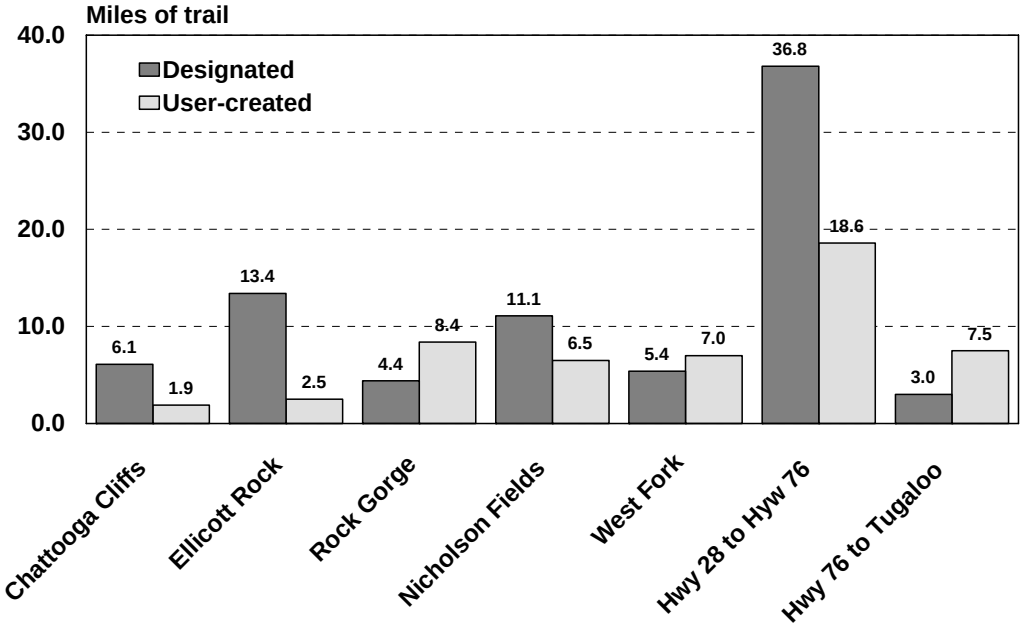

Figure 4. Miles of designated and user-created trails for Chattooga River Segments.

- User-created trails are more prevalent in the Rock Gorge and Nicholson Fields reaches compared to others on the upper river.
- The map produced by the monitoring effort shows the greatest number of user-created trails near Burrells Ford and in the Nicholson Fields Reach. To help "standardize" the miles of user trails for the relative sizes of the different river segments, we calculated the miles of user-trails per mile of river. This analysis showed less than a mile of user-created trails per mile of river for Chattooga Cliffs (0.4), Ellicott Rock (0.5), and Rock Gorge (0.9). Nicholson Fields averaged 2.0 miles of user trails per river mile and lower river segments averaged about one mile of user trails per river mile.

- There were 91 erosion problems observed along trails in the upper river. Just under half (44) of those were in the Rock Gorge segment, with many in the higher use area near Burrells Ford Bridge. There were also 27 in the Nicholson Fields Reach (most near the Highway 28 Bridge), 17 in Ellicott Rock, but only 3 in Chattooga Cliffs.
- The number of erosion sites was "standardized" relative to the miles of trail and the miles of river in each segment. This analysis showed relatively few erosion sites for Nicholson Fields (2.1 sites per trail mile and 6.8 per river mile) and Rock Gorge (2.5 per trail mile and 6.3 per river mile) and fewer for Ellicott Rock (1.1 sites per trail mile and 3.4 per river mile). On the lower river, the highest numbers were for Highway 28 to Highway 76, which includes Section 2 and 3).
- GIS mapping allowed an assessment of the miles of trail that were within 20 feet of the river (which may create a greater erosion threat). For designated trails, about 2% of the mileage was within 20 feet of the river. For user trails, about 10% were within 20 feet, with the highest amount on the West Fork (28% of user trails were within 20 feet). In the Ellicott Rock and Rock Gorge reaches, about 8% of user trails were close to the river. On the lower river, about 9% of the user trails from Highway 28 to Highway 76 were close to the river.
- During the expert boater panel, access to and from the river was at Norton Mill Creek, Bull Pen Bridge, Burrells Ford, and the take-out below Highway 28 Bridge, all using existing designated or user-created trails. To the extent that boaters use existing trails, adding boating use would not produce extensive new trail impacts at these sites unless trails are poorly designed. For example, during the expert panels boaters used a short well-defined trail at Burrells Ford Bridge (downstream on the GA side) to access the river. This trail may have erosion problems that could be exacerbated by boater use (particularly when trails are wet), but reconstruction or use of other existing trails could mitigate such impacts.
- During the boater panel fieldwork, boaters scouted or portaged 5 to 7 rapids between Norton Mill Creek and Highway 28. At the flows during the fieldwork, boaters did not pioneer new routes, and were able to stay below the ordinary high water mark (where soils and vegetation begin) in all but one location. However, one might assume that regular boating use (if allowed) might develop five user trails that are above high water for scouting or portaging at some of these areas. If the average length of these trails is about 100 feet, about one-tenth of a mile of new trails would be developed. This would be less than 1/5th of 1% of existing trail miles, about half of 1% of user-created trail miles, and about 4% of existing user-created trails within 20 feet of the river.
- Boating (if allowed) might also create a few new trails to attraction sites that are currently unused by hikers, swimmers, or anglers. The locations and lengths of these trails are difficult to predict, but the sum total is probably similar to the amount described for portage trails (above). As with portage trails, the level of impact depends on soils, trail routing and design, level of use, and timing of use.
- In general, existing or new trails from potential boating appear unlikely to create substantial sedimentation problems from an ecological standpoint. According to a study of sediment sources in the Chattooga watershed, about 2.6% of sedimentation is due to recreation use (presumably trail and campsite site impacts), while 80% is due to road sources, 9% to timber harvest, 4.5% to agriculture, and 2.8% to development (Van Lear, Taylor, & Hansen, 1995). Trail and site impacts are probably more important from an aesthetic / scenic perspective, with highly impacted sites detracting from a "sense of naturalness."

Potential indicators and standards

The initial monitoring report provides a baseline for tracking and managing trail impacts, suggesting several possible indicators:

- Miles of user-created trail (per segment, and standardized per mile of river in a segment).
- Number of erosion problems (per segment, per mile of trail in a segment, per mile of river in a segment)
- Miles of designated trail within 20 feet of the river
- Miles of user-created trail within 20 feet of the river

In all cases, standards could be expressed in terms of change from the baseline condition (even if that baseline is not the condition at the time of WSR designation, which is unknown). The simplest standards might be phrased as "no net increase over 2006-07 levels;" this would address the "no degradation" standard of the WSR Act. If the goal is to enhance resource values, "reduce impact" standards might go further (these are examples):

- Reduce miles of user created trails to less than 0.5 miles per mile of river in a segment.
- Reduce number of erosion problems on designated trails to 0.
- Reduce number of erosion problems to less than 1 per mile of user created trails.
- Reduce miles of designated trail within 20 feet of the river to less than 1% of total designated trail miles.
- Reduce miles of user-created trail within 20 feet of the river to less than 5% of total user-created trail miles.

There is little specific information from existing studies about "how much trail impact is too much" from a visitor or manager perspective. Standards often specify a "no degradation" goal, but establishing more stringent standards is an "improvement" goal based on the assessment of current conditions. If those standards were met with trail design or maintenance projects, more stringent standards (additional improvement) might be contemplated in the future.

Managers should note that the amount of user-created trails does not necessarily indicate a problem. Some user trails follow old logging roads and may be well-designed or access places that are appropriate for visitation. In other cases, user trails may be redundant, part of an expanding social trail network, or poorly located through sensitive areas. A "next step" could evaluate the function and condition of specific user-created trails to determine whether some should be re-routed, eliminated, or turned into designated trails (to be shown on maps, with regular monitoring and maintenance).

Addressing trail impacts

The literature on trail impacts, their effect on biophysical resources, and ways to address them suggest the following considerations:

- Most trail impacts are caused by construction itself (opening tree canopies, soil compaction, changes in drainage patterns, or habitat changes), although heavy use and lack of maintenance can exacerbate problems (Cole, 1999). Most people do not think of designated trails themselves as "an impact," but they represent a change from the natural condition. By designating a trail in a particular "condition class," managers are essentially agreeing that the corresponding level of impact is acceptable.

- Assessing trail impacts requires documenting the length and location of trails and making decisions about the "appropriate" size and condition for their level of use. For example,

wider trails for side-by-side walking may be appropriate in a frontcountry setting but inappropriate in the backcountry. Clarity about the type and condition of designated trails is a way of defining "acceptable" vs. "unacceptable" impacts. In the Upper Chattooga, most designated trails are designed for backcountry settings (single track, narrow tread), but a few follow old logging roads and may be wider.

- Trail impacts occur rapidly from pioneering uses, while recovery occurs more slowly, so the creation of new user trails is often a major issue. User-created trails also may be poorly located or poorly "designed" (even if they access places that are acceptable for people to visit such as satellite camps or fishing holes). An evaluation of these trails can help decide whether they should be left "as is," or redesigned, rehabilitated, or removed.
- The number of people using a trail does not usually determine its condition. By definition, a well-designed trail can withstand intended uses, so increasing numbers seldom increases impact. Unacceptable impacts usually come from poor design, unanticipated use patterns that lead to user-created trails, or unintended uses (such as horse, bicycle, or motorized use of trail designed for foot traffic).
- The primary way that trail impacts are addressed is by redesigning, rehabilitating, or eliminating trail segments. For trails that managers want to rehabilitate or close, barriers such as logs, brush, rocks, or shrub transplants may be more effective than signs. Where re-routing is an option, new alignments should be chosen carefully, particularly as they approach riparian areas and water sources where poor design can exacerbate sedimentation (Marion, 2003).

Litter on trails

Lack of litter is a key component of high quality recreation management, and multiple studies show that it is important to recreation users and managers. The effect of litter on aesthetic evaluations is a major issue, although litter may also affect wildlife, soils, or water quality.

Existing impacts

The Forest Service monitoring project documented the amount of trash (measured in gallons) along designated and user-created trails on public land in the Chattooga basin. Detailed findings are available in that report, but summaries are given in Figure 5 and the bullets below:

- In general, there appears to be more trash along trails in the lower river segments (particularly Sections 2 and 3 from Highway 28 to 76). The amount of trash per mile of trail was also high for Nicholson Fields, West Fork, Chattooga Cliffs, and below Highway 76.
- Review of individual trail data suggests that high amounts for a segment are often influenced by a few areas with considerable trash (over 10 gallons) rather than multiple areas with widespread but small amounts of trash. This suggests that litter impacts are location-sepcific (e.g., sites prone to "dumping") or caused by a small number of inconsiderate users.
- There was considerably more trash on user-created trails than designated trails. This may reflect better agency maintenance, better clean-up efforts by users, or better "norm activation" on designated trails (Vaske, Donnelly, and Whitaker, 2005).

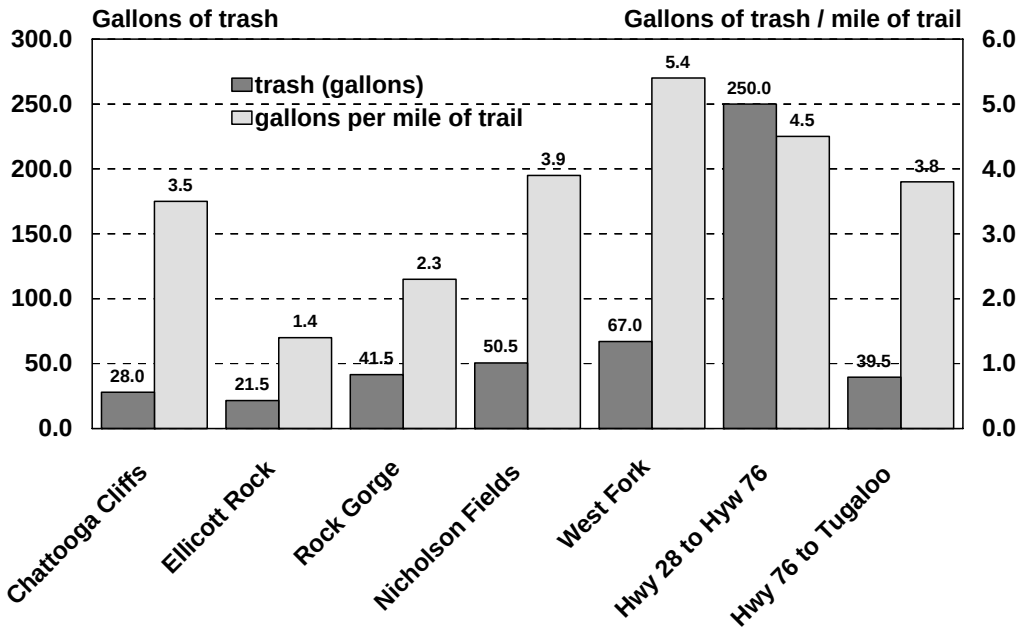

Figure 5. Gallons of trash observed along trails (and per mile of trail) on Chattooga River segments.

- Monitoring was rarely able to determine which types of users were responsible for trash at a site, and this has not been analyzed.
- If boaters were allowed on the Upper Chattooga, they probably would not contribute substantially to ***trail-related*** trash because they would travel along the river rather than trails. However, they might contribute to trash on the short trails used to access the river at bridges. Boating use (if allowed) might also increase litter ***along the river***, just as any additional use has the potential to increase litter. Having noted this possibility, high skilled boaters in hard shell craft are less likely to contribute to litter from capsizing and losing their gear, compared to less skilled boaters using open canoes or rafts (more common on Sections 1, 2, and 3 on the Lower Chattooga).

Potential indicators and standards

The initial monitoring report provides a baseline for tracking and managing trail litter; the obvious indicator is "gallons of litter per mile of trail." A typical standard might be expressed in terms of change from the baseline condition (even if that baseline is not the condition at the time of WSR designation, which is unknown). However, current litter levels strike us as relatively high. If the goal is to enhance resource values, a "reduce impact" standard might be "reduce litter to less than 1 gallon per mile of trail."

Many studies show low tolerances for litter in recreation settings; in most wilderness or backcountry rivers, we have documented close to a "zero tolerance" standard. No specific studies for the Upper Chattooga directly asked users to express a tolerance for litter among trails, although the Ellicott Rock study (Rutlin, 1995) showed that 91% "strongly dislike" litter in campsites.

Addressing trail litter impacts

Few studies have documented a relationship between use levels and litter. Instead, litter appears to be caused by a small proportion of users and correlated with environmental cues (such as the presence of other litter, general condition of the setting) and the strength of norms within recreating groups (Cialdini et al., 1991; Schwartz, 1973; Heberlein, 1971).

Two general approaches are commonly used to address litter impacts: regular maintenance/clean-up activities or directed education/regulation efforts. Clean-up efforts are self-explanatory and limited mostly by agency resources. Education efforts are driven by the belief that people will stop undesirable behavior once they are aware of the impacts it causes. However, littering still occurs despite persuasive social norms against it.

Camp impacts

Camp impacts are an issue on the Upper Chattooga; the primary concerns are the amount of bare ground and cleared area, damaged trees, and litter. Camp site impacts also have an aesthetic component; higher impacts associated with poor camp condition may increase feelings of crowdedness or decrease the sense of remoteness or naturalness.

Existing impacts

USFS monitoring in 2006-07 documented the number of camps, and at each camp estimated the amount of bare soil (in square feet), the additional cleared area (in square feet), the amount of litter at the site (in gallons), and the number of damaged trees in the area. Summarized information is given below; more detailed information is available in the Forest Service report (USFS, 2007).

- There are 97 campsites on the 21 miles of the Upper Chattooga, or 4.6 per mile (Figure 6). This compares to 101 sites on the 32 miles of the Lower Chattooga (3.1 per mile). The highest concentration of camps is in the Ellicott Rock and Rock Gorge segments, with over 8 per mile (but the Rock Gorge segment includes the 30 or so sites in the Burrells Ford walk-in campground).
- Of the 97 sites on the Upper River, about 26 (27%) are within 20 feet of the river. On the lower river, 15% of the camps are within 20 feet of the river. These sites represent greater erosion risks, and violate current regulations that require camping more than 50 feet from water. Over half of the upper river sites close to the river (15 or 57%) are on the Rock Gorge segment.

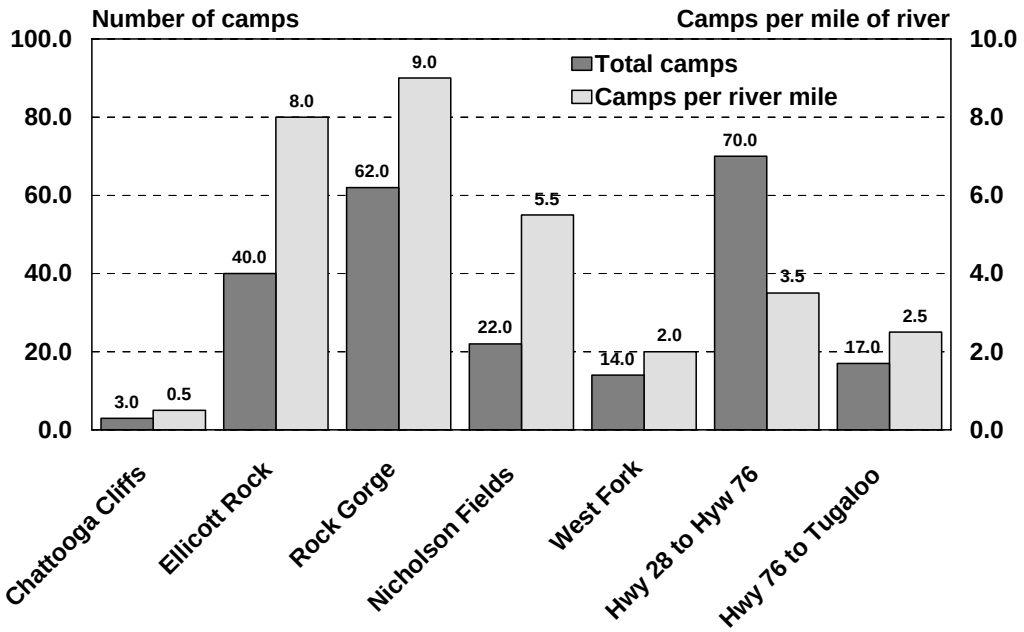

Figure 6. Camps and camps per mile of river for Chattooga River segments.

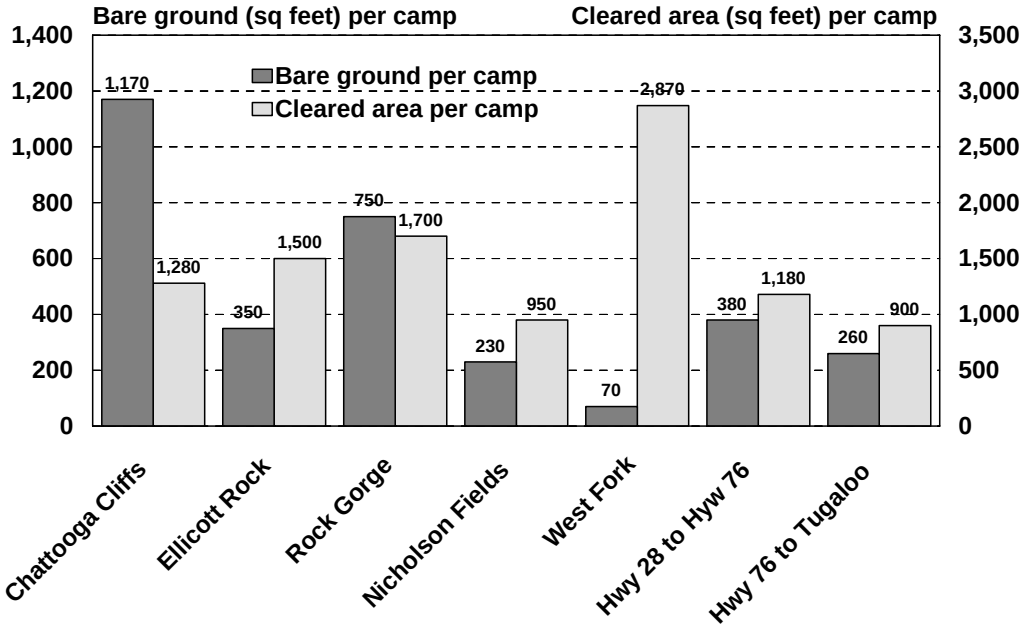

Figure 7. Average bare ground and cleared area per campsite for Chattooga River segments.

- The size of cleared area and bare soil varies considerably from site to site. Some had as little as 100 square feet of cleared area and no bare soil, while larger camps exceeded 4,000 square feet (with more than 2,000 square feet of bare soil). The median amount of cleared area was 1,000 square feet; the median amount of bare soil was 180 square feet.

- Average amounts of cleared area and bare soil are given in Figure 7. In general, the camps with larger cleared areas were on the West Fork and the upper river. The camps with larger amounts of bare soil were in the Rock Gorge and Chattooga Cliffs reaches (although the latter is skewed by having only three sites, one of which was relatively large at 2,500 square feet).
- The amount of trash (in gallons) and the number of damaged trees per campsite varied from site to site. A few had no trash or damaged trees, while others had over 10 gallons of trash and over 20 damaged trees. The average amount of litter was 0.5 gallons; the average number of damaged trees was 5.5.
- Average amounts of trash (in gallons) and damaged trees per camp are given in Figure 8. In general, segment differences were small for damaged trees. There were higher amounts of trash at camps from Highway 76 to Tugaloo Lake, although this was partially an artifact of two sites with 30 and 40 gallons of trash, respectively.
- Monitoring was rarely able to determine which types of users were responsible for trash at a site, and this has not been analyzed.
- If whitewater boaters were allowed on the Upper Chattooga, it is unlikely they would contribute substantially to ***on-river campsite impacts*** because few would camp from their boats. Whitewater boaters generally take day trips in areas with good access, particularly if whitewater is difficult and a boat loaded with overnight gear is a disadvantage. The short duration of boating flows would also encourage day trips to avoid stranding from low flows after a night camping. Among the scenic-oriented boaters, overnight trips would also likely be very rare.
- Although boaters (if allowed) are unlikely to camp from their boats on the Upper Chattooga, many would ***car-camp at dispersed or developed sites***, so boating could increase overall camping use in the area. Using the 1,200 boaters per year estimate and assuming that half camp one night in the area, boating would likely add about 600 camper-nights per year, mostly in the winter and spring.

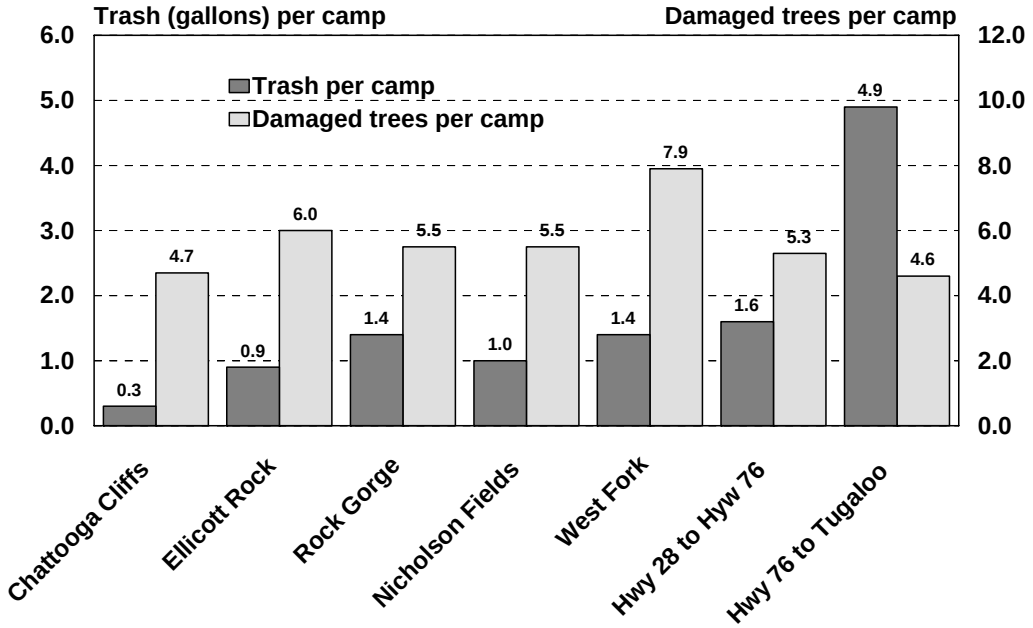

Figure 8. Amount of trash and damaged trees per camp for Chattooga River segments.

Potential indicators and standards

The monitoring report provides a baseline for tracking and managing camp impacts, suggesting several possible indicators:

- Number of camps (per segment and standardized per mile of river in a segment).
- Number of camps within 20 feet of the river (per segment and standardized per mile of river in a segment).
- Median or average square feet of cleared area per camp.
- Median bare soil per camp.
- Average gallons of trash per camp.
- Average number of damaged trees per camp.

In all cases, standards could be expressed in terms of change from the baseline condition (even if that baseline is not the condition at the time of WSR designation, which is unknown). The simplest standards might be phrased as "no net increase over 2006-07 levels" for each; this would address the "no degradation" standard of the WSR Act. If the goal is to enhance resource values, "reduce impact" standards might go further (examples only):

- Reduce camps to an average of less than 5 per river mile (assuming current numbers are too high).
- Reduce the number of camps within 20 feet of the river to 0.
- Reduce cleared areas at the largest camps to less than 2,000 square feet.
- Reduce bare soil at the largest camps to less than 500 square feet.
- Reduce average gallons of trash to less than 0.5.
- Reduce the number of damaged trees at high impact sites to less than 5.

There is little specific information about standards for these indicators from existing Chattooga studies. Establishing more stringent standards is essentially a way of expressing an "improvement" goal based on the assessment of current conditions. If those standards were met with campsite rehabilitation or maintenance projects, more stringent standards might be contemplated in the future.

In setting these standards, managers should note that the number of sites by itself does not necessarily indicate a management problem. However, some sites may be redundant or poorly located in sensitive areas. A "next step" could include evaluating the function and condition of specific sites to determine whether some should be redesigned, rehabilitated, or removed.

Addressing camp impacts

The literature on camp impacts, effects on biophysical resources, and ways to address them suggest the following considerations:

- Studies have consistently found that camp impacts typically occur rapidly during pioneering use (the first few groups that camp in an area). After a site has seen consistent use, additional parties camping on the site induce relatively little change (Marion and Cole 1996).

- Campsite expansion (new satellite campsites, social trails between tent pads, redundant trails to water sources) may be related to large group sizes rather than the frequency with which a camp is used. Group sizes larger than about 10 may trigger these kinds of expansions.

- Damage to trees may cause them to die, detracts from the natural setting, and may induce some micro-habitat changes (Hall & Farrell, 2001).

- Vegetation changes from camp impacts may increase invasive species, which can have indirect effects on wildlife habitat over the long term. Note: The current monitoring effort on the Chattooga did not document invasive species.
- A major concern related to camp impacts in wetter climates (like the Chattooga) relates to erosion and sedimentation. Locating camps away from water sources with drainage that avoids direct paths to the river is the technical fix for this problem.
- Cut trees and similar damage have been categorized as depreciative behavior, but it is unclear whether these result from willful violations or ignorance about appropriate "leave no trace" practices. The former require law enforcement; the latter may be reduced by education efforts (Roggenbuck, 1992).
- Fire ring size and location are an additional camp impact discussed in the literature; they were it was not measured in the present monitoring effort. Fires and fire rings are traditional in Appalachian forest settings (which have available wood and relatively lower fire danger compared to the arid west). Most Chattooga users also oppose restrictions on fires (Rutlin, 1994). However, large, poorly constructed, or litter-strewn fire rings may detract from an area's "naturalness." Most campsites on the Upper Chattooga have fire rings, and some are large; this is an indicator candidate for future monitoring efforts.
- Marion (2003) notes that individual site management actions (e.g., well-defined trails or barriers like logs) can limit the extent and severity of camp impacts by channeling use to more durable surfaces.
- Cole (1987; 1994) notes that durable campsites generally lack of groundcover vegetation or have resistant vegetation, have an open tree canopy, and a relatively flat but well-drained site. Restricting overnight use to designated camps with these characteristics (or otherwise durable locations) is a useful strategy for limiting camp impacts.
- Marion (2003) suggests that resource impacts are primarily related to visitor behavior rather than group size or frequency of use, which argues for an educational effort to encourage low impact camping practices.
- Site closures may be necessary to protect sensitive environments, rare flora and fauna, or fragile historic resources. However, this action results in loss of access and has a heavier managerial footprint (Cole, 1994).

Wildlife impacts

Recreation use has the potential to disturb wildlife or alter their habitat (Anderson, 1995; Cole and Landers, 1995). The literature review regarding recreation impacts on wildlife (Berger, 2007b) describes several impacts, including:

- Direct mortality: the immediate, on-site death of an animal (e.g., from hunting or fishing, off-leash dogs that kill game).
- Indirect mortality: eventual premature death of an animal caused by humans (e.g., poor handling practices during catch and release fishing; feeding wildlife, which may lower their fitness).
- Lowered productivity: reduced reproduction, nesting success, or survival rates due to disturbance or displacement.
- Reduced use of habitat: changes in use of habitat due to human displacement or disturbance.

- Reduced quality of habitat: human-caused impact that lowers the ability of habitat to provide some type of resource to wildlife.
- Behavior/stress: human-cased disturbance affects wildlife behavior, or raises stress levels, which could reduce their long-term fitness.

Substantial impacts on wildlife from recreation use may occur from direct mortality caused by hunting or fishing. However, these impacts are broadly addressed through fish and game management that balances harvest and productivity, or enhances productivity through programs such as fish stocking. As discussed in Chapter 2, those issues are not part of the present analysis. Another major impact relates to large-scale habitat manipulation from land development (which may be recreation-driven), but this is not a major concern in the Upper Chattooga (most of the immediate watershed is protected).

Wildlife impact concerns in backcountry river settings like the Chattooga tend to focus on disturbance effects on reproductive success, use of important habitats, and behavior changes/stress on individual animals. However, assessing these types of impacts is challenging. Species vary in their responses to different types of recreation activity in different settings. Relevant variables include:

- The type, timing, location, and predictability of recreational activity.
- The individual responses of recreation users to wildlife encounters.
- The species, gender, age, life cycle stage, and size of animals involved in encounters.
- Experience of animals with similar encounters (some animals can learn to habituate or ignore human use).
- Environmental factors such as type of habitat, season, weather, food abundance for that year, etc.

Assessing recreation impacts on wildlife requires careful consideration of many variables. The process usually involves identifying sensitive species, considering what is known about how recreation users may interact with it, then assessing potential effects and mitigation options. It is beyond the scope of this report to conduct such an assessment for every wildlife species that may be affected by Upper Chattooga recreation use. However, the literature review (Berger, 2007b) identified key sensitive and indicator species for the Upper Chattooga corridor, and the following summary focuses on the major types of impacts that have been discussed by stakeholders:

Disturbance impacts on birds and mammals

Recreation use may disturb wildlife, and the disturbance response may affect wildlife fitness. There is a large literature on disturbance distances (the distance at which an animal notices or flees from approaching humans) and the conditions under which these events are adverse for various species (Knight & Cole, 1995). Some important findings include:

- Recreation use may displace birds from trail corridors and discourage nearby nesting. Displacement may be temporal (e.g., during high use times) and/or spatial. Whether these effects are important depends on the abundance of bird species and other suitable habitat.
- Dogs, particularly if they are off-leash, generally increase disturbance and displacement.
- The predictability and frequency of trail use may affect the severity of impacts. Effects may depend on how fast people move, predictability of movement, number of people, distance

between people and wildlife, and terrain. These factors are usually more important than the specific recreation activity.

- Some bird species habituate to regular trail use, but still show reactions to off-trail approaches. Recreation users that stay on predictable travel routes are likely to have fewer impacts.
- Waterfowl nesting areas near lakes and rivers are particularly susceptible to disturbance from water-based approaches, especially close approaches by wildlife photographers (Klein, 1993).
- The presence of boats may limit foraging among some birds of prey (e.g., eagles or osprey feeding on spawned-out salmon), but this may benefit related scavenging guilds (e.g., ravens, crows, and gulls) who are less disturbed by people (Knight et al., 1991).
- Fishing may affect bird distribution and abundance, reproductive success, predation rates, and foraging.
- Some bird species can habituate to regular boating use, but may be disturbed by occasional use or boats making closer approaches (Knight and Knight, 1984).
- Habitat fragmentation is probably the greatest threat facing Southern Appalachian black bears (Tankersley, 1996), and it is unlikely that any Upper Chattooga recreation use substantially contributes to this problem. However, black bears during winter hibernation are susceptible to disturbance and usually den farther than 1 to 2 km from roads, homes, or other development. Activity closer than one km sometimes causes den disturbance but researchers apparently did not study the lower level uses such as camping, hiking, or boating. Some bears tolerate disturbance immediately adjacent or even inside dens, but others may abandon them (Linnell, et al., 2000).

It is possible to develop indicators and standards for wildlife disturbance issues, but one must first identify sensitive species and potential recreation impacts, and compare to baseline information. This can require substantial research efforts beyond the scope of the present analysis. During the NEPA phase of the capacity analysis, USFS biologists are expected to qualitatively assess potential impacts on sensitive species.

Even without quantifiable indicators and standards, some river management plans include wildlife impact mitigation efforts. In general, strategies focus direct recreation use away from sensitive habitats, changing how people use an area rather than limiting their numbers. Specific management actions may include:

- Routing trails or travel routes away from nesting sites.
- Closing sensitive areas to camping or other uses.
- Encouraging users to stay on designated trails.
- Education or regulations regarding maintaining appropriate distances from wildlife.
- Time of day restrictions on boating use (to minimize impacts during forage periods).
- Regulations regarding off-leash dogs.

While recreation use can cause adverse impacts on wildlife, the literature also acknowledges benefits such as appreciation of wildlife or support for wildlife management programs. Properly designed trails and campsites can also create new or more diversified habitat (particularly in even-age disturbed forests).

Wildlife attraction impacts

Poor sanitation at campsites can attract animals that become dependent on human food sources. Some Appalachian backcountry areas have problems with black bears, skunks, raccoons, or other rodents getting into campers' food or packs. These behaviors are often unhealthy for wildlife (snack food may be just as poor for wild animals as it is for people), and "begging" or "raiding" incidents may detract from a sense of naturalness (even though some recreation users may like the "close contact" with wildlife).

It is unclear if the Upper Chattooga has significant wildlife attraction problems; recent user surveys did not address wildlife issues, but this could be assessed in future monitoring. A potential indicator variable could be the "number of attraction incidents" for various problem species. The wildlife literature generally supports a "no tolerance" goal for these incidents, and several parks and forests have aggressive programs to reduce or eliminate them (e.g., Great Smoky Mountains, Yosemite). Most management strategies focus on user education or regulations regarding proper food storage and sanitation in camps. Some agencies have "aversive conditioning" programs (for bears), and the Rogue River in Oregon have some camps with agency-provided electric fences to discourage black bears from raiding campers' food. This impact is usually caused by user behavior rather than number of users, and use limits are unlikely to reduce it.

Bank trampling and fisheries impacts

Recreation use can impact fisheries in several ways, but one common issue is bank trampling. Vegetation impacts in riparian zones may occur with even low to moderate levels of use, reducing habitat and cover for fish or other aquatic species (Leung and Marion, 2000; Liddle & Scorgie, 1980; Liddle, 1997). Erosion and trail mileage estimates from Forest Service monitoring effort did not address bank trampling specifically, except to the extent that user trails within 20 feet of the river were identified. Bank trampling typically refers to impacts closer to the water.

Given current Upper Chattooga use patterns, one would expect greater bank trampling impacts near frontcountry (higher use) angling areas, or near heavily used camps. On higher density rivers where bank trampling is a severe problem, education efforts encourage anglers to walk in the stream rather than along the bank. In some frontcountry areas, some reaches may even be closed to fishing for riparian rehabilitation. On Alaska's Lower Kenai River, metal grate walkways keep people from trampling vegetation, but this type of recreation development may not be appropriate in more primitive settings such as the Upper Chattooga.

Effects on salamanders or other amphibians

Stakeholders have discussed potential effects of in-water users on salamanders or other amphibians. Some rare salamanders (e.g., hellbenders, which can exceed 20 inches, and green salamanders) occur in the Upper Chattooga, and critical habitat may include damp rocks and cliffs along the river where recreation users may visit. It is beyond the scope of this report to assess specific impacts from these activities or boaters, but the frequency and extent of in-channel use on the Upper Chattooga is probably limited to a small portion of the river and day. The literature suggests the most substantial threats to these amphibians are related to nearby agricultural uses (which appear correlated with higher sedimentation rates) and purposeful "collecting;" minor impacts might include occasional hellbenders being caught by bait anglers

(Humphries, 2007). The Chattooga has relatively few agricultural impact issues, although sedimentation from roads and and other sources may be an issue (Van Lear et al., 1995). Collecting is also an unlikely activity for current or potential Chattooga recreation user groups. This impact probably does not require a specific indicator and standard.

Lead sinker impacts

Stakeholder discussion has identified "lost lead sinkers" as a possible biophysical impact from angling. This issue is separate from litter that might be associated with fishing; it refers to lead sinkers ingested by animals (usually waterfowl are the greatest concern).

There have been studies on the toxic effects of lead ingested by birds (Pokras & Chafel, 1992; USGS, 1999). However, ingestion of sinkers is generally rare and is limited to "hot spots" with high fishing use and waterfowl feeding areas (e.g., lakes in Minnesota and the Northeast with loon populations who feed by ingesting gravels). In rare cases, this problem has been documented in birds (including eagles) eating fish that have ingested lead sinkers. However, lead does not appear to accumulate in aquatic food chains (fish appear to pass lead through their systems without harm), so widespread effects of this sort appear unlikely.

Some states and countries have banned the use or sale of small lead sinkers (e.g., Minnesota, Maine, New York, Vermont, New Hampshire, Canada, and Britain). The American Sportfishing Association generally supports education efforts rather than statewide or national bans. The primary reason for opposition to non-lead alternatives is their higher cost.

The Upper Chattooga sees regular fishing use, but the prevalence of lead or non-lead sinkers or in angler tackle is unknown. It is also difficult to estimate the amount of sinkers lost into the river. The Upper Chattooga has limited waterfowl populations (although wildlife "openings" are maintained in the Nicholson Fields reach to improve habitat). Relative to other biophysical and social impacts, this issue is probably minor and generally unrelated to the number of anglers (unless they increased by an order of magnitude or more).

Woody material management and Woolly Adelgid issues

Large woody material (LWM) in the river provides cover for fish and can be affected by ecreation use. Logs that span the river, block boat passage, or otherwise create a safety risk are sometimes removed by agencies or boaters, potentially reducing "structure" or changing other ecological functions.

There is currently no assessment of LWM in the Chattooga, nor any formal analysis of whether current levels are a limiting factor for any species. Developing an appropriate indicator and standard for LWM would require such analysis. However, one could develop a "no degradation" standard that would discourage or prohibit LWM removal for boating passage.

Logs prompted 3 to 5 portages (depending upon boater skill levels) during the expert boating reconnaissance (most on the Chattooga Cliffs segment, but also at Big Bend Falls). But more LWM is likely in the future because the *Woolly Adelgid* epidemic has killed many hemlock trees in the Chattooga basin and this will probably introduce more LWM into the river. Whether logs should (or will be) removed if they create boating hazards are open questions (if boating is allowed).

There are extensive debates among boaters and river professionals about the settings and conditions under which it is appropriate to remove LWM for boating (Interagency River Management Workshop, 2007). There is no clear consensus on this issue, which appears to be decided on a case-by-case basis (Hughes, 2007). Variables may include the ecological value of individual logs (not all logs are equally beneficial), the type of boating (log hazards or portages are more problematic for rafters than kayakers), potential impacts from portage trails created to avoid the hazard, level of use, overall "primitiveness" of the river, and specific implications for boaters (is the log a substantial safety threat, or just an inconvenience?).

In many cases, user groups may remove hazardous LWM (Blevins, 2007). There appears to be tacit agency support for some of these efforts, but sometimes there is no agency consultation and formal agreements are rare. Occasional log removal would probably occur on the Upper Chattooga if boating was allowed, but highly skilled kayakers are used to getting under, over, or around log hazards.

The ecological values of aquatic species are "outstandingly remarkable" values on the Metolius and Upper Rogue WSRs in Oregon, and both have management protocols to maintain large woody material. On the Upper Rogue, the "no boating" headwaters segment appears to have been established in part to ensure that woody debris will never be removed for boating passage (the only other year-round non-motorized boating closure on a WSR that we know of). The Upper Rogue is a very small and steep creek with many downed trees crossing the river and a "lava tube" where the entire river goes underground for a short distance, all of which discourage boating on that reach. On the Metolius, a larger river where boating is common, woody debris is managed more aggressively on one reach to allow safe boating passage, but it is generally not removed on another reach to maintain the function of remaining logs (IWSRCC, 2007).

Other impacts

Human waste

Human waste impacts are a common river management topic, particularly when high use is concentrated at popular camps or day use areas. Poor human waste practices can transmit disease through insects or from water-born pathogens, and exposed human waste is an important aesthetic problem for users and managers.

On many western "overnight" rivers, agencies require boaters to use portable toilet systems that virtually eliminate human waste impacts. Similar systems are being developed for alpine areas or other environments where disposal options are limited. These systems require appropriate knowledge and equipment; to date, they apparently are not required or used on many eastern rivers.

Human waste impacts were not specifically monitored during the recent USFS effort, but some impacts were observed during fieldwork at some larger camps. A typical indicator is the proportion camps with some visible impacts, and multiple studies show a "no tolerance" norm.

In addition to regulations that require waste carry-out systems, the most common strategies for reducing this impact include education about proper disposal techniques and agency clean-up patrols. Like litter impacts, human waste impacts are not resolved by use limits (because a small number of people behaving inappropriately can create the "problem").

Boat markings

Stakeholder discussion has identified "boat markings" as a possible impact from boating use. If canoes or kayaks hit rocks, a small mark the color of the boat can occur. This appears to be framed as an aesthetic rather than ecological impact; for some users, marks on rocks diminish the "naturalness" of the river setting.

It is difficult to quantify the number or locations of boat markings or the proportions of non-boaters likely to see them if boating were allowed. This would probably depend upon boating use levels, the types of boats used, the flows boated (trips at higher flows would probably mark fewer rocks, and the abrasiveness of rocks (smooth or slippery ones are much less likely to be marked). If a certain level of boating occurs, susceptible rocks will likely have become marked, so additional use may have less effect. This impact does not appear to be a substantial concern on other rivers with whitewater use, and we have not seen it discussed in the literature or at river management symposia. Relative to trail impacts, camp impacts, or social impacts such as encounters or conflicts, it is probably minor.

Biophysical impact conclusions

Taken together, information in this chapter suggests several general conclusions about biophysical impacts:

- There are biophysical trail and site impacts on the Upper Chattooga from current uses, but unacceptable impacts can probably be addressed with trail and site design, rehabilitation projects, and more regular clean-up (all of which may present administrative and budgetary challenges).
- Literature on wildlife-related impacts suggests more specific analyses after key species, habitats, and potential recreation impacts to those species and habitats have been identified. It appears unlikely that recreation will have population-level effects, and unacceptable smaller-scale impacts can probably be addressed with education or regulation strategies that encourage low impact behaviors.
- Many biophysical impacts are related to pioneering users, so potential "new" uses such as boating deserve attention and monitoring.
- Many biophysical impacts are addressed with "technical fixes" (site hardening or changes that direct use to non-sensitive or more durable areas) or education/regulation (encouraging people to adopt better "low impact" practices). It is relatively rare (because it is usually less effective) to address biophysical impacts through use limits.
- As a potential new user group, non-motorized boaters are unlikely to camp from their boats, would mostly use existing trails at access points, and represent a low level disturbance to wildlife. However, they would probably create a small number of portage and attraction site trails, contribute litter proportional to their numbers, and utilize car-accessible dispersed or developed camping sites. ,

6. Social Impacts

This chapter examines social impacts from existing or potential recreation uses. For each type of impact, it describes (1) the range of likely impacts on the Upper Chattooga (if known), (2) potential standards to consider in the LAC / NEPA process, and (3) lessons from research or management about addressing these impacts.

Introduction

Social impacts refer to effects visitors have on each others' experiences; examples include encounters, perceived crowding, competition for fishing water, noise levels at a campground, or conflicts between recreation groups. A chapter of the literature review (Berger, 2007) focuses on social impacts and conflict issues, reviewing general knowledge, types of impacts and conflict, and ways that managers typically address them. Specific impacts are described in the "impact by impact" sections below; general findings include:

- Recreation use can affect experiences in many ways. Considerable work has focused on interaction impacts such as encounters, but competition and interference impacts are also important. Signs of use impacts (litter, human waste) were addressed in the biophysical impacts chapter.
- "Normative" research examines evaluations of social impacts; it provides a framework for collecting and organizing evaluative data. Normative methods explore individual evaluations, aggregate responses for groups, and the level of agreement within and between groups.
- Early research focused on encounters in backcountry settings, where encounters were low, users could count and remember them, and encounters have important effects on solitude. Encounter norm research in higher density frontcountry settings shows more variation in tolerances for interaction impacts.
- Norm research methods have been applied to a diversity of impacts, including spacing between anglers, number of people in a viewscape, percentage of time within sight of others, incidents of discourteous behavior, competition for fishing areas, waiting times at rapids and boat launches, and amount of angler interference (Shelby & Vaske, 1991; Shelby et al., 1996, Manning, 2007).
- Social impact research generally recognizes differences between preferences (a more stringent standard) and tolerances (a less stringent one). Expectations are a third variable distinct from, but related to both preferences and tolerances.
- Different user groups may have different concerns or tolerances for impacts in different settings within a recreation area (Manning, 2007). Tolerances can vary for the same person depending upon the setting or timing of an impact. Recreation planning requires impact and tolerance information to be organized for relevant settings, opportunities, and groups.
- Unlike most biophysical impacts, relationships between use and social impacts are often linear, so use limits may offer a powerful management strategy for addressing them (Shelby & Heberlein, 1986). Other strategies include education efforts that help users match their expectations with likely impacts, or education / regulation efforts that help reduce particular behaviors that exacerbate competition or interference impacts.

- Use conflict refers to situations where the presence or behavior of one group interferes with or decreases the quality of another group's recreation. Conflicts between different recreation users are among the most challenging management issues in outdoor recreation settings. When asked to rate the importance of different types of impacts, users often rank conflict-related issues as high as development and signs of use impacts. In many cases, they are rated more important than crowding-related impacts. Additional discussion of distinctions between capacity and conflict is provided in Chapter 8
- Considerable research has documented conflict between different groups (e.g., backpackers and horse users, motorized and non-motorized boaters, skiers and snowmobilers) in a variety of settings, describing characteristics of sensitive and insensitive groups, and predicting when conflicts are likely to be greater. A common finding is that conflicts are asymmetric (one group is sensitive to the impacts of the other, but not the reverse).
- Most efforts to reduce recreation conflicts focus on 1) separating uses by space or time; 2) using "technical fixes" to reduce objectionable impacts; 3) educating users about impact issues to minimize behavior-based problems; or 4) developing new "norms" that support shared use (see additional discussion in Chapter 8).

Encounters

Encounters refer to contacts between groups, and can be distinguished by type of groups (e.g., anglers and boaters, hikers and anglers), timing (e.g., season, weekend/weekdays), and location (e.g., on the river, on trails, in camps, or at attraction sites). Encounters are a common social impact indicator for backcountry settings and they have received considerable attention in the recreation literature. Key concepts and findings from this literature include the following:

- Encounters are important to many river users, particularly in lower use, wilderness-like settings (Vaske et al., 1986; Shelby et al., 1996, Manning, 2007).
- As encounters increase, perceived crowding increases (Vaske & Donnelly, 2002).
- Measuring actual encounters is challenging (Shelby and Colvin, 1982). Few studies measure actual encounters, and most rely on user reports ("reported" or "perceived" encounters). Numbers of encounters reported by visitors are generally lower than actual encounters recorded by trained field technicians. When encounters are over five per day, reported encounters may underestimate actual encounters by about half. Explanations may include cognitive filtering and the perception-recall process, or the lack of distinction between "unique" (contact with a new group) and "repeat" encounters (Shelby & Colvin, 1983; Hall & Shelby, 2000; Whittaker, 2003).
- Measuring encounter standards is also challenging (Manning et al, 2002; Hall & Roggenbuck, 2002). Encounter preferences are generally lower than tolerances for a given type of experience (Manning et al., 2002; Manning 2007).
- Not all encounters have equal effects on quality (Cole, 2001; Cole & Stewart, 2002;). There may be differences for encounters that occur at different times and locations, or with different types of groups.
- The effect of encounters varies for different users. Some are more solitude-seeking and therefore sensitive to encounters, while others are more gregarious, even in wilderness-like settings (Patterson & Hammitt, 1990; Jonas & Stewart, 2002). Information about the likely level of encounters for a setting may influence expectations, which interact with preferences and actual encounters to influence effects on trips (Shelby et al., 1983).

- Even with stable use levels, the number of encounters may vary by day or by trip, so it makes sense to focus on average encounter levels (usually per day).
- Studies in wilderness and backcountry settings show agreement among users that encounter levels should be low (Vaske et al., 1986). In general, wilderness preferences are for fewer than 2 or 3 encounters with other groups per day, while tolerances are slightly higher, about 4 or 5 per day. For less primitive backcountry experiences encounter tolerances are higher still, but usually less than 10 encounters per day.
- For camp encounters, numerous studies have shown that backcountry users prefer to camp out of sight and sound of others (and that camp encounters are generally more important than river or trail encounters).
- Compared to river or trail encounters, camp encounters (camping within sight or sound of another group) usually have lower correlations with use levels because the geography and popularity of individual sites play a larger role (Shelby & Colvin, 1982).

Existing impacts and evaluations

Some research has examined encounter impacts, tolerances, and preferences on the Chattooga, although not usually with enough specificity to distinguish between types of encounters, or group, seasonal, or weekend/weekday differences. Key findings include:

- Most Ellicott Wilderness users are not particularly sensitive to trail encounters (Rutlin, 1995). Only 15% reported disliking trail encounters (23% liked to see other hikers and 61% were neutral). In contrast, many are sensitive to camp encounters (58% dislike "seeing others while in camp") or encounters with loud groups (76%).
- Ellicott Wilderness users prefer low levels of encounters (similar to other wilderness users), but their tolerances are not quite as stringent (Rutlin, 1995). Average preferences were less than 4 other groups at the trailhead, 3 on the trail, and 1 in camp. Average tolerances were 9 groups at the trailhead, 7 on the trail, and 3 in camp.
- Actual encounters reported by Ellicott Wilderness users were in between their preferences and tolerances, with about 6 groups at the trailhead, 4 on the trail, and 2 in camps.
- The 1995 Ellicott Wilderness study did not distinguish data by season, day of the week, or different types of users (e.g., anglers, day hikers, or backpackers/campers). Given the use patterns discussed in Chapter 4, encounters on weekends and in summer and the fall color season are likely to be considerably higher than weekdays, but there are no data to quantify this. Interestingly, the study did not sample users in winter because use levels were too low to cost-effectively administer the survey.
- No other data from Chattooga studies directly address encounter impacts, but studies of lower river boaters (Dye & Burnett, 1994) indicate some boater interest in solitude (even though they experience higher use densities than we expect on the Upper Chattooga if boating were allowed). Several Lower Chattooga management strategies (particularly commercial boating regulations that limit and space commercial trips through the day) are designed to minimize encounters between boaters.
- The number of encounters between boaters and other users (hikers, swimmers, anglers) is difficult to estimate. Actual encounters are based on several variables including the type and enforcement of management actions (if there are use limits, how well do users comply?), the travel patterns of the different groups (especially the timing of their use), how groups behave

when encountering each other (do some try to avoid close contact?), and vegetation and topography (can they see each other?).

- Without a recent user survey of Upper Chattooga users (previous studies have focused on Ellicott Wilderness users and Burrells Ford campers), assessing the relative number and effects of different types of encounters is challenging. However, based on available information, it is possible to draw some conclusions about different types of encounters:

  Encounters ***between hikers on trails*** (including both day hikers and backpackers) are likely to be the most common encounters in the Upper Chattooga, but they are probably less important to trail users than some other impacts.

  - Hikers represent the highest use group on the trails, and encounters among them are likely to be high because they travel the same routes and use the same areas. Although use data suggest summer use by frontcountry anglers and general recreation users can also be high, those groups use of designated trails less often. Backcountry anglers also have relatively lower use levels and do not always use designated trails (preferring user trails closer to the river in some areas).
  - The highest encounter periods among hikers will be during summer and fall color weekends. However, off season and middle of the week periods may offer noticeably low encounters that managers may want to maintain.
  - Based on the (perhaps dated) 1995 study, current trail encounter levels appear to be acceptable and less adverse than other impacts (biophysical impacts, camp encounters).

  Encounters between ***backcountry anglers and hikers*** are likely to be relatively low and less adverse than other encounter impacts.

  - Hikers are more likely to use designated trails, which are often separate from the riverside user trails preferred by anglers. For example, Nicholson Fields (DH) anglers usually travel along the user trails on both sides of the river, while hikers use the designated trail that is parallel but usually out of view.
  - Anglers generally use trails to get to fishable water, but spend most of their time at the river rather than on trails where encounters occur.
  - In the Ellicott Rock reach, where designated trails are closer to the river, backcountry angling use is lower than downstream.
  - The highest use periods for hiking (warm mid-summer weekends) are not usually a high use period for backcountry angling. Both groups are likely to have high use levels during fall color season.
  - From an angler perspective, seeing hikers on the route to a fishing location is likely to have smaller adverse effects than encountering other anglers on the river (an angler-angler encounter, which is related to fishing competition), even though anglers are likely to feel some kinship with other anglers. Hikers are unlikely to distinguish between encounters with anglers or other hikers when encounters occur on trails.

  Encounters between ***hikers and boaters*** (if boating were allowed) are likely to occur more frequently in some parts of the corridor compared to others. The impact of an encounter is also likely to vary, depending upon when and where the encounter occurs, and individual tolerances of the parties involved. Based on the following, many of these encounters may have similar effects as trail encounters with other hikers or anglers (although for some individual boaters or hikers, they could be more adverse).

- As with angler-hiker encounters, boaters travel on the river, while designated hiking trails are often out of view of the river so contact between the two groups may be limited. To estimate the proportion of trail that is separated from the river, the Forest Service calculated the extent of designated and user-created trails within 100 feet of the river (a conservative estimate of when it is possible to see the river through vegetation). In the Upper Chattooga, about 26% of designated trails and 51% of user created trails are within 100 feet of the river. In many if not most cases, encounters between hikers and boaters will be "brief sightings" through the trees.
- Boating use (if allowed) is likely to be highest on winter and early spring days immediately following storm events, which are relatively rare (see Chapter 7). Some proportion of those days will be rainy and cold, lowering hiking and backpacking use, and reducing the chances of boater-hiker encounters.
- If whitewater boating is allowed, boaters are also likely to spend more of their time in the parts of the river with more difficult rapids, which tend to be the steeper reaches where designated trails are farther from the river. On lower-gradient sections, whitewater boaters are likely to pass by quickly. This will reduce the number and length of boater-hiker encounters.
- Geography and timing can interact to affect the likelihood of boater-hiker encounters, particularly when hikers have left designated trails to get to the river (e.g., to relax, picnic, or camp). For example, if a site is near the boater put-in and hikers reach the area after mid-day, boaters are likely to be downstream and no encounter would occur; if a site is at the end of the reach and it is near the end of the day, boaters are likely to pass by).

Encounters between ***anglers and boaters*** (if boating were allowed) could be high on the days when flows are acceptable for both, but several variables affect the number and effects of these interactions. When they occur, these encounters are likely to be adverse for anglers, but less so for boaters.

- Boater and angler use are related to the frequency of days with acceptable or optimal flows, a complex topic addressed in Chapter 7. In general, flows too low for boating or too high for angling would produce few boater-angler encounters. In between, there are two "overlap ranges" where both activities occur and encounters might be high for some segments. In one overlap range, angling is optimal but boating is only "acceptable;" in the other, the converse is true.
- Because anglers spend most of their time near the river, and usually fish a small segment of the stream, they are likely to be passed by nearly all the boaters using the segment on that day (unless there is a timing differential; see next bullet). This is a major difference from hiker-boater encounters, which are less likely to occur because the two travel in different areas (one on the trails, the other on the river).
- Timing affects the number of angler-boater encounters. In general, boating occurs in the middle of the day due to the logistics of arranging shuttles, preparing gear, and taking advantage of warmer weather. In contrast, timing for anglers vary through the year. For example, the best fishing in summer is early morning before temperatures have risen; in winter, the best times are the middle of the day when the sun has raised temperatures slightly; in the spring and fall, there are typically better periods in morning and late afternoon, but some months offer uniformly good conditions throughout the day (see further discussion under fishing interference impacts below; also Berger, 2007). Based on this information, angler-boater encounters are more likely to occur in the winter

months (December thru February) when both groups are on the river in the middle of the day (although angler use levels for some reaches may be lower during those months). As the weather warms by mid-March and April, boating concentrated in the middle of the day would likely produce relatively fewer boater-angler encounters.

- Geography and timing can interact to affect the likelihood of encounters, as with hikers. Anglers that fish near the start of a boating run in the first half of the day will probably see most of the boaters that might launch that day; if they fish the same location in the afternoon, they may not see any.
- Some boaters may avoid the Nicholson Fields (DH) reach when boating from Burrells Ford, because this lacks challenging whitewater and there is a take-out option via Lick Log / Thrifts Lake trail. This take-out also shortens the length of the run (which is otherwise long for a day trip) and the shuttle. However, it is only likely to be used by kayakers (it is a long uphill carry for a canoe or raft).
- Taken together, we believe angler-boater encounters are among the most important impacts associated with allowing boating use on the Upper River. Several other studies of angler-boater encounters have shown that anglers can be very sensitive to this impact (Heberlein & Vaske, 1977; Manning, 1979). In some studies, encounter tolerances were as low as 2 groups per day, although in others tolerances have been as high as 7 per day.

Encounters between ***swimmers/frontcountry recreation users and boaters*** (if allowed) are likely to be rare and do not represent a substantial impact.

- As discussed above and in Chapter 7, boatable flows are more likely to occur outside the summer season when temperatures are too cool for most swimmers. Although a stakeholder demonstrated it was possible to swim during the January 2007 expert panels, few people are likely to swim outside summer months.
- Swimming occurs at relatively defined locations (particularly Sliding Rock, Bull Pen Bridge, and Burrells Ford) that boaters are unlikely to use at typical summer flows. For example, unless the segment through Whiteside Cove is adjudicated "navigable," Sliding Rock does not offer access to the rest of the river and is unlikely to be used by boaters (it is not a good playboating location). Conversely, Bull Pen Bridge is not a safe place to swim at boatable flows, and it is not boatable at swimming flows.
- Even at locations in the lower river (e.g., Bull Sluice Rapid) where swimmers and boaters commonly interact (and boating use is much higher than is likely on the Upper Chattooga), there appear to be few interference impacts as long as boaters and swimmers behave responsibly and communicate; addressing these sorts of problems is usually accomplished through education efforts (Hedden, 2006).

Boater-boater encounters have not received much attention during stakeholder discussion, but could be a relevant impact if boating were allowed. While there are no data about boater preferences or tolerances for encounters on the Upper Chattooga, there is limited information about these for the Lower River (Sections 3 and 4). In general, private boaters on those sections prefer to see less than about 20 other users per day, but would tolerate as many as many as 40 to 50; current averages suggest they see about 20 to 30, with at least half of those being commercial users (Dye & Burnett, 1994). Public meeting comments and expert panel fieldwork suggest potential upper river boaters are interested in a lower density boating opportunity compared to the lower river.

Camp encounters refer to the percent of nights spent in sight or sound of another group and are only relevant for groups that camp (generally backpackers, but some backcountry anglers

may camp as well). They are likely to be a very important impact for campers, and they interact with camping competition impacts described in a separate section below.

- Camp encounters are likely to be related more to the geography of specific camps than use levels, as on other rivers. There are several clusters of backcountry camps (as well as the developed walk-in campground at Burrells Ford) and those who occupy them will usually camp within sight or sound of others. Other sites (about 15 of the 97 on the upper river) are more isolated. The proportion of sites with more privacy is a potential indicator of the likelihood of camp encounters.
- For the campsites that are in sight or sound of other camps, the open question is how often people will occupy sites in close proximity to others. The 1995 study suggests that campers saw an average of two other groups while in camp, but the survey question wording may not be equivalent to "two groups camped in sight or sound." The estimated peak backpacking use levels are about 10 groups each in the Ellicott Rock and Rock Gorge Reaches, which have 40 and 30 backcountry campsites respectively. Unless these groups tend to camp at the clusters of sites next to each other, they probably are not having encounters with two groups per night (and there are probably other sites where more privacy is available).
- Boating (if allowed) is unlikely to affect camp encounters because very few are expected to camp. Boatable flows often occur for only a day or two, challenging rapids encourage boaters to take as little gear as possible.

Potential encounter impacts and standards

Based on the review of existing conditions and potential user preferences/tolerances, potential encounter indicators include the following:

- Encounters on trails (groups per day).
- Encounters along the river (groups per day).
- Proportion of campsites in sight/sound of other camps.
- Number of groups in sight/sound while camping.

An additional related indicator, "boats passing anglers," addresses both angler-boater encounters and potential interference impacts related to that encounter; it will be examined in greater detail below. The list does not include an encounter measure for frontcountry areas; research indicates that encounters are more difficult to measure and less meaningful to users in higher density settings (Manning, 2007). The two camp encounter indicators do not apply to Burrells Ford, which is a developed walk-in campground.

With each of these encounter-related indicators, standards could be set at one of three levels:

Current conditions/tolerances (based on 1995 study and/or professional judgments that account for potential changes since that study, plus the review above):

- Less than 7 trail encounters per day.
- Less than 3 encounters while at sites on the river.
- At least 15% of backcountry campsites are out of sight and sound of other camps
- Less than 3 groups (on average) in sight/sound while camping.

Improvement from current conditions (professional judgments that attempt to improve the current situation toward user preferences rather than tolerances).

- Less than 5 trail encounters per day.
- Less than 2 encounters while at sites on the river.

- At least 30% of backcountry campsites are out of sight and sound of other camps.
- Less than 2 groups (on average) in sight/sound while camping.

Preferences for more primitive or wilderness-like conditions (based on research from other areas, and professional judgments about conditions that meet user preferences).

- Less than 3 trail encounters per day.
- Less than 1 encounters while at sites on the river.
- At least 50% of backcountry campsites are out of sight and sound of other camps.
- Less than 1 group (on average) in sight/sound while camping.

It is possible to choose different standards to provide different recreation opportunities, although this creates challenges for management and enforcement (see discussion in Chapter 8). Given the uneven use patterns in the Upper Chattooga, less stringent standards might be applied to high use periods (summer and leaf season weekends) and more stringent standards to the off-season and middle of the week.

Addressing encounter impacts

The relationship between use levels and river or trail encounters is well established in linear management units such as rivers, so use limits are probably the most powerful tool for addressing them. However, use limits are a substantial managerial effort, and most of the rivers in the country have not applied them. Just over twenty North American Rivers have full permit systems (limits on both commercial and non-commercial use) although about 50 others appear to have commercial limits or protocols for limiting non-commercial use if capacity standards are exceeded. Similarly, many backcountry and Wilderness areas have permit systems designed to keep encounters low. In most cases, use limits apply to overnight trips, although day use limits is also limited in a few places. Chapter 8 provides additional information about these use limit systems.

It is also possible to limit use indirectly through other actions such as managing the size of access parking lots. Using information to disperse use spatially or temporally may also be effective if there are adequate substitutes. Even if education attempts fail to actually redistribute use, they prepare users for the encounters they will experience, making expectations and tolerances more "realistic."

Unlike trail or river encounters (which are correlated with use levels), camp encounters are usually related to site locations and geography. Management actions such as designating sites out of sight/sound of each other are more likely to reduce camp encounters.

Competition impacts

Encounters involve "just seeing" another group; competition impacts involve contention for potentially scarce resources. Competition for camps or fishing water are common examples. Key findings from this literature include the following:

- "Fishing competition" has been measured as "the percent of time users pass up a desired fishing area because it was occupied." It has been studied at several moderate to higher density fishing areas in Alaska, Oregon, and California.
- Impacts and tolerances for fishing competition have varied widely, but tend to be much higher on Alaskan salmon streams (40 - 50% responses are common) than lower density trout

streams (10 - 20%). In most studies, angler tolerances are slightly higher than the level of impacts they report.

- There are no comparable data for the Upper Chattooga. Fishing competition is probably an issue at the frontcountry fisheries at Burrells Ford and Highway 28 during stocking season (April through October), and for the Nicholson Fields reach during DH season. Based on studies conducted elsewhere and use estimates in this report, current competition levels are probably similar to the lower density trout segments at about 20% (e.g., California's Pit River Canyon, Alaska's Situk River; low use segments and seasons on Oregon's Deschutes).
- A few studies have measured camp competition. Studies on ten rivers in Alaska asked boaters to report the proportion of camps they wanted to use but could not because the camps were occupied, and then compared those impact levels with a parallel question about camp competition tolerances (Whittaker et al., 1990; 1996; 2000). Results showed users were willing to pass up 10 - 20% of camps on wilderness-like rivers and 30 - 50% on less primitive rivers.
- Camp competition is theoretically similar to campsite occupancy rates (number of occupied camps divided by the total number of camps). This, in turn, is related to the density of trips, making occupancy rate a reasonable indicator of camp competition. In Grand Canyon, for example, there are about 200 camps overall but only about 80 "more desirable" camps. At high use times, there are about 60 trips at one time (TAOT), and this "75% occupancy of desirable camps" indicator reflects the camp competition reported by users. However geographical "bottlenecks" exacerbate the issue, making this a less-than-perfect indicator for these areas.
- There are approximately 70 backcountry camps in the Upper Chattooga (not including the 30 camps at Burrells Ford), and total overnight use probably does not exceed 25 groups at one time on peak weekends. This produces a (roughly) 35% occupancy rate.
- On the Chattooga, use estimates suggest there may be as many as 10 overnight groups in the 5 mile Ellicott Rock reach and 10 in the 7 mile Rock Gorge reach during high use times, so densities may range as high as .5 to .7 miles per trip in these reaches. In a review of 25 multi-day wilderness-like rivers, the median density was 2.3 miles between trips (Shelby & Whittaker, 2003), so Chattooga camping densities are generally higher than on many other wilderness rivers. However, during non-peak times, densities are probably less than half as high.
- This campsite occupancy rate does not necessarily correlate with low competition, because the number of "desirable sites" is probably lower. On the Upper Chattooga, there are some higher quality sites near good swimming/relaxing beaches or at a "popular" distance from trailheads, and there is at least one large camping area with multiple sites (confluence of the East Fork). There are probably trade-offs between having a good site and camp encounters. No study has addressed these impacts for the Chattooga, but Appalachian Trail users (Landres, et al., 2005) preferred to see less than three other parties at one time at sites in that moderate to higher density backcountry setting.

Potential competition indicators and standards

Three ***potential competition indicators*** include:

- Percent of fishing areas passed because they were occupied.
- Percent of campsites passed by because they were occupied.
- Percent of camps occupied per segment.

Current conditions/tolerances:

- Less than 20% of fishing areas passed because they were occupied.
- Less than 30% of campsites passed because they were occupied.
- No more than 30% of campsites occupied.

Improvement from current conditions:

- Less than 10% of sites passed because they were occupied.
- Less than 15% of campsites passed because they were occupied.
- No more than 25% of campsites occupied.

Addressing competition impacts

Like encounters, there is probably a linear relationship between competition impacts and use levels (especially in an elongated river corridor). Use limits are one tool for managing them, and several rivers and wilderness areas employ a permit system to keep the number of overnight parties at a level commensurate with the number of camps. In some places, campsites are also reserved to improve efficiency, and decrease competition.

Other management actions (as discussed for encounters above) can also be used. Information about camp sizes and locations can help users choose and make expectations realistic. An inventory would also help identify "bottleneck" areas that may benefit from other management actions.

There is little history of addressing fishing competition on public land with permit systems, with one notable exception in Georgia. Dukes Creek is managed with a limited access system that ensures that no more than 15 anglers. The angling area just over four mile, so it produces low densities and limits encounters and competition (Durniak, 2007). The Nature Conservancy operates a similar limited access program (10 anglers at one time) on a 3 mile reach of California's McCloud River. In both cases, the limited access concept appears to be strongly supported by anglers who value solitude.

On some rivers, regulations of fishing techniques reduce competition between anglers. For example, Alaska's Kenai River and Oregon's Lower Deschutes have "no fishing from a boat" regulations for some reaches to give bank anglers priority. Because all anglers fish from shore, boat-based vs. shore-based fishing competition is prevented. Managers are considering regulations on the West Branch of the Delaware to address competition between shore-based and tube- or canoe-based anglers.

Interference with angling

Interference with anglers impacts refer to potential consequences of angler-boater encounters: boats passing anglers may make anglers move (themselves or their lines) or "spook" fish.

"Making anglers move" is a social impact which is related to several variables: characteristics of the location (e.g., river width, part of the river anglers are fishing, space for boaters to pass); tackle (e.g., spinning gear, which has a longer "range"); behavior of anglers (e.g., bank fishing vs. wading in to the channel); and behavior of boaters (do they know and take the "path of least disturbance?"). For example, during expert panel fieldwork, boaters encountered anglers about a half-mile upstream of Burrells Ford. This was a wide part of the river and boaters chose to pass on the opposite side, well away from where anglers were fishing, although spinning gear could "access" the entire width of the river. Such encounters probably minimize interference with

angling. This would change in narrower locations, if anglers wade farther into the river, or if boaters choose a different route.

"Spooking fish" is a biophysical impact that is sometimes framed in terms of "fish stress" or "health." Research focused on improving the stocks of hatchery fish suggests individual trout vary in their response to "stress," more sensitive fish feed less, and these traits appear heritable (Oliveri, 2006). However, "spooking fish" is more often discussed in terms of effects on fishing success (do passing boats cause fish to stop taking tackle, and if so, for how long?), a topic with less research.

Many natural predators attack fish from above, so fish are likely to be sensitive to disturbances from that direction. Some anglers are careful in how they approach a reach ("being stealthy," trying not to disturb the water while wading or casting, etc.), and anecdotal evidence suggests that boats passing over fish cause them to "spook." However, many high quality fishing rivers have considerable boat traffic (e.g., Blackfoot, MT; Madison, MT; Big Horn, WY; Middle Fork Salmon, ID; Kenai River, AK) and many anglers catch fish while boats pass. The open question is the length of time it takes for fish to return or resume feeding after boats pass.

Requests to several Forest Service or other fish biologists have not produced research addressing the effects of passing boats on population viability, fish behavior or fishing success. Idaho's Upper Main Salmon River is closed to boating during Chinook spawning periods to prevent boating disturbances over shallow gravel bars. One Idaho biologist noted "informal administrative results" showing that passing boats can "disturb and displace spawning Chinook salmon if the interactions occur at close proximity," although "we have no idea at what level these disturbances affect their reproductive success" (Moulton, 2007).

An experiment addressing "fish welfare" suggests trout may experience "fear," and can learn and remember an "avoidance behavior" (but provides no information about how long the fish remained "afraid") (Yue, Moccia, and Duncan, 2004). In addition, this finding seems too general for estimating the length of time a passing boat may cause "diminished fishing" in natural settings, let alone in the specific conditions found on the Chattooga. Instead, we rely on discussions with the angler expert panel and several fish biologists to suggest the length of "diminished fishing." In general, these discussions suggest boats may cause an effect that probably lasts from from a few minutes to an hour (although a few anglers say "the rest of the day"). Variables hypothesized to affect "diminished fishing" include:

- Type of fish (brown trout are more sensitive)
- Hatchery vs. wild fish (wild or naturalized fish are more sensitive)
- Size/flow of the stream (fish in smaller or lower flow streams are more sensitive)
- Water clarity (fish in clearer streams are more sensitive)
- Number and behavior of boaters
- Frequency of boats and the ability of fish to habituate to boating use

Managing the social and biophysical aspects of interference with angling is challenging; this is a "conflict" between recreation uses with many variables, and reviewing the issues in the previous section shows no simple way to totally eliminate negative effects from boater-angler encounters. In higher density situations (e.g., different segments on Oregon's Deschutes River), we have documented angler tolerances for 0 to 3 boats passing ***per hour***. In lower density situations, the impact has generally been examined as encounter tolerances, and tolerances are more on the order of 4 to 6 boats per day (Alaska's Situk River; Whittaker, 2003) or 2 to 7 groups of boats per day (Heberlein & Vaske, 1977; Manning, 1979). Many anglers prefer to fish areas that are not being

used by other recreationists such as boaters (Harris & Bergersen, 1985), but surprisingly little research documents these preferences or associates such preferences with different types of anglers or river settings. .

A related issue focuses on the nature of boater-angler encounters, particularly the extent to which anglers feel that boaters pass discourteously. As with "fish spooking" impacts, there is anecdotal evidence that some boaters pass anglers too closely, move to fast, splash, or are noisier than some anglers prefer, behaviors that may exacerbate the level of interference with fishing. Unfortunately, we have not found any studies that document the extent of these problems, nor angler perceptions toward them.

Following up on stakeholder lists of specific rivers with potential for adverse angler-boater interactions (e.g., Conasauga and Jacks River, WV; rivers in Great Smoky Mountains NP, Cranberry River, WV), we were unable to document the frequency or severity of these types of impacts; in many cases, river planners noted that the two groups used different flows or seasons and rarely interacted. Absence of evidence does not mean these interactions do not occur, but the issue does not appear to have become a management priority on most southeastern rivers.

On several rivers in Montana (e.g., Blackfoot, Ruby, Rock Creek, Beaverhead, Big Hole, and Madison) conflicts between boat-based and shore-based anglers are a management issue, and Montana Fish, Wildlife, & Parks has implemented "no fishing from a boat" regulations to address them. On a few reaches however (particularly the Blackfoot and Rock Creek), scenic rafters, canoers, or tubers are also an issue for anglers, who are largely displaced when boating traffic increases in the middle of the day (Sperry, 2007).

In lower density situations such as the Upper Chattooga, separating uses by space and time are one way to address these types of impacts. For example, the Nicholson Fields reach (DH reach) is highly attractive to anglers but has no whitewater; boaters could take out above the reach at Lick Log Creek (zoning in space) and eliminate encounters. Similarly, the best boating occurs at times when flows are higher, while the best angling occurs when flows are lower (see Chapter 7 for additional discussion); boating only during high flows (zoning in time) eliminates encounters.

There may be times (mid-range flows) when both activities could occur, and it is possible then to limit boating to "zero capacity" (to eliminate encounters). It is also possible to limit boaters to numbers low enough to be tolerated by anglers. Although anglers probably prefer zero boaters, they may tolerate some boat passes if they knew the numbers would be low. Chapter 8 describes some separation/zoning choices that would capitalize on natural use patterns.

Group size and large group encounters

The size of groups affects opportunities for solitude and the character of wilderness trips, as well as group logistics and dynamics. Monz, et al. (2000) reports about 52 percent of wilderness areas have established group size limits; most limits are less than 24, with the median at 12. A review of group size limits on 25 multi-day river systems in the west (River Management Society, 2003) shows that about one-third have limits at 16, and three-quarters have limits of 26 or less.

The Upper Chattooga apparently attracts some large groups (e.g. boy scouts, hiking club outings), but information about the number and their size is anecdotal at best. Although there is no current group size regulation, the recent Forest Plan revision identifies a group size standard of 12 (USFS, 2004). Most groups are much smaller than this (based on survey data), but some

organized groups apparently exceed 20 users. Enforced group size limits may address some biophysical impacts, and they limit "large group encounters," which can affect wilderness character and solitude (Monz et al., 2000).

Trailhead congestion / parking

Access congestion refers to the quantity of people and gear at access points such as trailheads or boat launches, and the way it affects efficient use of facilities (boat ramps, rest rooms, parking). Access congestion has been examined in some river studies, but it appears less important to users than river encounters or camp competition, particularly on multi-day trips (Whittaker, 1993). Users appreciate efficient facilities that can handle the expected volume of use, but a small proportion of the trip is spent at access points, so short-lived congestion is probably tolerable.

Recent studies in the Chattooga corridor did not specifically address congestion problems, but anecdotal evidence suggests it may occur in busy summer and fall color seasons at parking areas for Sliding Rock, the DH reach, and at Burrells Ford. The obvious indicator in these cases is "percent of parking spaces occupied;" and a standard might be set near 100%.
Stakeholder discussion has shown some concern for parking impacts from allowing boating use, particularly at areas where the number of spaces is limited (e.g., Bull Pen Bridge, Highway 28). If boating occurred when other use was high (e.g., peak weekends in summer), this impact is more likely to develop. However, hydrology analysis suggests that boatable flows are far less likely during the summer and fall when hiking and angling use is higher.

Search and rescue impacts

Some stakeholder discussion has focused on potential search and rescue (SAR) impacts associated with allowing boating on the Upper Chattooga. As described in the expert panel reports, all three reaches have at least one Class V and several Class IV rapids, so boaters need appropriate skills and experience. The addition of large woody material from dying Hemlock is likely to add to these risks.

Estimating the number and type of incidents (or the associated SAR impacts) that might occur if boating were allowed is challenging. To address these issues, we consulted a well-known whitewater boating safety expert (Walbridge, 2007), the Lower Chattooga river ranger (Hedden, 2007), a Forest Service summary of Lower Chattooga river fatalities (Forest Service 2007), a North Carolina river manager (Hendricks, 2007), a river ranger on the Big South Fork (Moses, 2007), and the AW river accident database and related reports (Wittman, 2006; Phyler, 2006).

- Walbridge (2007) points out that if boating were allowed on the Upper Chattooga, "there are going to be some accidents, injuries, and eventually a fatality." However, based on likely use levels and information from other rivers of similar difficulty, he estimated that "the number of fatalities or serious accidents due to boating is likely to be low, and a few will require SAR responses."
- A fatality rate calculation for whitewater boating from 35 rivers from 1994-98 suggests about 0.9 fatalities occur per 100,000 user days (Wittman, 2006); 1998 had the highest rate with 1.1 fatalities per 100,000 user days. For kayaking only, the rate was 2.9 fatalities per 100,000, presumably because kayakers boat more challenging rivers than whitewater boaters (including rafters, canoers) as a group.

- Applying the 2.9 rate to our "guesstimate" of about 1,200 user days per year on the Upper Chattooga, a fatality is likely to occur about once every 28 years. This should be viewed as a very rough estimate.
- Specific characteristics of a river can substantially influence fatality rates. Fatality rates may be as high as 1 in 4,000 user days (Class V Russell Fork KY) because of sieve and undercut hazards, or as low as 1 in 1,000,000 (Class IV New River Gorge, WV) where powerful hydraulics may flip boats but rarely cause fatalities (Walbridge, 2007). Walbridge thought the Class IV-V Upper Youghigheny, PA might be a good point of comparison for the Upper Chattooga in terms of difficulty; the first fatality occurred in the past year after about 30 years of higher use than is expected on the Upper Chattooga.
- On Tennessee's Class IV Big South Fork National River, there has been one fatality in about 25 years of regular boating (150 day season, peaks about 100 private boaters per day), but SAR responses are generally required about two times a year (Moses, 2007). The 8 mile gorge segment of this river is similar to the Upper Chattooga with limited road access, which presents some SAR response challenges but impacts from these responses have not been a substantial issue for management.
- The Lower Chattooga has had 23 fatalities since more active safety efforts began about 1975 (Forest Service, 2007). Of these, about one third (8) were associated with kayaking, one third (6) with rafting, and one third (9) with swimming, wading, or hikers crossing the river. Most of these occurred on Section IV in the Five Falls rapids, which have several known hazards. The frequency of similar hazards on the Upper Chattooga is not known. Despite consistent hiking, swimming, and angling use on the Upper Chattooga for at least two decades, there do not appear to have been any fatalities above Highway 28, and SAR responses are rare (Hedden, 2007).
- About half of the Lower Chattooga fatalities apparently required larger-scale SAR responses or body extractions (Forest Service, 2007). SAR squads apparently respond to the river about 6 to 8 times per year (not always for a fatality), although the Forest Service does not track these incidents (Hedden, 2007).
- The AW accident database (2007) identifies two accidents on Overflow Creek (generally considered more difficult than the Upper Chattooga by the expert panel), but apparently neither was a fatality. Walbridge reports that several other boaters have been injured on Overflow, but they have generally walked out or self-rescued. Several sources agree that many non-fatal accidents during whitewater boating are "handled" and never reported; a major factor is the skill and experience in the group (or passing groups). In general, Class IV-V boaters have first aid and swiftwater rescue experience (Walbridge, 2007), but some wonder if this is declining among younger boaters (Hedden, 2007).
- Hendricks (2007) estimated varying rates of SAR incidents on several NC rivers. At the high end of the spectrum, the new flow releases on the Cheoah appear to be relatively more dangerous because of live trees in the channel due to low base flows for several decades; the river has already had one fatality and appears to require a SAR response about every other release. On the other end of the spectrum, the Class II-III Nantahala has only 1 to 2 SAR incidents a season despite very high use (although this is expected to increase as new relicensing flow releases are provided in the more challenging gorge).
- About 60% of boating fatalities occurred when boaters were not wearing a PFD (Phyler, 2006); higher skilled boaters are less likely to boat without such equipment.

- On a segment of the James River in VA, requiring boaters to obtain a permit helped reduce the number of accidents by discouraging less experienced boaters (Robertson, 2002).
- If SAR or body extraction efforts are required on the Upper Chattooga, there may be impacts related to access to the scene for staff and equipment. Wilderness designation complicates the use of some equipment and access, although "minimum tool" analyses and a pre-accident plan with "equipment approval levels" have been developed for other rivers in NC with similar constraints (Hendricks, 2007).

Taken together, the number of accidents, fatalites, and SAR responses will probably increase if boating is allowed on the Upper Chattooga. These responses, in turn, are likely to create some localized or access-based impacts, but these will probably be low.

Social impact conclusions

Taken together, the preceding chapter suggests several general conclusions about social impacts on the Upper Chattooga:

- Some social impacts may be greater than typical standards for Wilderness or more primitive backcountry settings, but existing information does not provide enough detailed information to be sure.
- The recreation literature shows that some of these impacts are probably important to users (e.g., encounters at camps or riverside destinations), but others are probably less important (e.g., trail encounters).
- Although there have been no Upper Chattooga studies assessing the relationship between use levels and social impacts, studies from other locations suggest that use-social impact relationships are often linear. More people entering the trail system will probably produce more encounters and competition, although geography and the thick wooded setting may minimize the effects.
- If boating were allowed, boater-angler encounters and interference with fishing are likely to be the most substantial social impact issues for anglers. There are likely to be fewer encounter problems with hikers, swimmers, or frontcountry users (who tend to use the river in summer when boaters are less likely to be present) and hikers in particular may not see boaters through the heavy vegetation when trails are not immediately adjacent to the river.
- Other social impacts include angler-angler encounters and fishing competition in the DH during DH season, and camp encounter and competition on peak summer weekends.

7. Flow Issues

This chapter assesses flow requirements for fishing and boating opportunities, and applies hydrology information to estimate how often each would be available in an average year (if boating were allowed). It begins with an introduction to flow-recreation concepts, summarizes Upper Chattooga (also known as the North Fork Chattooga) hydrology, reviews findings about flow requirements from the expert panel fieldwork, and summarizes the "frequency of days" analysis.

Introduction

In many river settings, recreation opportunities occupy different "niches" in the flow regime. For example, many studies have documented that anglers prefer lower flows and whitewater boaters prefer higher ones (Whittaker, Shelby, & Gangemi, 2006; Whittaker, Shelby, & Abrams, 2006). If these uses "naturally" occur at different flows (and thus at different times), capacity and conflict issues may be small. When there is "overlap," both groups use the river concurrently and are more likely to affect each other.

With boating identified as a potential use through the AW appeal and the Forest Service Appeal Response, it is important to assess how often boating might occur. Comparable information for other flow-dependent recreation opportunities will show the "niches" occupied by other recreation activities on Upper Chattooga. When integrated with use information (see Chapter 4), this can help assess the potential impacts. Stakeholder discussion and the Sumter Revised LRMP (Appendix H) included assertions about boating and angling at different flows, but this information was imprecise and sometimes debated among stakeholders.

"Flow-dependent" recreation activities generally cannot occur at some flows, and their quality changes as flows change. In contrast, "flow-enhanced" activities such as hiking, camping, biking, wildlife observation and other riverside recreation usually occur regardless of flow, even though flows provide aesthetic benefits (Brown, 1991; Whittaker, 2002). Whitewater boating, angling, and swimming are the Upper Chattooga recreation opportunities most likely to be flow-dependent.

An extensive literature review documents techniques for assessing flows and recreation (Whittaker et al., 2006); the goal is to identify flow ranges for different recreation opportunities, often because flows can be manipulated by an upstream dam. For the free-flowing Chattooga, the goal is to learn when different activities are most likely to occur. The Forest Service developed information about Upper Chattooga hydrology and convened "expert panels" to assess flow needs for boating and angling in January 2007. Details are in a separate report (Berger, 2007c); summary information is provided below.

Chattooga hydrology

The Upper Chattooga (North Fork) sub-watershed has a relatively small drainage area (64 square miles) but receives considerable rainfall through the year, often in short but heavy storms. These storms produce a "flashy" hydrology where flows rise and fall quickly. During the summer (growing) season, substantial flow changes can occur within hours, although changes generally occur less rapidly during the winter (dormant) season. This flow regime affects the types of recreation that can occur.

Describing the Upper Chattooga's hydrology is challenging because the closest Chattooga gage (until recently) is at Highway 76, over 20 miles downstream from the end of the upper river. Hydrology information summarized below is based on analyses conducted by the Forest Service (Hansen, 2007); interested readers should review that report.

Understanding Chattooga River gages

- Hydrology information for the Upper Chattooga is primarily based on two gages:
  1. ***USGS Highway 76*** (No. 02177000); real-time gage updated every 15 minutes; period of record from 1940 to present; 21 miles downstream below the end of the Upper Chattooga.
  2. ***Burrells Ford*** data logger; collects water level data in 15-minute increments but must be downloaded manually; period of record beginning Jun 23, 2006; located in the middle of the Upper Chattooga, about 11 miles above Highway 28 and 10 miles below Grimshawes Bridge.
- Staff gages were also placed on Grimshawes Bridge, Bull Pen Bridge, and Highway 28 Bridge. Basic stage-discharge data were used to develop rating curves to allow future analyses at these locations. For the purposes of this report, the focus is on flows at Burrells Ford. Table 2 provides locations, basin sizes, and stage-flow conversion equations (when known).
- A gage was also recently installed on the West Fork Chattooga. It collects water level data from a data logger in 15-minute increments but must be downloaded manually. The period of record began April 14, 2007; the logger is located near Warwoman Road bridge. This may allow additional correlation between North Fork and West Fork flows, but insufficient data exists for use in this report.
- Initial analyses explored relationships between Burrells Ford, Highway 76, and other nearby USGS gages. The objective was to see if existing real-time gages could be used to estimate simultaneous flows at Burrells Ford, and whether the long record for Highway 76 could be used to describe the frequency of different flows at Burrells Ford. With sufficient overlapping data and analyses, the other nearby USGS gages may provide useful indicators of flow at Burrells Ford. Table 2 provides gage locations and basin sizes.

Table 2. Gages on or near the Upper Chattooga River.

Gage Location	Type	Basin size (square miles)	Stage-flow conversion
Chattooga Grimshawes Bridge	Staff	8	In development.
Chattooga Bull Pen Bridge	Staff	23	In development.
Chattooga Burrells Ford	Staff + data logger	47	Flow = 169.3 x stage$^{1.93}$ R^2 = .99
Chattooga Highway 28	Visual staff	64	Flow = 62.6 x stage$^{2.02}$ R^2 = .97
Chattooga Highway 76	USGS	207	Provided by USGS.
Cullasaja near Highlands, NC	USGS	19	Provided by USGS.
Davidson near Brevard, NC	USGS	40	Provided by USGS.
Talullah near Clayton, GA	USGS	57	Provided by USGS.
French Broad at Rosman, NC	USGS	68	Provided by USGS.

- Although we have less than one year of data to develop "simultaneous flow" relationships, analyses suggest the following:
  - Simultaneous flows at Highway 76 and Burrells Ford are moderately to highly correlated ***during non-storm periods*** and accurately "translate" between the two locations.
  - Simultaneous flows at Highway 76 and Burrells Ford have a lower correlation ***during storm events***, so "translations" should be used with more caution. This appears mostly due to timing (rain raises flows at Burrells Ford, but those flows take time to travel downstream to Highway 76). For some storms (particularly in summer), flow differences may also be due to localized storm cells that have larger effects at Burrells Ford but smaller effects at Highway 76.
  - Comparing across five gages in the area ***during storms***, the Highway 76 gage was generally the worst predictor of simultaneous flows at Burrells Ford (the Cullasaja was the best). During any particular storm, these nearby gages differed substantially. Although additional data and modeling could be used to improve estimates, installing a USGS-caliber gage at Burrells Ford is simpler, direct, and more accurate.
- Although Highway 76 data have limitations for predicting simultaneous flows at Burrells Ford, they can be used to assess the times when certain flows are likely to occur in an average year. The water in the Burrells Ford drainage area is well represented by the Highway 76 hydrograph even though the short-term timing during storms has lower correlations.
- It is possible to develop "translations" between the two gages so evaluations of flows based on one gage can be compared to evaluations at the other. This is important because most anglers are "calibrated" to the Highway 76 gage (which is highly correlated for the lower flows anglers tend to fish), while boaters (during the expert panel) made evaluations based on flows at Burrells Ford.
- Some boaters are accustomed to using one or more other gages when trying to estimate flows. Due to its proximity and smaller drainage area, the Cullasaja gage is probably the best gage for estimating whether flows in the Upper Chattooga are rising or falling during storm events.
- Regression analyses that "translate" flows between the two Chattooga gages are shown in Figure 9 and Table 3. Separate regression lines are shown for storm (initial response extended from peaks + 48 hours) and non-storm periods, and for summer (June to September) and fall/winter (September through March). We also report variance explained by the regression equation (the R^2 value); higher values show stronger relationships (a perfect correlation explains 100% of the variance).

Table 3. "Translating" flows between Highway 76 and Burrells Ford.

Period	Equation	R^2
Summer during storms	Flow at BF = 0.21 x (flow at 76) + 6	.56
Summer during non-storm periods	Flow at BF = 0.27 x (flow at 76) – 20	.71
Winter/fall during storms	Flow at BF = 0.33 x (flow at 76) + 18	.63
Winter/fall during non-storms	Flow at BF = 0.31 x (flow at 76) – 6	.93
Comparing peaks	Flow at BF = 0.48 x (flow at 76) – 37	.90

- In general, summer flows at Burrells Ford are about 27% of Highway 76 flows when it is not raining (dictated primarily by sub-surface inputs). During and just after summer storms, flows at Burrells Ford are about 21% of Highway 76 flows.
- In general, fall/winter flows at Burrells Ford are about 31 to 33 % of Highway 76, with little difference between storm and non-storm periods (although the relationship during storms has more variance).
- The precision of "translations" is considerably better during non-storm periods; storm cells introduce "noise" into the system. This "flashy" hydrology is common in headwaters streams. It is relevant for recreation because higher flows associated with storms are hard to predict and available for relatively short periods of time. This makes it hard for recreation users to use or avoid them.
- A separate analysis of storm peaks is shown in Figure 9. In this analysis the timing differences between the gages were removed and the explained variance increased, supporting the notion that timing causes variation between Highway 76 and Burrells Ford.
- For the 27 storms in this analysis, Highway 76 peaks averaged 8.3 hours after Burrells Ford peaks. For larger storm events (peaks over 900 cfs at Highway 76), the difference averaged 5.8 hours (because larger storms cover a wider area and tend to track from the southwest).
- During storm events, peaks at Burrells Ford are about 48% of peaks at Highway 76. This suggests that peaks at Burrells Ford rise and fall more quickly than those at Highway 76. This "attenuation" of downstream peak flows is common to many streams; headwaters are more flashy than the lower river.

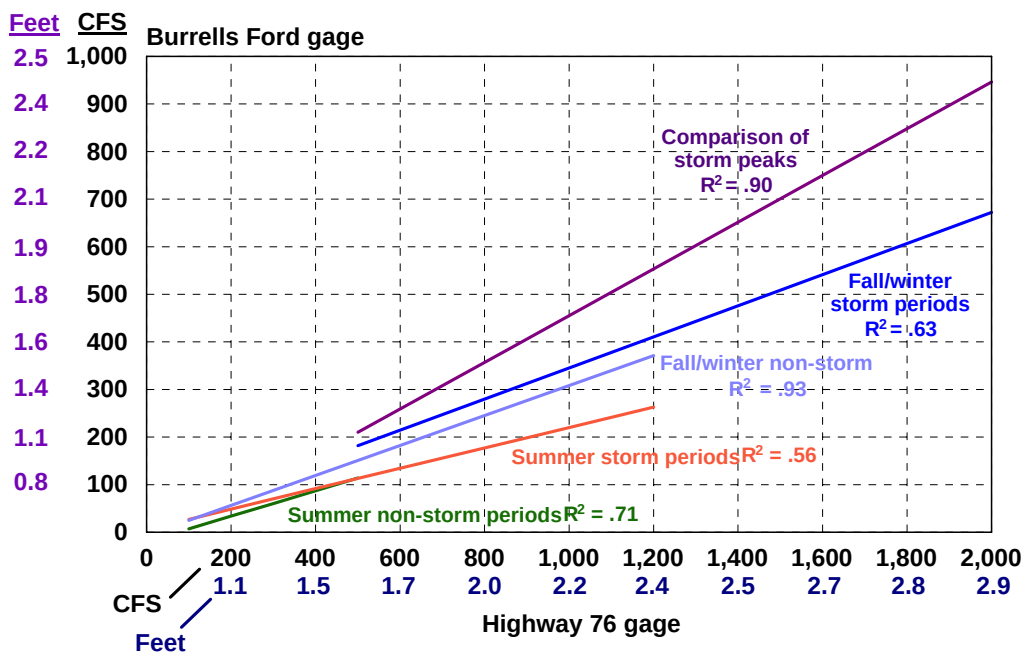

Figure 9. Relationships between Burrells Ford and Highway 76 gages.

Chattooga annual hydrograph

Chattooga base flows are generally low compared to storm peaks which tend to rise and drop rapidly. The seasonal pattern shows higher base flows from November to May (with the highest flows in April). The seasonal flow variation is primarily related to evapotranspiration changes in the summer growing and winter dormant seasons (trees utilize substantially more water when they are gowing), hot vs. cooler temperatures, and more vs. less intense solar radiation.

Figure 10 gives median daily flows for the period of record (in purple) at Highway 76 to show the seasonal variation of base flows. It also includes two recent example years to illustrate the flashy nature of storm events and potential variation between years. 2001 (shown in red) was the driest year since 1940, while 2005 (shown in blue) was the third wettest and was atypical because of two large summer hurricanes (in a more typical wet year, more frequent storms occur in winter).

The shape of the falling limb of the hydrograph after a storm is fairly consistent (receeding at a decreasing rate as flows drop toward base levels), but recessions can be interrupted by additional rainfall events. The average annual flow at Highway 76 over 67 years of record is 650 cfs; this is equivalent to an average of 42.6 inches of water yield over the entire watershed above the gaging station. The average rainfall to produce this average flow is estimated to be over 70 inches per year, and the Upper Chattooga probably receives more than this average because it has a higher elevation.

Based on the regression equations between Burrells Ford and Highway 76, a comparable Upper Chattooga hydrograph (not shown and currently unavailable) would probably have peaks about half the size of those at Highway 76, while base flows are probably about one-third to one-quarter of those at Highway 76. Accordingly, a hydrograph for the upper river is likely to be even more "flashy" than the one shown in Figure 10.

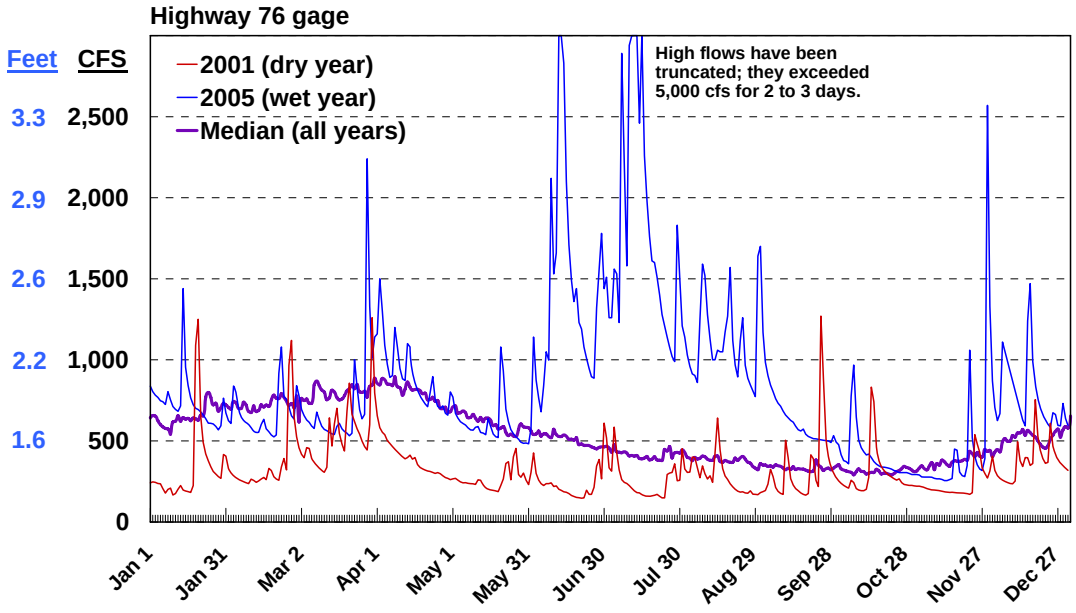

Figure 10. Median daily flows and example wet and dry year hydrographs for Highway 76 gage.

Flow ranges for boating and angling

Expert panel methods

Several sources of information helped develop flow ranges for boating and fishing, but the primary source was the expert panel fieldwork on January 5 and 6, 2007. A longer report provides details (Berger, 2007); it is summarized below.

- Panels included 8 anglers and 8 boaters (with each group accompanied by two consultants). Participants were chosen from self-nominations; the goal was to represent experienced users who could assess how flows affect angling and potential boating opportunities on the Upper Chattooga. Panels included advocates for stakeholder groups interested in the capacity effort.
- Panels assessed the Rock Gorge and Nicholson Fields reaches from Burrells Ford to Highway 28 on January 5th and the Chattooga Cliffs and Ellicott Rock reaches on January 6th.
- Flows were similar on both days:

  Day 1: Rising flows from 340 to 400 cfs (1.5 to 1.6 feet) at Burrells Ford; about 1,100 cfs or 2.3 feet at Highway 76 using the fall/winter storm period equation.

  Day 2: Falling flows from about 400 cfs to 375 cfs (1.5 feet) at Burrells Ford; about 1,100 cfs or 2.3 feet at Highway 76.

  Note: As discussed in the study report, Highway 76 flows on the second day reached 1,400 cfs, but this peak was not observed by panelists because it moved through Burrells Ford during the night.
- Panelists were asked to rate flows on an acceptability scale, and average ratings were used to create "flow evaluation curves." Panelists also answered "specified flow questions" to identify the acceptable and optimal ranges for different types of boating and angling opportunities.
- Anglers generally assessed flows in relation to the Highway 76 gage. This gage is well-correlated with Burrells Ford for angling flows, and anglers have used it for years.
- Boaters assessed flows in relation to the Burrells Ford gage, which better represents flows in the reach. Boaters do not have a long history of using the Highway 76 gage for the upper river (because boating has not been allowed).
- Anglers rated flows similarly for all reaches, so results are combined. They provided separate assessments for fly, spin, and bait fishing, which are shown separately.
- Boaters provide specified flows for "technical" (lower flow), "standard" (higher flows with better whitewater) and "big water" (much higher flows with more powerful hydraulics) boating opportunities.
- Boaters generally assessed flows for kayaks, inflatable kayaks, or whitewater canoes. Although small rafts could probably run these segments at some flows, that use is likely to be rare. Panelists generally agreed that the Upper Chattooga is not appropriate for larger rafts with 4 to 6 people per boat.
- The expert panel report provides detailed findings for boating and angling opportunities. In this report, we have simplified information to highlight major distinctions.

- For angling, we have focused on the acceptable and optimal ranges for each type of fishing. The best fishing occurs in the optimal ranges; acceptable ranges represent declining fishing quality for most anglers.
- For boating, we have focused on technical, standard, and big water boating. The best boating occurs in the optimal standard range, and technical and big water ranges represent declining boating quality for most boaters.
- We have not focused on scenic boating in this analysis; as discussed in Chapters 3 and 4, these opportunities have access issues and are likely to involve small numbers of users. In general, these opportunities can occur at much lower flows than whitewater boating, particularly if they are focused on the 4 miles of alluvial river between Lick Log Creek and Highway 28. If boaters using this reach were willing to walk through the periodic shallow riffles, it is likely "boatable" at even relatively low base flows.

- Many flow-recreation studies require greater precision than can be attained from "single flow reconnaissance" by two panels. Assessing more flows would improve the precision of flow ranges identified below. Similarly, hydrology data show some "noise" in converting assessments from one gage to another. Nonetheless, results are precise enough to identify the "best flow ranges" for each activity, and when flows are acceptable but lower quality. Additional precision is unlikely to change this "big picture," although it may help narrow specific flow thresholds.

Expert panel findings

Figure 11 shows "range bars" for three types of fishing (all reaches combined) and the three types of whitewater boating (separated by reaches). The goal is to identify flow ranges for "optimal fishing" and "optimal standard boating."

- Flow related-conditions for ***angling opportunities*** are optimal at low flows (below 225 cfs at Burrells Ford; 700 cfs at Highway 76). Lower flows provide more wadeable and fishable water, allows easy crossings in most areas, and has good water clarity (although some anglers prefer more "color" that occurs at higher flows).
- The upper end of the optimal range is lower for fly angling and higher for bait angling, with spin angling in between. Fly anglers are more likely to wade, require more casting space, and thus prefer lower flows to gain access to more fishable water.
- Optimal flows for fishing end between 250 and 450 cfs at Burrells Ford (750 to 1,400 cfs at Highway 76), depending upon the type of fishing. Acceptable flows for fishing end between 450 and 650 cfs at Burrells Ford (1,400 to 2,000 cfs at Highway 76). Anglers can still fish higher flows, but wading and crossing more challenging, water clarity decreases, and the amount of fishable water declines.
- Optimal standard boating ranges for the three segments taken together start about 350 to 400 cfs and end about 600 to 650 cfs at Burrells Ford (1,800 to 2,000 cfs at Highway 76). Although the Chattooga Cliffs segment has higher gradient, more constricted rapids, and more logs, the optimal ranges for the three reaches are more similar than different.
- Taken together, range bars show that the highest quality fishing and boating generally occur in different parts of the hydrograph (the exception is bait fishing, which remains optimal through higher flows). The best fishing flows are not the best boating flows, and vice versa.
- Acceptable but lower quality fishing opportunities overlap with optimal boating; acceptable but lower quality technical boating overlaps with optimal fishing. At these overlap flows

some users of each group could be present (if boating were allowed), and encounters could create impacts and conflict (see Chapter 8).

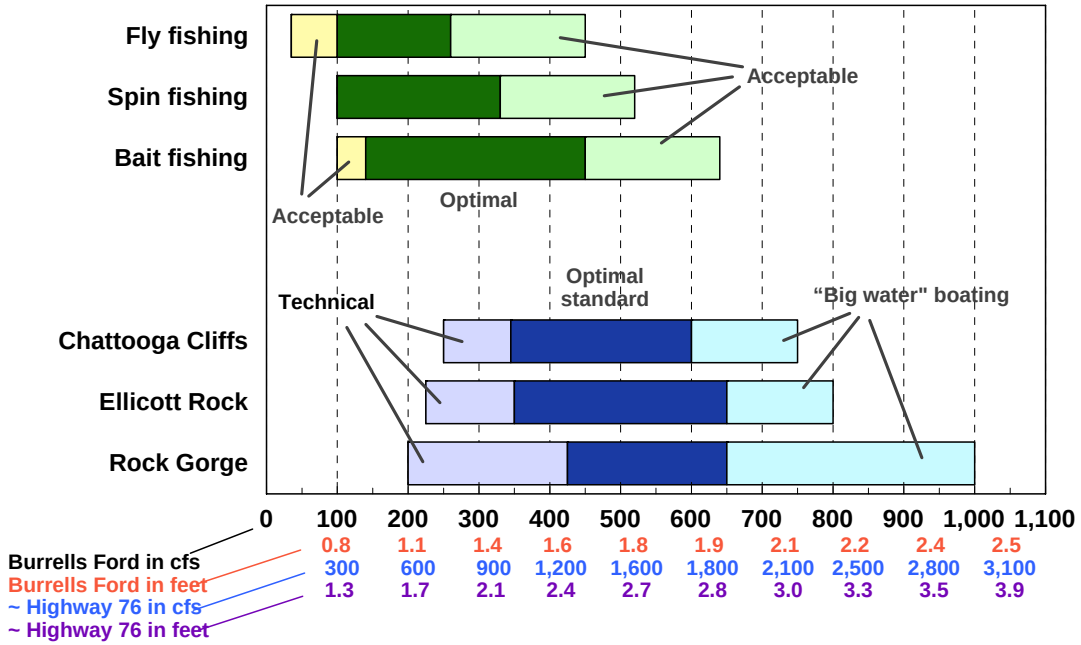

Figure 11. "Flow range bars" for fishing and boating opportunities on the Upper Chattooga.

Flow ranges from other sources

Web articles and angler message board comments. Several web-page articles and message board posts provided ***illustrative*** information about flow ranges for angling. As one example, a web-based article on Delayed Harvest fishing provided the following discussion of flows on the Nicholson Fields reach:

> *"Water levels are an important consideration on the Chattooga because it is free flowing. It will commonly rise a foot or more after a day of rain and become swift and dangerous. Water levels up about 1.8 feet on the U.S. Highway 76 gauge allow for fairly comfortable wading. If the level is higher than 1.8 feet, fishermen will have to pick and choose their entry points. If the water level is much over 2 feet, the Chattooga is probably best avoided until it runs down a little. The good news is that it goes down almost as quickly as it comes up, unless there have been several days of heavy rains." (Samsel, J., 2007)*

Similarly, several fishing reports on the Northern Georgia Trout Online message board offered comments about different flows (usually associated with the DH or Burrells Ford areas). The following parts of messages provide examples:

> *It's still raining like crazy here right now so the Chattooga probably won't be fishable for a day or two now. I don't recommend getting out there if the gage is over 2.0." (Harris, J. January 2006)*

> *It usually takes a pretty good rain to color the Chattooga. Check the gage, if it's over 2', don't try it. ("Fly flicker," February, 2006).*

It was pretty high this morning when I got there (9:30am). Kind of made me wish I had a wading staff or at least a fishing partner to inform my next of kin when I fell in. The water levels did drop by about 4-5 inches during the course of the day. Tomorrow I would guess it will still be higher than it has been in a long time but should be ok for wading in most parts. If you wade...be careful. I seriously thought I was going to take a swim on a couple of occasions today. [Mean daily flow on Oct 28 was 968 cfs (about 2.2 feet) and averaged 568 cfs (1.7 feet) on Oct 29] (Chris B., October 29, 2006).

We have not conducted an extensive analysis of these comments and do not suggest they should be given equal weight with expert panel evaluations. Message boards may not be representative of those who fish the river, are not systematic responses to the same set of issues, might have provided different advice to different audiences (e.g., inexperienced vs. experienced anglers), and the precise timing and location evaluated are not always obvious. In spite of these limitations, message board discussions of flows generally concur with expert panel findings suggesting better wading and fishing conditions occur at flows less than about 2.0 to 2.3 feet at Highway 76 (800 to 1,100 cfs; 300 to 350 cfs at Burrells Ford).

Whiteside Cove fishing reports. A member of the Whiteside Cove Association sent information from fishing logs dating to 1963 (Bamford, 2007). These entries in a log book identify activities on specific dates, which were then associated with a mean daily flow at Highway 76. Despite some methods problems using historical use data to identify flow needs (Whittaker et al., 1993), and the timing problem using a gage over forty miles away, data show that anglers use a full range of flows in rough proportion to the availability of those flows, but their choice of dates also appear to be influenced by other considerations (such as vacation time or day of the week). The expert panel assessment provides more specific information about how quality changes at different flows.

Comparisons with other studies. The literature review included a chapter on flow ranges for boating and fishing from other rivers (Berger, 2007). The lowest acceptable boating flows are typically at least 200 cfs, with some notable exceptions: very small headwater streams, steep streams (e.g., Chelan Gorge, Nantahala Cascades), a modified channel (e.g., Clear Creek whitewater park), and some flatter canoeing streams (Little Susitna, Bedrock Canyon on Dolores River). These results are consistent with the lowest technical flows identified by the boating panel.

The review also suggested that optimal flows for standard whitewater boating are usually substantially higher than minimum flows to get down the river (as shown by expert panel results). On steeper rivers the differences tend to be smaller (e.g., Chelan Gorge, Seneca Reach of Upper North Fork Feather), but on less steep rivers, the higher volume is needed to create good whitewater (e.g., Slickrock Canyon on Dolores River, Lower Kern). The reaches of the Upper Chattooga are to be more like the steeper rivers.

"Number of days" analyses

Given the flow ranges described above, it is possible to use hydrology information from the Highway 76 gage record to assess the number of days with different flow ranges in an average year. Figure 12 shows the days of technical, optimal standard, and big water boating for an average year, and when whitewater boating is unlikely to occur because flows are too low or too high. Table 4 provides the same information, but adds data for example wet and dry years (to show the extremes). Note: This analysis does not assess the frequency of days for potential scenic boating on short segments that do not include the steeper, higher gradient whitewater. In

general, we believe scenic boating on the short flat reaches might be available much of the year, particularly if participants were willing to walk or line boats/tubes through shallow riffles.

The analysis focuses on the frequency of days in specific flow ranges, so terms such as "optimal boating" or "optimal fishing" refer exclusively to flow and not other attributes that affect boating or fishing. For example, optimal flows for fishing that occur in the summer when water temperatures may be too high may not attract many fly anglers, but would be highly valued in cooler months such as October – November or March – April. Similarly, optimal boating flows that occur in January when air temperatures are near freezing might attract few boaters compared to the same flows in March when temperatures are generally warmer.

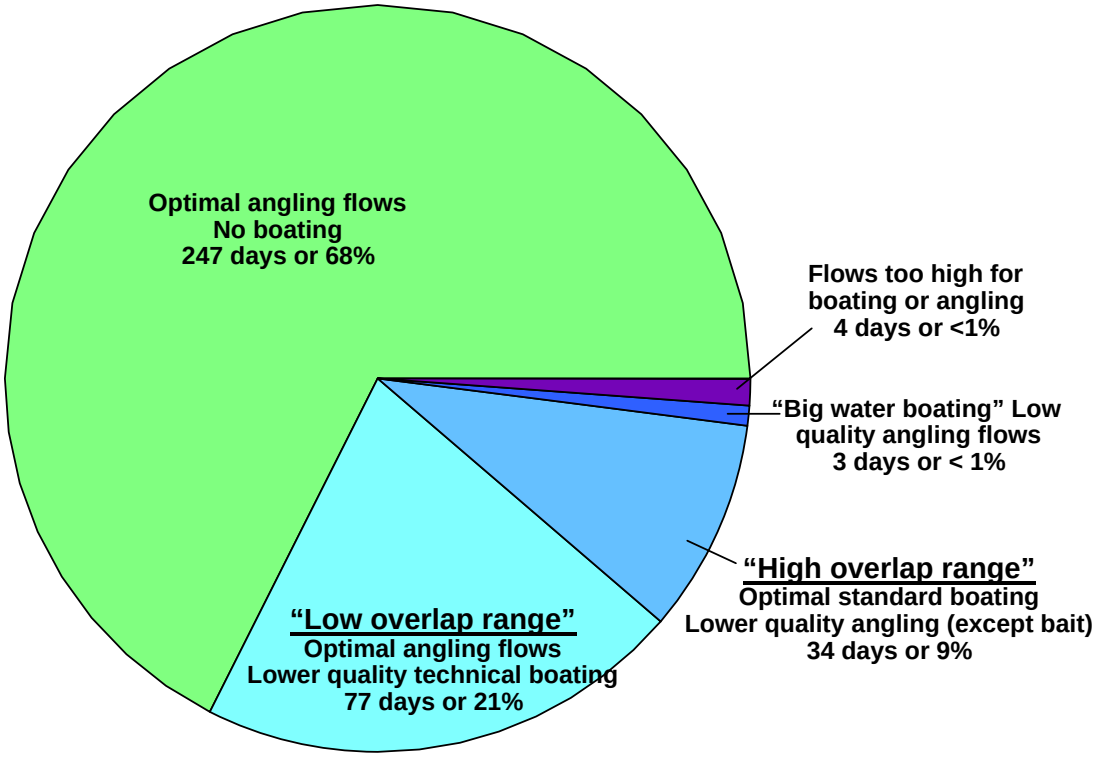

Figure 12. Estimated days per year of boating opportunities (averages for the period of record).

- Flows below 225 cfs (1.2 feet) at Burrells Ford (700 cfs at Highway 76) provide optimal angling flows for of all three types. This is available 247 days in an average year, with no "potential for conflict" because flows are too low for boating.
- Flows of 225 to 350 cfs (1.2 to 1.5 feet) at Burrells Ford (700 to 1,100 cfs at Highway 76) provide optimal angling flows and lower quality technical boating flows. In this "low overlap range," which occurs 77 days in an average year, boating quality is lower and declining as flows drop.
- Flows of 350 to 650 cfs (1.5 to 2.0 feet) at Burrells Ford (1,100 to 2,000 cfs at Highway 76) provide optimal standard boating and lower quality angling (except for bait fishing). In this "high overlap range," which occurs 34 days in an average year, angling quality (except for bait fishing) is lower and declining as flows rise.

- Flows of 650 to 800 cfs (2.0 to 2.2 feet) at Burrells Ford (2,000 to 2,500 cfs at Highway 76) provide big water boating and low quality angling. Flows above 800 at Burrells Ford are too high for boating and angling. These higher flows occur about 7 days in an average year, with no "potential for conflict" because flows are too high for angling, boating, or both.

Figure 13 shows optimal standard boating days for each month. The likelihood of boating flows is higher between December and May, with the highest likelihood months from February to April. As discussed in the "using boatable flows" section below, storms also tend to be larger and last longer in these months, so there is likely to be more advance warning and more hours or days with boatable flows, which make them easier to use.

These optimal boating days, which overlap with lower quality but acceptable fishing, probably also have the greatest "potential for conflict." In these months, boatable flows may occur on about 20% of days, and fishing use is common during these months (particularly in the DH reach). From mid-February through April, other fishing-related conditions aside from flow are commonly optimal (air temperatures, water temperatures, and hatches).

Table 4. Number of days in various boating & angling ranges.

	Burrells Ford		Highway 76		Period of record average	Example dry year (2001)	Example wet year (2005)
	cfs	feet	cfs	feet			
Optimal angling **No boating**	<225	<1.2	<700	<1.9	**247**	352	181
Optimal angling **Lower quality technical boating**	225 to 350	1.2 to 1.5	700 to 1,100	1.9 to 2.3	**77**	9	109
Optimal standard boating **Lower quality angling (except bait)**	350 to 650	1.5 to 2.0	1,100 - 2,000	2.3 to 2.9	**34**	4	59
"Big water" boating **Low quality angling**	650 to 800	2.0 to 2.2	2,000 - 2,500	2.9 to 3.3	**3**	0	6
"Too high" for boating **No angling**	>800	>2.2	>2,500	>3.3	**4**	0	10
Total boatable days	225 to 800	1.2 to 2.2	700 to 2,500	1.9 to 3.3	**114**	13	174

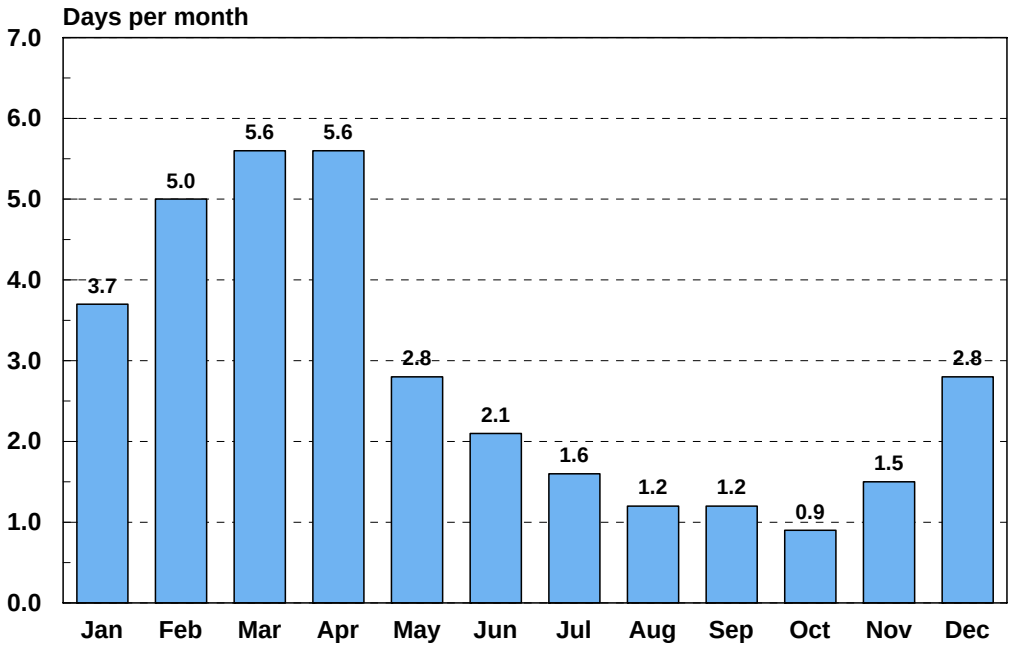

Figure 13. Estimated days per month of standard boating opportunities (averages).

Using boatable flows

As discussed above, peak flows rise and recede quickly on the Upper Chattooga, particularly in summer months. To examine the duration of boatable flows in various seasons, we reviewed data from individual storm events (Burrells Ford gage).

- During the summer, a storm peak flow that reached 850 cfs receded to 300 cfs in only 11 hours. If such a storm occurred in the afternoon, boatable flows would not be usable by the following morning.
- The lower the initial baseflow, the "flashier" the storm flow, and the more difficult it is for boaters to use it. During the summer, 3 inches of rainfall is probably needed to produce a one day boatable period, and boaters would need to start about 480 cfs to ensure the entire trip remained above 350 cfs.
- During the winter-spring season, a storm that reached 1,600 cfs receded from 900 to 300 cfs in about 36 hours, three times longer than the summer example. During a storm that reached 3,000 cfs, 900 cfs to 300 cfs took 47 hours (two days of boating). Although more predicatable, such storms usually provide only 1 to 2 days "notice" and 1 to 2 days of boatable flows.

This review suggests only large storms (or a series of close-together storms) are likely to produce boatable flows with enough "notice" and duration for most boaters to take advantage of them. For "ideal conditions," storms need to be predicatable at least a day in advance and the boatable range needs to be available for several hours in daytime after the storm is clearly waning.

Flow issue conclusions

Studies on many other rivers show that better boating flows are higher and better fishing flows are lower. When natural flow regimes provide a range of flows through the year, these two groups tend to separate and there is less likelihood of conflict. However, there are overlap ranges on the Chattooga, and they occur more often than estimated during the Sumter Forest plan update in the early 2000s. On the Upper Chattooga, boaters can probably get down the river at lower flows, and optimal standard boating starts at slightly lower flows, than was believed prior to the expert panel fieldwork.

However, for many days in the "high overlap" period, boater-angler conflict and related capacity problems would be unlikely. These are lower quality fishing days for all but bait anglers, and they tend to occur in winter when bait angling use is low. Some fly and spin anglers certainly fish these flows, particularly in March and April on the DH reach, but they have lower quality flow conditions in comparison to the other 320 or so days per year that have lower flows. For boaters, these optimal flows are also infrequent and difficult to predict, requiring attention to weather reports, and a flexible work schedule to take advantage of them. Most boatable days come during or immediately following a storm, and the "boatable window" may be less than a day, particularly in summer. In addition, only about 10 of these "best boating days" are likely to occur on weekends or holidays (assuming about 30% of days are on weekends/holidays, and boatable days are distributed randomly). Realistically, only optimal flows on a weekend day are likely to produce the maximum boater use levels identified in Chapter 4.

For the "low overlap" period, the converse is true. These are high quality fishing flows, but lower quality technical boating flows. There are more of these days (77), and they tend to occur in warmer times of the year (when angling use is higher and boaters might be motivated by good weather). In this "overlap range" management actions (such as use limits, separation by segments or timing) may be necessary to protect high quality fishing if boating were allowed.

8. Management Actions

This chapter begins with a brief discussion of recreation capacity and conflict concepts. It then reviews management actions that might be used to address specific "impact problems" or conflicts on the Upper Chattooga, their likely effects, keys to success, and examples from other rivers.

Distinguishing Capacity and Conflict

Carrying capacity is sometimes used as an "umbrella" concept to refer to any overuse or visitor-impact issue, including conflicts between users. However, it is useful to distinguish between these terms and management strategies that may be used to address them.

Carrying Capacity

Carrying capacity is defined as the level of use beyond which impacts exceed standards (Shelby and Heberlein, 1986). It has roots in range management and Hardin's (1968) "tragedy of the commons." Individual behavior is not the problem, but as each new person visits a park or a river, they may incrementally and collectively degrade biophysical resources or the experiences of all (Vaske, Donnelly & Whitttaker, 2000; Manning, 2007). The general solution is to set limits – in Hardin's words, "mutual coercion, mutually agreed upon" – which requires agreement about management objectives and specific standards that define when impact levels become unacceptable (Shelby & Heberlein, 1986; Manning, 2007).

Recreation planning frameworks that address carrying capacity (including Limits of Acceptable Change) link management objectives, standards, and actions in slightly different ways, but they all are based on two major premises: 1) all use causes some impact; and 2) defining a capacity (or choosing other actions to meet standards) requires "lines in the sand" (standards) about how much impact is acceptable.

Conflict

Recreation use conflict is related to, but different than, carrying capacity. At its root, conflict implies an incompatibility between two recreation activities, with one group generally showing a "zero tolerance" for another group's activity or behavior. Under this strict definition, there is little room for defining "acceptable impact levels."

In the real world, some conflicts are "zero tolerance" (e.g., motorized use in Wilderness), while others are multi-faceted and may allow some level of contact or impact (e.g., skiers and snowboarders at a ski resort). Successfully addressing conflict requires understanding the impacts which cause problems, the type of conflict (see discussion below), and its overall intensity. The following bullets highlight conflict research findings:

- Conflicts between different groups are well-documented in the recreation literature (see Graefe & Thapa, 2004 for a review). The most commonly studied conflicts are between motorized and non-motorized users (e.g., motorboaters and floaters; snowmobilers and skiers; hikers and ATV users), but some work has examined other activities (e.g., hikers and mountain bikers; hikers and stock users; waders, snorkelers, and motorboaters; walkers, runners, in-line skaters, and bicyclists; and skiers and snowboarders).

- One model defines conflict in terms of "goal interference" attributed to another group's behavior (Jacob & Schreyer, 1980). Contact can be direct (e.g., a rafter encounters a motorized boat) or indirect (a skier sees a track left by a snowmobile); it can also refer to people doing the same activity (e.g., conflict between partying vs. quiet campers).
- "Goal interference" does not require conflicting groups to have different goals (e.g., they both may be interested in "experiencing nature," "getting exercise," "being with friends," etc.), but it implies the behavior of one group somehow prevents the other from achieving their goals (Gibbons & Ruddell, 1995).
- The goal interference model (Jacob & Schreyer, 1980) suggests four factors that may intensify conflict: 1) groups more intensely involved in their activities; 2) groups with greater "place attachment;" 3) groups engaged in more "focused" (sensitive to the environment) activities; and 4) groups with lower tolerance for "lifestyle diversity." Research has found qualified support for some of these factors; demographic variables (age and gender) may also play a role.
- Todd (1987, as reported in Graefe & Thapa, 2004) is the only study we've found specifically examining conflict between non-motorized boaters and anglers. Conducted on the Delaware River, this master's thesis showed more conflict within an activity (canoeists with other canoeists) than with other users (anglers, motorboaters, tubers, and rafters), and more conflict with groups behaving discourteously than from the mere presence of another group.
- An alternative to the goal interference model defines conflict in terms of incompatible norms about appropriate activities or behavior. This applies normative theory (which underlies capacity research) to conflict, and focuses on specific impacts and evaluative standards of them as acceptable-unacceptable (Whittaker & Shelby, 2004).
- Many conflicts are "asymmetrical" – group A reports adverse impacts from group B, but not the converse. As conflicts escalate however, it is common for Group B to develop antipathy toward Group A (although it may be more generalized) (Graefe & Thapa, 2004). "Asymmetrical antipathy" explains why the "non-sensitive" group may be willing to "share" while the sensitive group may not; "sharing" does not have the same price for each group.
- Not all conflicts require contact in the resource setting. Vaske et al. (1995) distinguish "face-to-face" conflict and "social values conflict," where the sensitive group opposes an activity that they believe is inappropriate regardless of whether they encounter it. Vaske et al. found social values conflict among big horn sheep viewers on Colorado's Mt Evans, who considered hunting inappropriate, even if it occurred in a different season. In contrast, Vaske et al. (2006) found more face-to-face than social values conflict among hikers regarding mountain bikers. For several Alaskan rivers (e.g., Situk, Delta, Togiak NWR rivers), we have found social values conflict among about one-third of non-motorized users (toward motorized boaters).
- Sensitive groups often develop long lists of specific impacts that may be caused by the offending group, making it challenging to pinpoint the underlying "causes" of antipathy. Categories include biophysical impacts (e.g., jet boats erode stream banks); social impacts (jet boats are too loud); and safety impacts (jet boats may collide with or capsize canoes). When in-groups and out-groups have been established in a conflict, the lists of "problems" may grow long and include scapegoating, where unrelated impacts are blamed on the offending group (Whittaker & Shelby, 1993).
- Some assertions in conflicts are based on philosophical or value-based perspectives about appropriate recreational uses and management goals (e.g., whether a river should be managed

as wilderness). Weighing the importance of one argument versus another is challenging, particularly in polarized, politicized, and legal/adversarial environments.

- In a study of motorized and non-motorized trail users on Kodiak Island (Alaska), more active trail users (enthusiasts) held more polarized opinions about conflict and solutions than the general public (Whittaker, 2004). Graefe & Thapa (2004) caution that conflicts are not always "high and growing."
- Most efforts to reduce conflicts in recreation settings focus on 1) separating uses by space or time; 2) using "technical fixes" to reduce objectionable impacts; 3) educating users about the impact issues to minimize conflict behavior (if possible); and 4) developing new "norms" that support solutions that are viewed as "fair" (Graefe & Thapa, 2004; Whittaker & Shelby, 2002).
- Vaske et al. (1995) suggest social values conflicts are less well-addressed by separation strategies, arguing instead for education to reconcile misconceptions about the offending activity. We have less confidence that education can modify social values, and believe that separation remains an important tool. For example, "no motors in Wilderness" and "no hunting in National Parks" are separation solutions to conflicts that probably have substantial social values components. However, we recognize these two examples have been "settled" through federal laws with clear mandates; developing "fair" separation strategies can be more challenging in areas without such mandates.

Research on conflicts has looked at backgrounds and attitudes of users, economic impacts, safety, enforcement problems, and ecological impacts (Kuss et al., 1990; Graefe & Thapa, 2004). These issues are interesting and important, but they tend to obscure the more central issue, which is the nature of contrasting experiences in conflicts (Shelby, 1980). If a sensitive group feels that another use decreases the quality of their experience, it is important to understand whether a primary impact is to blame, or a more global objection. If two activities are incompatible and both are to be provided, "zoning" options that equitably share the resource (perhaps capitalizing on natural use patterns) are usually the best solution.

Conflict and capacity on the Upper Chattooga

The potential addition of whitewater boating on the Upper Chattooga appears to have both conflict and capacity components, with the conflict illustrating many classic characteristics (asymmetry, interference impacts, and contrasting definitions of appropriate use).

For some proportion of current users (particularly hikers who spend most of their time on designated trails and that do most of their hiking in summer or fall), the mere presence of boating is unlikely to be the problem, although they may prefer encounters with boaters to be low and infrequent. For these users, ***capacity is probably the primary issue***.

Many of these users are concerned about boating use because of high boating use levels on the Lower Chattooga (up to 200 people per day on some segments) or other rivers (e.g., the Nantahala and Ocoee). Although this report estimates that use levels on the Upper Chattooga are likely to be much lower (but still might approach 70 boaters per day on the highest use segment), there are concerns about numbers of boatable days and the number of boaters that would use them. For these users, ensuring there are low numbers would probably alleviate most of their concerns.

For other users, particularly anglers interested in using "overlap flow ranges" (see Chapter 7), boating use would create encounter and interference impacts, which introduces conflict. Capacity

may be relevant for those willing to tolerate two to three interference impacts per day; for others, even low boating use could be disruptive. For these users, ***face-to-face conflict is the central issue***, and actions such as separation during overlap periods become more important.

For still other users (which may include anglers, hikers, or others with a preservationist philosophy), there is probably ***social values conflict*** (rather than face-to-face conflict issues) is probably driving their antipathy toward boaters on the Upper Chattooga. Boating has been absent for 30 years (and was rare even before that), so the "current baseline" setting lacks boats. It is not surprising some believe that is how the place "should be" and resist any change. For these users, any boating represents a "problem" even if they have no face-to-face encounters; the 1976 boating closure to protect these opportunities is considered a "compromise solution," and any additional boating erodes it.

Deciding which group of upper river users "deserves priority" is a major challenge. No survey data estimate the relative numbers of users who see boating issue in terms of capacity, face-to-face conflict, or social values conflict, and such data probably might not be decisive in any case (for example, what percentage of users in any particularl category would be sufficient for decision-makers to give it priority over alternative groups?) In searching for "balances" among competing groups, the best course may be to develop 2 to 3 alternative combinations of actions to compare to the "no action" alternative, then let the public react to the analyses of various impacts.

Major types of actions

Visitor impact frameworks (such as LAC) recognize several ways to review current management and address impact problems that exceed standards. The rest of the chapter reviews categories of actions, the impacts they address, keys to successful implementation, and example rivers where they have been used.

The discussion centers around two "action-impact" matrices (Tables 5 and 6). These show which actions are likely to affect which impacts, and allow readers to focus on a particular action (to see what impacts it will address) or a particular impact (to see what actions might help address it). The first matrix examines development, education, and regulation alternatives; the second examines use limit and conflict separation actions.

Development / improvement / maintenance actions

Development actions typically use a "technical fix" approach and refer to "capital improvements" that modify the environment. Development actions are important when creating new recreation opportunities and maintaining or enhancing existing opportunities. In general, these actions are used to minimize biophysical impacts, enhance wildlife, or provide expected services. Examples of development / improvement actions that may be helpful on the Upper Chattooga include:

Trail redesign / maintenance

These actions focus use away from sensitive sites and harden heavily used areas (Cole 1979; 1987; Hammitt and Cole 1987). In the Upper Chattooga, the issue is ensuring that trails handle the volume of use without unacceptable erosion. The recent Forest Service inventory of trails and erosion problems provides a good start for identifying potential maintenance, re-design or closure locations. Trail redesign is a common approach to trail impacts in WSR plans; prominent examples include the Upper Rogue, Metolius, and Wilson Creek (Diedrich, 2007).

Camp rehabilitation / reorganization

This action reduces biophysical impacts at camps (litter, cut trees, bare soil, etc.), usually through "hardening" or creating barriers that funnel use to durable areas or away from "redundant" social trails and satellite sites. At several camps on the Upper Chattooga, another major issue is moving camps back from the river or other water sources (to minimize erosion). The action may help reduce camp encounters or large group encounters by "organizing" which sites campers should use (designated sites out of sight and sound of each other).

The Forest Service monitoring effort identifies camps with larger "footprints" and water-proximity problems. These are candidates for redesign or closures in order to meet standards. Formal designation of specific sites (which relates to education actions) can be part of this action. Camp rehabilitation / reorganization is a common approach on WSR rivers; prominent examples include the Metolius River and in Hells Canyon.

Wildlife openings

It is sometimes possible to "develop" improved habitat or create attractions that increase or concentrate wildlife. Similar to other "technical fixes," this includes large-scale habitat manipulations (e.g., prescribed burns that increase ungulate browse; increasing woody debris for fisheries, or flow manipulations for riparian habitat). On the Upper Chattooga, the primary option is creating wildlife openings (fields with better waterfowl habitat in an otherwise forested environment).

Backcountry pit toilets

This development action addresses human waste impacts in areas of concentrated backcountry camping use. Pit toilets are generally considered inappropriate in primitive settings, but they can be effective. On the Upper Chattooga, the large camping flat near the confluence with the East Fork would be a candidate, except that it is in designated Wilderness. If other camping areas in the Rock Gorge or Nicholson Fields reaches are used by large numbers of groups, pit toilets may be preferable to human waste impacts. These types of toilets were common on several WSRs (Rogue, Hells Canyon, Middle Fork Salmon, and Main Salmon) through the late 1990s, but they have been reduced since then. They are still used in some locations on the Lower Deschutes (Oregon) and Gulkana (AK).

Develop more single party camps

One way to address camp encounter or camp competition impacts is to create more camps. Based on current use and camp information, there are adequate numbers of camps on the Upper Chattooga, but "bottleneck" areas may create problems. Developing single party camps out of sight of sound from others could be helpful. This action works with camp rehabilitation efforts to ensure an appropriate number of camps, but it may exacerbate trail encounters by attracting more use. It needs to be coordinated with education efforts so users know locations and regulations. This action has been used on several WSRs, including the Pecos, Wilson Creek, and Lower Deschutes.

Clean-up patrols

Addressing litter impacts often simply means conducting more frequent clean-up patrols (or coordinating similar volunteer clean-up efforts). The biophysical monitoring effort conducted in 2006-07 can help prioritize trail segments and campsites that require greater emphasis. Many WSRs have active patrol programs.

Education

Education actions are often viewed as a panacea for addressing human-caused impact problems (Roggenbuck 1992); the idea is that people who "understand" the impacts they cause will behave differently. Compared to regulatory approaches, education is appealing because it is less obtrusive (Fish and Bury 1981). On rivers, education actions often focus on teaching etiquette (e.g., norms to minimize camp competition) and minimum-impact practices (e.g., no-trace camping or human-waste disposal), but may also be used to disperse use to lower use times or places. Education is most effective when it helps users better accomplish their existing goals using equipment which is available to them (e.g., education about more effective backcountry food storage practices, using agency-supplied bear-proof containers). Education actions that may help on the Upper Chattooga include:

Reducing/dispersing use via information

This action reduces impacts indirectly by dispersing use through information about use levels, bottleneck areas, or other impacts (Lucas 1981; Krumpe and Brown 1982). For example, if hiking densities are publicized, some people will avoid higher use times to match their preferences. Information to disperse use helps visitors choose the type of experience they want, or allows them to "prepare for" the conditions they are likely to find. Research suggests such information is highly valued by users, although it seldom has major effects on use patterns (Roggenbuck 1992).

On the Upper Chattooga, information about use levels in different parts of the corridor or at high use camps sites could benefit interested in solitude. Grand Canyon uses information to disperse camping in bottleneck areas and many WSRs provide general information about seasonal and weekday/weekend use patterns.

Leave no trace education

This action teaches users better backcountry practices to limit biophysical impacts. Messages focus on litter disposal, human waste practices, minimizing the size and use of fires, and avoiding new user trails or campsites.

Persuasion and attitude change literature in other natural resource areas suggests that some behavior modifications are possible with well-developed educational efforts, but "engineering" long-term, lasting change is challenging and complicated (Roggenbuck, 1992). Designing and implementing effective education campaigns requires clear understanding of persuasion and communication theory and practice, which is often missing from natural resource management efforts (Manfredo, 1992; Whittaker, Vaske, & Manfredo, 2002).

As with many behaviors based on "environmental ethics," widespread conformity depends on whether people recognize the consequences of their actions and accept responsibility for them.

Most agencies support “leave no trace” education efforts, but fewer river managers have developed or implemented a multi-faceted program.

Etiquette education

This action changes discourteous behavior that may exacerbate encounter or competition impacts. Etiquette issues on the Chattooga include camp proximity (don’t camp within sight or sound of others), fishing proximity (don’t fish too close to other anglers), and best ways for boats to pass anglers (if boating is allowed).

Similar to “no trace” education, effective etiquette campaigns can be challenging and probably need to be multi-faceted. Etiquette information is commonly available for WSRs through brochures, maps, or signs at launches and trailheads, but we have not seen research evaluating their effectiveness.

Regulations

Regulatory actions usually employ a “structural fix” approach, focusing on changing behavior to minimize impacts. They may be effective when educational alternatives fall short, although the two approaches are complementary (Lucas 1982), because regulations can reinforce educational efforts, regulations become widely known through education, and they “educate” users about problem behaviors (and the impacts they cause). Regulation actions that may help on the Upper Chattooga include:

Fire regulations

Fire regulations include limiting fires to existing fire rings, requiring fire pans, or prohibiting fires altogether. Such regulations might decrease firewood collecting (and related tree damage), or minimize the number and size of fire rings at camps. Fire regulations have been used in alpine environments where firewood is scarce and on western rivers where wild fire dangers are more common, and in many cases fire ring impacts have virtually been eliminated. However, the Ellicott Wilderness user study shows little support among current users for fire regulations (Rutlin, 1995).

Human waste regulations

Most multi-day western rivers require boaters to carry out human waste via portable toilet systems, and some agencies are experimenting with similar rules for climbers in high use areas. On multi-day rivers, these systems are widely accepted and have virtually eliminated human waste impacts. However, carry-out regulations require equipment investment from users (portable toilets) and agencies (scat machines), and a major shift in user norms, and equipment is also not well-suited for backpackers.

Regulations to reduce wildlife impacts

Regulations are commonly used to protect wildlife habitat or prevent wildlife disturbances. Area closures, or prohibitions of certain types of use, are the most common approaches. Examples include 1) boating restrictions where bald eagles nest or feed and buffer zones around eagle nests (Anthony et al., 1995) and 2) dog prohibitions or leash laws for areas with nesting bird colonies

(Burger, 1995). Current studies have not identified species or habitat requiring such regulations on the Upper Chattooga.

Fishing regulation changes

Fishing regulations are commonly used to manage the number of fish caught and harvested, but they can also affect use levels, types of use, and angler behavior. For example, catch and release regulations tend to attract more specialized anglers interested in trophy fish, but eliminate bait anglers interested in harvesting fish. The Delayed Harvest regulations on the Nicholson Fields reach have almost certainly modified use patterns during the DH season and thus affect preferences or tolerances for encounters or other uses by current users. Any major changes in stocking patterns would also likely affect the number and type of anglers, which could affect impacts (e.g., lower summer stocking for harvest would probably reduce bait angling and attendant litter).

Regulations can also reduce competition or interference impacts between different types of anglers (e.g., boat vs. bank anglers). This is a primary strategy on several western rivers desgined to limit interference impacts from boat-based anglers on shore-based anglers. Rivers with "no fishing from a boat" regulations include the Madison, Ruby, Beaverhead, Big Hole, Rock Creek, and Blackfoot in Montana, the Deschutes in Oregon, and the Kenai in Alaska. We are not aware of similar regulations on eastern rivers, although they are apparently being contemplated on the Delaware. These regulations are only effective if boaters are interested in fishing; they do not address impacts from whitewater or scenic floaters.

Use limits

As discussed in Chapters 5 and 6 on impacts, use limits tend to be more effective for addressing social impacts (encounters, competition) than biophysical impacts. Use limit actions that may help on the Upper Chattooga include:

Limits on numbers of boaters

Limits on boater numbers are probably the best way to ensure that boating use (if allowed) does not substantially increase encounter rates in the river corridor. Boater limits (of both private and commercial use) are a central management tool for over 25 rivers (most in the west), and have reduced encounter and camp competition impacts to acceptable levels. Limits on commercial use appear to be in place on at least 50 other rivers, and can be effective at limiting certain types of social impacts if commercial use makes up a substantial proportion of all use.

In several cases, permit systems apply only to boaters with no limits on other uses such as hiking access or fly-in access (e.g., Rogue, Selway, Main Salmon, Middle Fork Salmon, Hells Canyon, Kern). In other cases permits are required for all overnight trips (e.g., Colorado in Grand Canyon, Yampa/Green in Dinosaur National Park, Forks of the Kern) but are not specific to an activity. Rivers managed for very low density Wilderness experiences include the Forks of the Kern (15 private boaters per day) and the Selway (one launch per day).

To meet the range of encounter standards described for various groups on the Upper Chattooga (see Chapter 6), reasonable limits to consider in alternatives would probably fall between 2 and 6 groups (10 to 30 boaters) per segment per day. Limits might be different for different segments (e.g., lower numbers on Chattooga Cliffs because of its difficulty, higher numbers on Ellicott

Rock because it has less angling use), or for different flow ranges (e.g., lower numbers for the "low flow overlap" range and higher numbers for the "high flow overlap").

Limits on numbers of day users

This action could address hiker-to-hiker trail encounters, and would make the most sense on high use summer weekends. It is unlikely to address other social impacts. With the exception of use limits in a few alpine areas (e.g., Mount Whitney, Mount St. Helens), we are not aware of day use limits on WSRs. Smaller park units (e.g., state and regional parks) may limit use levels by parking lot capacities (which act as *de facto* day use limits, see below).

Limits on numbers of anglers

This action would address fishing competition, on-river encounters, and possibly angler-boater encounters (if boating were allowed). The most likely place for such limits is the Nicholson Fields reach on weekends during DH season. Limits on anglers are relatively rare on public land, but have been used in some places (e.g., Georgia's Duke's Creek) to provide low density fishing experiences.

Limits on overnight use

Limits on overnight use are the most common capacities in river and Wilderness settings, and several wilderness units in the Southeast require overnight permits to address camp encounters or camp competition. These limits also allow "marginal" camps to be closed, thus reducing camp impact problems. Linville Gorge NC is a river in the southeast with overnight use limits (50 permits at one time, applicable from May to October), but this is mostly directed at hiking groups. Some boaters do run the challenging Class V+ gorge, but fewer apparently do so as an overnight trip.

A variation on overnight use limits may include designating and assigning camps, which allows more complete utilization of camps. This makes the most sense for "bottleneck areas" with camp competition. The Middle Fork Salmon in Idaho has assigned camps (in addition to use limits); commercial camps on the Lower Chattooga are also assigned.

Frontcountry parking limits

An alternative to limiting use via permits is to limit facilities at access points (parking lot sizes). This is the implicit strategy at many frontcountry park areas (e.g., public beaches, county and regional parks); it is an explicit strategy of some state parks along Alaska's Kenai River during high use salmon angling seasons (with the number of parking spaces linked to the number of available fishing sites). This action is successful only if it is illegal or impossible to park outside designated lots.

Group size restrictions

Group size regulations are commonly employed to minimize social and biophysical impacts in backcountry areas, and they can be effective if there is a relationship between group size and impacts. This action is likely to reduce large group encounters and perhaps address some site impacts.

Considerations for developing permit systems

If the Forest Service developed a permit system for boaters, anglers, hikers, or overnight use, there are several implementation issues. Major decisions include 1) will permits be available by reservation, first-come/first-served, or by lottery; and 2) will an administrative fee be charged? It is beyond the scope of the present analysis to sort through these issues, but the effort to administer (and educate users how to use it) are potentially substantial. If such a system were considered, we have developed a short list of features that might be incorporated in such a permit system for boaters (if that use is allowed). Because boatable days are rare, difficult to predict, and require boaters to be spontaneous in their trip planning, a permit system would have to be efficient. The following features are likely to help:

- A ***"pre-registration"*** component to put potential permit applicants into a system and provide numbered tags for boats.
- A ***"boat/no boat" prediction*** from the Forest Service two to three days prior to prospective boating days, based on existing flows and projected weather. If boating seems likely, pre-registered applicants would be encouraged to apply for the limited number of available permits.
- Boater ***applications might close*** mid-afternoon one day prior to the prospective boating day.
- The Forest Service would make a final ***"boat/no boat" decision for the date*** and ***select permittees*** from among applicants; permit winners would receive an email.
- Winning applicants would ***accept or decline the permit*** by 8 am the next morning (giving them a final opportunity to see if flows and weather are acceptable). Cancelled permits could be made available to others at that point.
- The Forest Service would post boat tag numbers of those with permits, and boaters would display their tag and carry the email permit while on the river.

Developing a larger use limit system that applies to all users might have similar administration issues, because most Upper Chattooga users are day users, and most are likely to have short planning horizons.

Separating uses to address conflicts

Earlier chapters document the potential for conflict between boaters and other users (if boating were allowed), and the most important impacts (on-river encounters and interference with angling). The opening section in this chapter describes use conflicts and the ways they are usually addressed (separating uses by space or time, or modifying norms about acceptable uses). Examples of conflict-reduction actions include:

Separating uses by space

The year-round boating closure above Highway 28 used this approach, essentially managing for boating on the lower river and non-boating activities on the Upper Chattooga. Variations might include closures for shorter segments and/or shorter time periods. Given current impacts and use patterns, the most beneficial ***segment separation options*** focus on the three frontcountry areas and the Nicholson Fields (DH) reach (if boating is allowed on the longer reaches):

- A boating closure at Sliding Rock (particularly in warmer months) could prevent conflicts between boaters and swimmers at this site (if boaters were otherwise allowed to use the

segment). This is unlikely to have a substantive effect on boaters running the Chattooga Cliffs reach, even if boaters used the pool below the slide as a starting point for their trips (which would only occur if the river though private land below Grimshawes Bridge was adjudicated in favor of public access).

- A boating closure for ¼ mile on either side of Burrells Ford Bridge. This could require boaters to take out above (when running the Ellicott Rock reach) or to put-in below (when running the Rock Gorge reach) that area. This involves a longer "carry" to the launching areas, but boaters currently portage similar distances at most Lower Chattooga launches. It would slightly increase trail use in the Burrells Ford area, but many of those trails are heavily used already, and could be redesigned to handle the boater traffic if necessary.
- A boating closure from Lick Log Creek or Reed Creek to Highway 28 (particularly during DH season). If boaters were allowed to use the Rock Gorge Reach but were required to take-out at Lick Log Creek (the ¾ mile trail to Thrift Lake), all boater-angler encounter and interference impacts would be eliminated in the Nicholson Fields or DH reach, arguably the "highest-value" fishing reach. This reach is mostly flat or Class I water, and less interesting to whitewater boaters, but such a closure would eliminate potential scenic boating (canoeing, boat-based fishing, or tubing) opportunities during periods when it is in place.

Separating uses by space (zoning) is among the most common ways of addressing use conflicts in land-based settings; for example, most national forests include include distinct areas where motorized and non-motorized uses can occur. In river settings, segment zoning is also common, particularly for separating motorized and non-motorized uses (dozens of WSRs or segments have been designated non-motorized). Zoning by space to address conflicts between non-motorized boating and other uses is more rare, but examples include non-motorized boating closures on all rivers in Yellowstone National Park, segments of the Merced and Tuolumne in Yosemite National Park, and the North Umpqua in Oregon (with a five mile reach closed to boating during peak steelhead season). The North Umpqua closure is by recommendation rather than formal regulation, but appears to have near complete compliance. We are unaware of non-motorized segment closures (aside from the Upper Chattooga) in the southeast.

Separating uses by time

An alternative approach is to separate uses by time, which includes seasonal, day of the week, or time of day closures. Given current impacts and use patterns, the most beneficial timing options would focus on the DH season, the higher use summer and fall color seasons, or certain times of day:

- A boating closure on the Nicholson Fields reach during the DH season would prevent conflict between anglers and boaters in the "highest-value" fishing reach during the "highest-value" fishing season.
- A boating closure in summer and early fall would address conflicts between boaters and hikers during the "highest-value" hiking season.
- Limiting boating to the middle of the day (e.g., 10 am to 5 pm) could reduce angler-boater interaction during late spring, summer, and early fall (when better fishing is in mornings or evenings). However, both groups prefer the middle of the day from November to about February (the majority of likely boatable days).

Several WSRs have timing restrictions. For example, the North Umpqua has boating time of day restrictions to minimize impacts on anglers (who tend to fish mornings and evenings). Similarly,

the motor/non-motor segment closures on Hells Canyon vary by season, Grand Canyon has a “no motors” season, and segments of the North Fork Virgin in Zion National Park are closed to whitewater boating and tubing during parts of the year.

Separating uses by flow

Separating uses by flow level is way of separating uses by time, allowing natural flow regimes to dictate boatable times. Two rivers where variations of this concept have been used include the North Fork of the Virgin River in Zion National Park (whitewater boaters are allowed to boat the river by permit during high flow periods of the year) and a segment of the Rio Grande near Albuquerque NM (commercial use is allowed on this segment only during higher flows).

As discussed in Chapter 7, the conflict between boaters and anglers is probably only relevant on the Upper Chattooga in the two “overlap ranges,” and separation by flow thresholds offers one way that high quality opportunities for both groups might be addressed.

There are challenges to a flow-based separation, beginning with the lack of a real-time gage at Burrells Ford. In addition, the river’s “flashy” hydrology means that “boating/no boating” decisions will sometimes be “wrong” in hindsight. It is also challenging to “split” overlap ranges. For example, for the “low flow overlap” (which provides optimal fishing and lower quality technical boating), the options appear to be:

- Prohibit boating on these days.
- Determine the flow splits the 77 days in overlap period; boating could be allowed above that flow.
- Choose the middle flow in the range (288 cfs at Burrells Ford); boating would be allowed above that flow.
- Allowing boating all days in this range.

Enforcing and administering zoning or use limits

Stakeholder discussion has offered differing opinions about whether spatial/temporal boating closures or use limits (if boating were allowed) could be enforced given current Forest Service staffing. Enforcement can be challenging, and more complex boating regulations (e.g., flow, segment, and timing components) would certainly be more difficult for boaters, anglers, other users to know what is legal (which would probably complicate the ability to prosecute violators).

On-the-ground enforcement of more complex boating (or other use) regulations might also be challenging (if boating were allowed). With the current boating closure, rangers focus their enforcement efforts on easily identifiable days with higher boatable flows. If they observe a boater on the restricted reaches, citing the violator is straightforward.

If more complex boating regulations were in place, enforcement efforts would conceivably have to occur on a larger number of days, and determining whether a boater was "legal" under the rules would greater sophistication. We believe that the amount of time "on-the-ground" for such law enforcement efforts is likely to be similar (boating is still only likely to occur on the relatively few days that flows are boatable), so the real increase in effort is likely to be related to permit system administration (if one is developed) and efforts to educate users on how to use it. This is discussed briefly under "administering a permit system," but the details of such efforts are not trivial.

Finally, user compliance with use limits or zoning closures is unlikely to be total, so impact estimation (e.g., encounters, interference incidents, competition) should take this into account. Whether intentional or not, some users are likely to exceed group size regulations, fail to obtain permits (if necessary), use lower than prescribed flows (if those are used in a zoning option), and so forth. Educational efforts and active law enforcement may go a long way to minimizing non-compliance, but these can be costly. In most low-to-moderate density settings, "norm enforcement" by other users is critical for determining the success of a management program such as use limits or zoning.

Table 5. Impact – Action Matrix I: Development, education and regulation actions.

Legend ++ Reduces impact + Slightly / potentially reduces impact — May increase impact □ No effect	Development / improvements						Education			Regulation			
	Trail redesign / maintenance	Camp rehab / reorganization	Wildlife openings	Backcountry pit toilets	Develop more single camps	Clean-up patrols	Disperse use via information	Etiquette education	"Leave no trace" education	Fire regulations	Human waste regulations	Wildlife issue regulations	Fishing regulations
Biophysical Impacts													
Trail erosion	++	+							+				
Litter on trails				+		++			+		+		
Camp impacts		++		+	+	++			+	+	++		
Wildlife impacts			++		—				+			+	
Bank trampling	+								+				
Woody material impacts									+				
SAR impacts													
Social Impacts													
Trail encounters					—		+						
On-river encounters							+						
Angler-boater encounters							+						+
Boater-boater encounters							+						
Large group encounters		+					+						
Interference with angling							+	+					+
Fishing competition							+						+
Camp encounters		+			+		+	+					
Camp competition					++		+						
Parking lot congestion					—		+						

Note: Impacts are not necessarily of equal importance and symbols do not necessarily connote equal effects.

Table 6. Impact – Action Matrix II: Use limits and conflict actions.

Legend ++ Reduces impact + Slightly / potentially reduces impact — May increase impact □ No effect	Use limits							Conflict actions						
	Limit boating	Limit day hikers	Limit anglers	Limit overnight use	Frontcountry parking limits	Group size limits	Registration – no limits	No boating by season	No boating by flow	No boating segment	No boating time of day	Education -- sharing	No boating recommendations	No boating -- entire river
Biophysical Impacts														
Trail erosion														
Litter on trails														
Camp impacts				+		+								
Wildlife impacts								+						
Bank trampling			+											
Woody material impacts														+
SAR impacts									+					
Social Impacts														
Trail encounters		++		++	++									
On-river encounters	++		++	++	++			++	++	++	++	+	+	++
Angler-boater encounters	++		++					++	++	++	++	+	+	++
Boater-boater encounters	++													
Large group encounters						++								
Interference with angling	++							++	++	++	++	+	+	++
Fishing competition			++		++									
Camp encounters				++										
Camp competition				++										
Parking lot congestion	+				++			+						

Note: Impacts are not necessarily of equal importance and symbols do not necessarily connote equal effects.

Management action considerations

Management actions can be used to reduce capacity and conflict impacts. Taken together with information from preceding chapters, the present analysis suggests several ways that management can help provide high quality recreation opportunities on the Upper Chattooga.

- For current uses, different segments provide different recreation opportunities at different times of the year. There are different densities, types of users, and levels of impacts associated with these opportunities, and users seem to have developed related tolerance levels, at least for the social impacts (we have no data about evalus of biophysical impacts).
- Adding boating to this mix would have some impacts on current users. The extent of these impacts depends upon the number of boaters and the times of year when boating occurs.
- Legislated goals for the river are to provide high quality ("outstandingly remarkable") recreation opportunities and maintain biophysical health. But any use causes some impact, and there is a natural tension between allowing use and the consequences (impacts) of that use. Good management limits use and impacts to acceptable levels.
- In choosing where to "draw the line" for impacts and designing actions to meet those standards, there are often trade-offs. In some cases, solutions can provide multiple opportunities which "fit together." In other cases, providing one opportunity creates adverse impacts on other opportunities or resources.
- In general, information about capacity and conflict issues on the Upper Chattooga suggests it is possible to develop alternatives which provide different mixes of multiple recreation opportunities. Existing data does not clearly indicate the "right" mix of different opportunities, so decisions about which ones to provide are not a "technical" task. However, identifying a reasonable range of such alternatives and analyzing their effects will require "honest conversations" about impacts and trade-offs. Information in this report is intended to clarify these trade-offs for decision makers, stakeholders, and the public to consider in the remainder of the LAC / NEPA process.

9. Proceeding with Planning and Decision-making

This final chapter briefly reviews additional information options for capacity or conflict decisions on the Upper Chattooga, and ways to integrate them into planning and decision-making.

Introduction

The present report has summarized and integrated existing information from many sources to provide a comprehensive overview of capacity and conflict issues on the Upper Chattooga. It is possible to collect more (or more precise) information about some topics. The following reviews information options, challenges in collecting or using the information, and the need for additional effort compared to the costs and benefits. It includes: (1) use information; (2) flow-recreation information; and (3) user survey information.

Use information

Use data for the Upper Chattooga remains sparse. Estimates of current use rely heavily on professional judgments from agency staff, and estimates for potential future boating use (if allowed) are even more challenging (see Chapter 4). The recently-initiated "spot count" data collection will continue through August 2007, resulting in better estimates for spring and summer periods, but this cost-effective program has some limitations (see discussion in Chapter 4). More extensive efforts could be developed (including more elaborate on-site counting or mandatory registration programs), but they can be expensive, take at least an additional year, or have a relatively heavy "managerial footprint."

Information summarized in this report is sufficient for understanding the overall use situation, but it is not detailed enough to develop precise relationships with specific impacts (e.g., "if there are X groups in Ellicott Rock reach, average daily encounters will be Y"). These relationships would help refine use limits if a permit system is used to control impacts such as trail or river encounters, but reasonable assumptions (based on information from other rivers) are sufficient to develop alternatives in the NEPA process. If a permit system is established, through planning, it would provide information to adjust limits through monitoring and "adaptive management." Similarly, if a user survey is conducted (see below), concurrent use data collection could help link use with reported impacts.

Improved use estimates for boating probably require actual boating; this is only an issue if boating is actually allowed. As discussed in Chapter 4, publicity and latent demand are likely to artificially increase boating use for at least a year (if boating were allowed), so even a one-year assessment may not depict "natural" use over the long run. Waiting for more precise data adds a "time cost" to decision-making; we believe it makes more sense to develop alternatives based on current estimates, with built-in monitoring and adaptive management features that allow "adjustments" when more precise information becomes available.

Flow information

Existing information for flow-dependent activities on the Upper Chattooga is relatively precise for a river with a "new" gage and formal assessment of just one flow. However, there may be opportunities to 1) improve hydrology relationships between Burrells Ford and Highway 76 gages as the period of record for Burrells Ford expands; 2) develop more precise boating flow ranges (if

boating is allowed); and 3) develop more precise angling flow ranges as anglers calibrate to the Burrells Ford gage. This information is important if management actions designed to reduce potential conflicts between boaters and other groups include a flow threshold component (see Chapter 8). But it may require time, a systematic effort, and the allowance of boating (potentially on a "trial basis"). We believe existing information is sufficient to develop alternatives that include such thresholds, and additional flow-recreation work is unlikely to substantially change the concepts underlying those alternatives. Given that adjustments can be made based on monitoring, available information is sufficient to develop flow thresholds during NEPA planning.

User survey

User surveys provide important data in most capacity analyses, particularly for social impacts. A few studies provided survey information from Upper Chattooga users (e.g., Ellicott Rock users and Burrells Ford campers), but they were not recent, did not ask about some social impact standards, or support for capacity and conflict management actions. While information about these topics would be helpful for developing alternatives for the Upper Chattooga, a major survey effort has challenges for this particular river:

- Unless boaters are allowed to use the river, it would be difficult to measure impacts from boaters and tolerances for such impacts (existing users would be speculating about how boaters affect them).
- Unless boaters are allowed to use the river, it is difficult to develop a sample of upper river boaters to learn their tolerances and management preferences.
- Developing representative samples of all groups is challenging, especially given the publicity and contention surrounding the boating issue.
- There are substantial time and effort costs to conducting a survey. Given OMB requirements regarding survey review, a survey is likely to delay a NEPA process and a decision for at least one year.

Additional information about users and their preferences is always helpful, but it is probably not necessary in order to consider standards and management actions in a NEPA planning process. Existing information about important impacts, tolerances, and support for management actions is sufficient to develop reasonable alternatives and allow stakeholder/public comment on them. For example, more precise information about average tolerances for trail encounters among hikers is unlikely to change stakeholder/public opinion about the concept of establishing encounter standards or using them to trigger a use limit system. There is sufficient information to develop management strategies, and adjustments to standards can be based on monitoring.

Conclusion

Taken together, we believe available information is sufficient to proceed with NEPA planning about capacity and conflict issues on the Upper Chattooga. Additional monitoring of biophysical and social impacts will be necessary in the future, but the additional precision provided by such efforts is unlikely to redefine what is already known. For the Upper Chattooga, the difficult decisions focus on (1) the opportunities to be provided, and (2) what kinds of limits or restrictions should be used to protect the quality of those opportunities. Existing information summarized in this report can be used to develop management alternatives that represent a reasonable range of opportunities, impacts, standards, and actions. This allows NEPA planning to move forward with detailed adjustments based on monitoring and adaptive management.

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