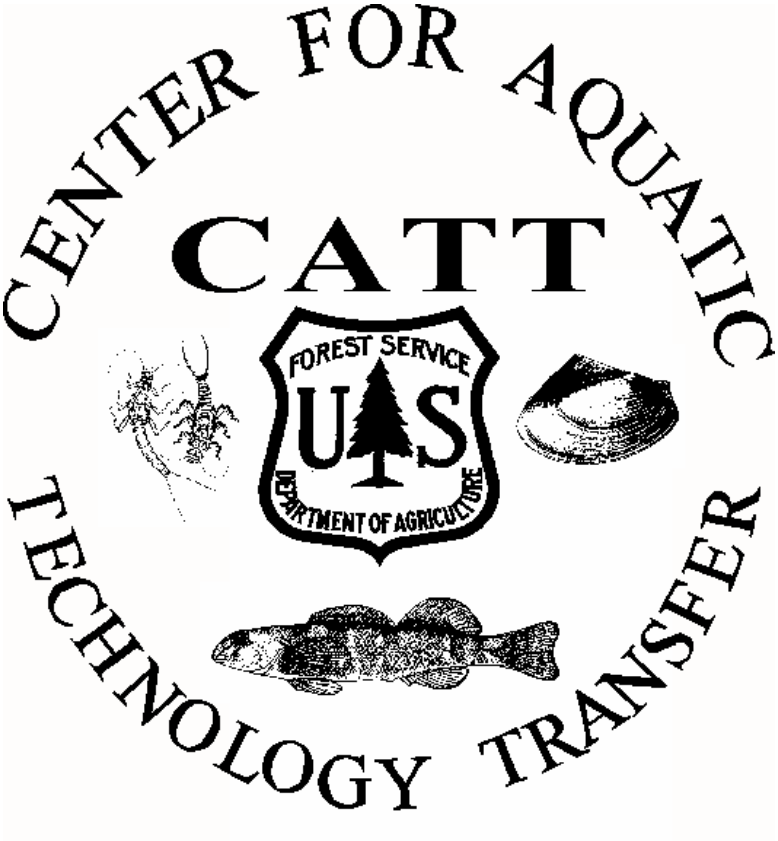
Inventory of Large Wood in the Upper Chattooga River Watershed, November 2007



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Introduction

Wood is an important feature of streams flowing through forested areas. In particular, large wood (LW) and other obstructions such as boulders slow flow, trap sediments, and damp and delay flood peaks (Montgomery et al. 2003). Tree boles are obvious major pool forming elements but wood contributes to aquatic habitat in diverse ways such as by providing cover from predators, refuge from high velocity flow, and substrate and organic matter for macroinvertebrates (Benke and Wallace 2003, Dolloff and Warren 2003). Large wood is considered so beneficial that riparian forests today are managed for LW inputs (Boyer et al. 2003, Jacobs 2004) and where recruitment or loading is judged insufficient, LW is intentionally added to stream channels (Reich et al. 2003).

Wood naturally enters stream channels by various avenues including bank undermining or blowdown of individual trees or groups of trees and transport en masse in debris flows or landslides from upstream channels or adjacent riparian areas (Swanson 2003). Although logging was one of the more dramatic causes of large wood loading and subsequent decline, other human influences such as roads and trails and land clearing for any reason have influenced both the rate and amount of large wood entering streams (Nakamura and Swanson 2003). Other more insidious events also can lead to variation in the rate of LW recruitment. Since the beginning of the previous century a fungus, inadvertently brought to North America on nursery stock from Asia, has killed nearly all American chestnut (*Castanea dentate*) trees. American chestnut was a dominant tree throughout much of the eastern US where, except for areas of salvage, its demise resulted in higher than expected rates of large wood and debris recruitment (Hedman et al. 1996). Today, the hemlock wooly adelgid (HWA) (*Adelges tsugae*), an aphid-like insect from Japan threatens eastern hemlock (*Tsuga canadensis*) with a similar fate (Koch et al. 2007).

The Chattooga River originates in North Carolina and flows south, forming part of the border between South Carolina and Georgia. Its watershed contains portions of the Francis Marion-Sumter (FMSNF), Chattahoochee-Oconee (CONF), and Nantahala National Forests (NNF), as well as the Ellicot Rock Wilderness Area (Figure 1). Like much of the forested land in the eastern US, the Chattooga River watershed experienced extensive logging in the early 1900s (Hedman et al. 1996, Manganiello 2006). In 1974, Congress designated 57 miles of the upper Chattooga River and a major tributary, the West Fork Chattooga River as 'Wild and Scenic' to preserve their outstanding natural and cultural resource values. The watershed receives heavy recreational pressure from several nearby population centers, including Atlanta, GA (Jacobs 2004) and has been infested by HWA since 2001 (USDA Forest Service 2007). Hemlocks are a primary component of the riparian forest throughout much of the watershed and are in a rapid state of decline (pers. obs.).

In fall 2007, the FMSNF contacted the Southern Research Station (SRS), Center for Aquatic Technology Transfer (CATT) to request assistance in development and execution of a LW inventory in the upper Chattooga River watershed (upstream of the West Fork Chattooga River confluence). The CATT collaborated with SRS scientists and resource specialists from the FMSNF and CONF to design and implement a LW inventory for selected stream reaches of the Chattooga River, West Fork Chattooga River (hereafter referred to as West Fork), Overflow Creek, and Holcomb Creek. During the week of November 12th 2007, personnel from the CATT, FMSNF, and CONF conducted an inventory of dead and down LW in the selected stream reaches. Crews counted all wood larger than 1 m long and 10 cm in diameter that had the potential to influence stream channel shape and function; in practice this meant all wood that impinged on the bankfull channel. Our primary goal was to describe the current abundance and distribution of LW within the selected reaches. Our data also provide a baseline for future LW monitoring efforts in the watershed.

Methods

Inventory Sections

The FMSNF requested an inventory of LW on 32.8 km of the mainstem Chattooga River from its confluence with West Fork to the Forest boundary near the confluence with Green Creek (Figure 1, Table 1). The majority of lands in the Wild and Scenic corridor between Green Creek and road 1107 near Grimshawes are in private ownership, precluding extension of the inventory upstream of Green Creek. The CONF requested an inventory on 9.7 km of the West Fork from its confluence with the Chattooga River to Three Forks (confluence of Holcomb Creek, Overflow Creek, and Big Creek). We also conducted inventories on 4.6 km of Overflow Creek and 4.4 km of Holcomb Creek for comparison with data collected on these streams as part of a larger study of fish habitat and production conducted during the late 80's - early 90's. Each inventory section was divided into consecutive 0.5 km reaches, as described below.

Reach Delineation

We acquired high resolution (1:24,000) National Hydrography Dataset stream data for the Chattooga River watershed and used an Arcmap extension (Beyer 2004) to locate points at the upstream extent of selected stream sections and every 0.5 km downstream thereafter (Figure 1). When the furthest downstream reach was 300 m long or less we joined that reach with the reach immediately upstream. When the furthest downstream reach was greater than 300 m long we allowed the reach to remain separate. As a result, of the 102 total reaches we delineated, 98 were exactly 0.5 km, 3 were longer, and 1 was shorter. The output was saved as a point shapefile. We converted the point shapefile to a series of

waypoints using a second Arcmap extension (Minnesota Department of Natural Resouces 2001) and loaded the waypoints onto Garmin eTrex Vista CX GPS[1] units.

[1]use does not imply endorsement

Field Work

Two-person crews entered the stream, located their assigned section, and then waded through each 0.5 km reach, tallying all pieces of LW that partially or wholly lay within the bankfull channel. Both crew members classified and counted pieces of LW. We recorded pieces of LW by size class (Table 2) and kept separate counts for each 0.5 km reach. In addition, we tallied rootwads and obstructions, observed riparian condition, photographed stream features, and recorded relevant comments. Rootwads were counted separately from attached pieces of LW. For example, if we encountered a size 4 piece of LW with a rootwad attached we tallied 1 piece of size 4 and 1 rootwad. We defined obstructions as single pieces or accumulations of LW that spanned at least half of the bankfull channel. Wood jams consisting of multiple pieces of LW counted as a single obstruction. We classified riparian condition as: 1) mostly forested; 2) mostly open; or 3) mixed forest/open. Crews recorded data on electronic datasheets. All data were stored in an Access database and exported to Excel and ArcMap for analysis.

Results

All streams were at very low discharge levels (USGS flow gauge near Clayton, GA was below 140 cfs for duration of inventory), allowing us to wade the majority of the stream channel. We inventoried 51.5 km of stream (Table 1) and recorded 8322 total pieces of LW (Table 3). At 329 pieces per km Holcomb Creek had the highest total LW per km, while neighboring Overflow Creek had the lowest, at 120 pieces per km (Table 4). Examination of individual 0.5 km reaches showed the highest total LW loads in Holcomb Creek, lower West Fork, and upper Chattooga River, lower loads in Overflow Creek and upper West Fork, and the lowest loads in the middle reaches of the Chattooga River (Figure 2). In most streams total LW was nearly equally split between the two small diameter size classes (sizes 1 and 3). Notable exceptions to this trend include Overflow Creek, where we found relatively few pieces of short, small diameter LW (size 1) (Table 5, Figure 3), and upper West Fork, which had relatively few long, small diameter pieces (size 3) (Table 5, Figure 5). We encountered the highest amounts of the larger diameter size classes (sizes 2 and 4) in the West Fork and upper Chattooga River, but overall these size classes were rare (Table 5, Figures 4 & 6).

We tallied 4 rootwads per km and 1 LW obstruction per km (Table 6). Rootwads were attached to less than 3% of LW pieces. Holcomb Creek had the highest number of both rootwads and obstructions per kilometer (Table 6, Figure 7). We classified all reaches as ‘mostly forested’ on Overflow Creek, and

Holcomb Creek. A single reach on the Chattooga River was classified 'mixed forest/open' with the remainder 'mostly forested'. Four reaches in lower West Fork were 'mixed forest/open with the remainder classified as 'mostly forested'. We noted hemlocks with varying states of hemlock wooly adelgid damage on all streams and documented fallen hemlocks in several reaches. We also noted pieces of cut wood in all streams. Cuts ranged in age from several days to several decades (Tables A2, A3, B2, B3, C2, C3, D2, D3).

We also have included results from a 1989 LW inventory conducted in Holcomb Creek and Overflow Creek. These data were collected as part of a larger study of fish habitat and production conducted during the late 80's - early 90's. In contrast to the 2007 inventory wherein all wood in the bankfull channel was counted, LW in 1989 was tallied within the wetted channel only. This means that we could not examine changes in the amount of LW between 1989 and 2007. However, we were able to compare LW loads between streams within each year. In 1989 there were 34 and 96 pieces per mile in Overflow and Holcomb, respectively. In both 1989 and 2007 Holcomb Creek had about 2.5x more total wood than Overflow Creek (Figure 8).

Discussion

We documented high variability in LW loads both within and among stream sections in the Chattooga River watershed. The smallest size class (size 1) comprised nearly half of the total LW load. The Chattooga River watershed is in a state of recovery from disturbance resulting from extensive logging in the early 1900's. Riparian forests in the southeast, even those managed as wilderness, provide minimal LW for at least 100 years after disturbance (Flebbe and Dolloff 1995, Hedman et al. 1996, Hornbeck and Kochenderfer 2000). During this period of low wood recruitment streams are particularly sensitive to LW removed during localized natural (e.g. floods) or human related (e.g. targeted removal) disturbances. Variation in scope and magnitude of these localized events and the presence of a high amount of small, easily transported pieces results in high amounts of variation in LW loads among and within streams.

In the period from 100 - 150 years after disturbance riparian forests mature and overstory mortality increasingly contributes LW (Hedman et al. 1996). Most of the Chattooga River watershed is entering this period when extant riparian forests become significant sources of LW. Hemlocks play an increasingly important LW role as riparian stands transition from this mid-successional period into late-successional and ultimately old-growth conditions. Hemlocks are shade-tolerant allowing them to grow in mixed riparian stands with a dense rhododendron (*Rhododendron maximum*) understory, as is common in the southeast (Ellison et al. 2005). Large fallen hemlocks are relatively stable, particularly in smaller stream channels (Nakumura and Swanson 1994), and slow to decay (Hedman et al. 1996, Ellison et al.

2005). Unfortunately, the majority of hemlocks in the watershed will die from HWA infestation over the next several years and much like the American chestnut, its days as a LW contributor are numbered.

The ongoing drought in the southern US will only serve to hasten their demise. Trees, particularly those already stressed by insects or disease, are further weakened by extreme weather conditions and thus are susceptible to windthrow or high precipitation events. It seems likely that even relatively mild storm events will contribute to increased slope failures and tree toppling over the next few years. In the short-term this will result in increased LW loads, though the ultimate amount is difficult to predict with precision. The long-term effect in many areas will be to reset the clock on riparian forest succession. Although *Rhododendron* likely will become the dominant riparian species where it is already established in the understory, in other areas hardwoods and yellow poplar (*Liriodendron tulipifera*) will replace hemlocks (Ellison et al. 2005). But it will be decades, if not centuries before the riparian forests can again provide significant amounts of LW. In the interim the streams will remain sensitive to LW removal and rely heavily on carry-over LW.

Carry-over LW are pieces that persist in the stream channel following their initial input. We counted many carry-over pieces of LW on Holcomb Creek and upper West Fork, left behind by loggers in the early 1900's. These pieces had two saw-cut ends and were typical saw log lengths, placing most of them in size category 3 (>5 m long, 10 – 55 cm diameter). Some had broken free from a disintegrating splash dam located about 0.5 km downstream of the bridge on FS road 86b. Others had likely remained in place for decades. In portions of the West Fork the logs were embedded in the stream banks. Holcomb Creek and West Fork had 2 – 3 times more size 3 LW per km than Chattooga River or Overflow Creek, where we saw no evidence of carry-over from logging activities. Results from our 1989 inventories on Overflow Creek and Holcomb Creek suggest that carry-over LW has elevated loads in some streams for decades. As hemlocks are recruited to the LW load they have the potential to contribute carry-over benefits for hundreds of years (Hedman et al. 1996).

Clearly carry-over LW has the potential to provide long-term benefits to streams in the Chattooga River watershed. Conversely, removal of LW can have long-term detrimental effects. We documented several locations on the Chattooga River, Overflow Creek, and upper West Fork where pieces of LW had been cut or removed from the stream channel. On the mainstem Chattooga the cuts were often near dispersed camping areas. We did not see evidence of camping on Overflow Creek or upper West Fork but the reach is a popular whitewater boating run (American Whitewater 2006). The cuts ranged in age from several days to several years. The most recent cuts were on a newly fallen, channel spanning hemlock and maple in upper West Fork. The LW had been cut into small, easily moved pieces. Some

pieces had been placed outside of the bankfull channel. Pieces that are removed from the channel can not function as LW and will not soon be replaced, an unintended consequence that will span generations.

The Chattooga River watershed faces many management challenges in the coming years. Recreation pressure will continue to increase and the HWA infestation will radically alter riparian and stream ecology. Regular monitoring will enable Forest Service managers to document LW input and carry-over during and after the HWA infestation. We recommend annual inventories for the duration of the infestation and following storm events and regular monitoring every 3 – 5 years thereafter.

In summary, our inventory found:

1) variability in the amount and distribution of LW within the upper Chattooga River watershed;

2) potential for large amounts of hemlock inputs from HWA caused deaths;

3) need to protect carry-over LW due to long-term loss of a dominant riparian species;

4) need to monitor LW inputs and removal.

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Tables

Table 1. Length and location of LW inventories, November 2007.

	Length (km)	Start	End
Chattooga River	32.8	West Fork Chattooga	Forest boundary near road 1108
West Fork Chattooga	9.7	mainstem Chattooga	Three Forks
Holcomb Creek	4.4	Three Forks	confluence with Addie Branch
Overflow Creek	4.6	Three Forks	confluence with unnamed tributary in from west; downstream of road 86b crossing
Total:	51.5		

Table 2. Size classes used for LW inventories in the Chattooga River watershed, November 2007.

Size Class	Length (m)	Diameter (cm)
1	1 - 5	10 - 55
2	1 - 5	> 55
3	> 5	10 - 55
4	> 5	> 55

Table 3. Counts of LW in each of four size classes, November 2007. See Table 1 for LW size classes.

	LW 1	LW 2	LW 3	LW 4	Total LW
Chattooga River	1974	24	2118	65	4171
West Fork Chattooga River	954	23	1142	35	2154
Overflow Creek	156	0	389	6	551
Holcomb Creek	646	1	788	11	1446
	3730	48	4437	117	8322

Table 4. LW per km in each of four size classes, November 2007. See Table 1 for LW size classes.

	LW 1	LW 2	LW 3	LW 4	Total LW
Chattooga River	60	1	65	2	127
West Fork Chattooga River	98	2	118	4	222
Overflow Creek	34	0	85	1	120
Holcomb Creek	147	0	179	3	329

Table 5. Percentage of LW in each size category, November 2007. See Table 1 for LW size classes

	LW 1	LW 2	LW 3	LW 4
Chattooga River	47%	1%	51%	2%
West Fork Chattooga River	44%	1%	53%	2%
Overflow Creek	28%	0%	71%	1%
Holcomb Creek	45%	0%	54%	1%

Table 6. Rootwads and LW obstructions encountered, November 2007.

	Rootwads		LW Obstructions	
	n	per km	n	per km
Chattooga River	143	4	26	1
West Fork Chattooga River	37	4	10	1
Overflow Creek	5	1	12	3
Holcomb Creek	28	6	24	5
	213	4	72	1

Figures

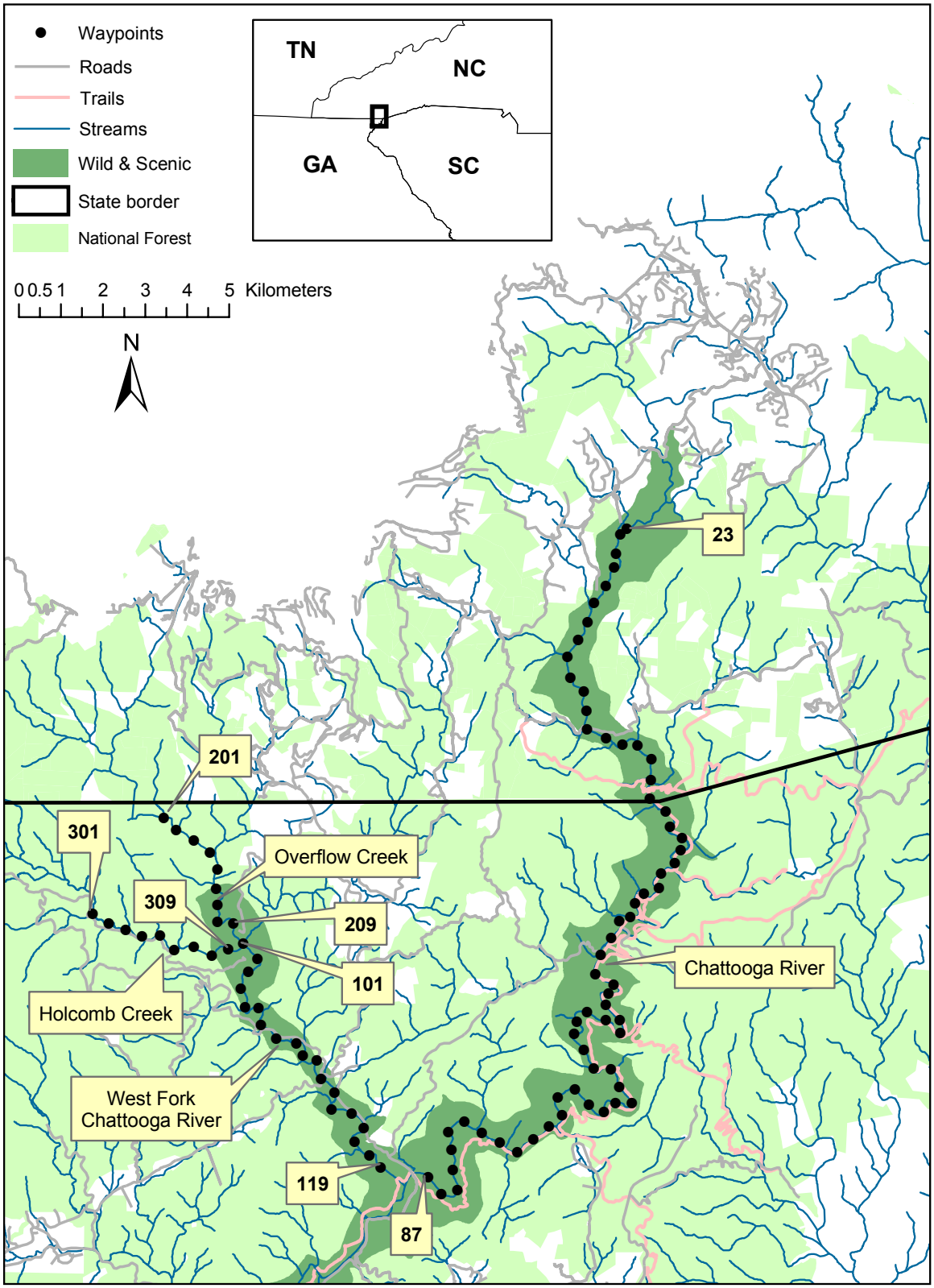

Figure 1. Waypoints marking upstream extent of corresponding reaches inventoried in November 2007. Waypoint numbers increase consecutively by 1 in a downstream direction.

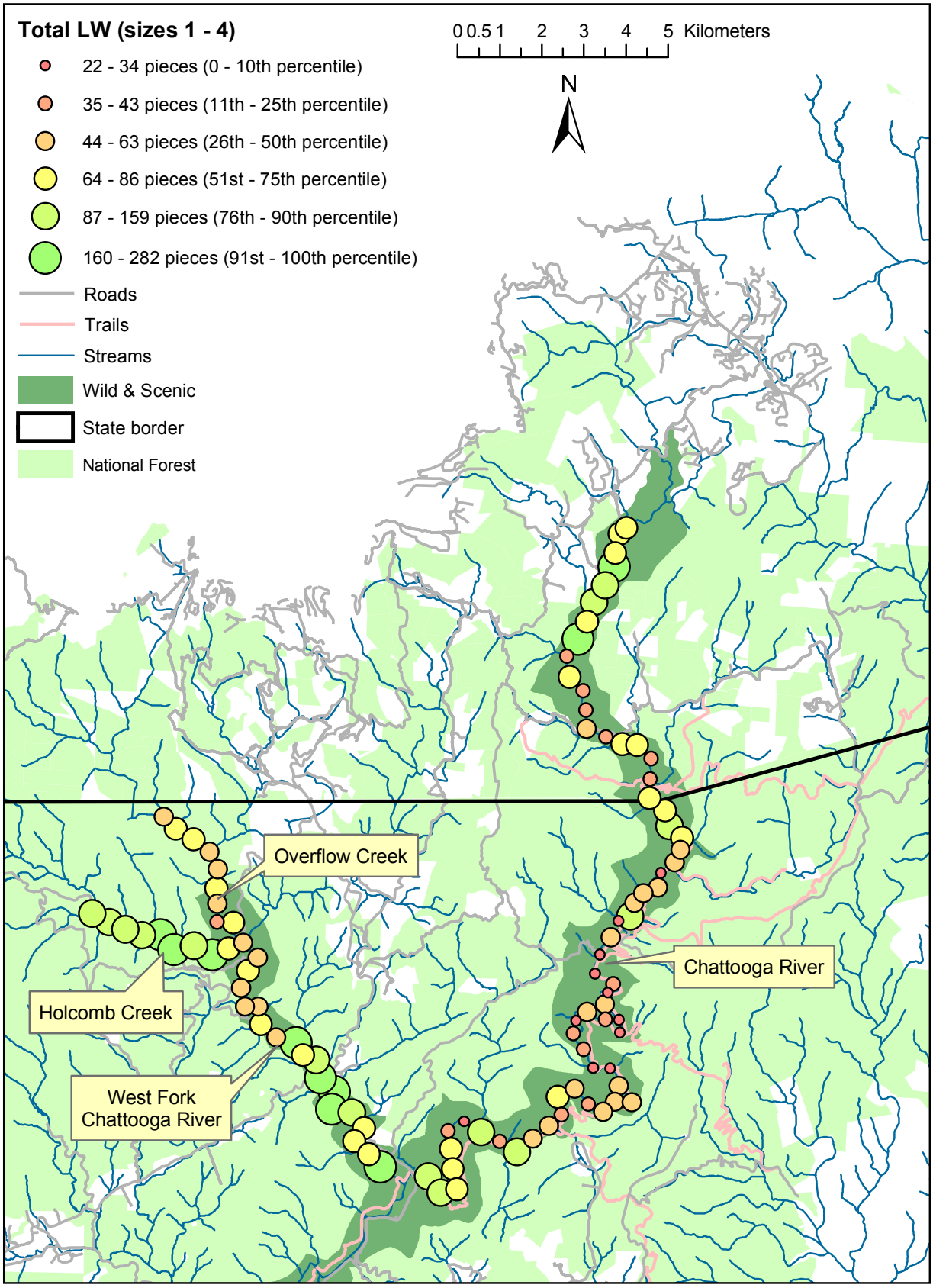

Figure 2. Total pieces of LW counted in 0.5 km reaches, November 2007.

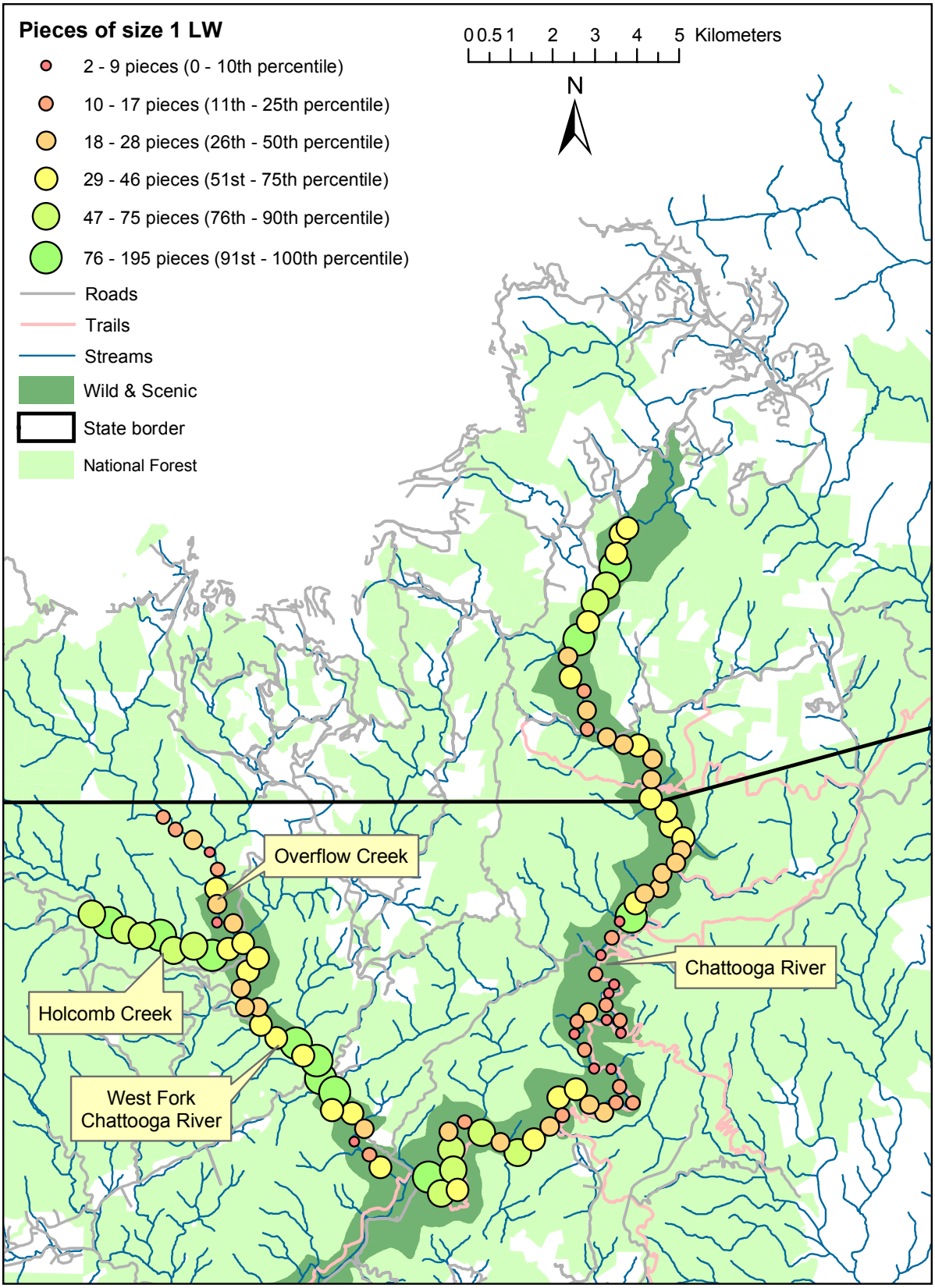

Figure 3. Pieces of size 1 LW (1 – 5 m long, 10 – 55 cm diameter) counted in 0.5 km reaches, November 2007.

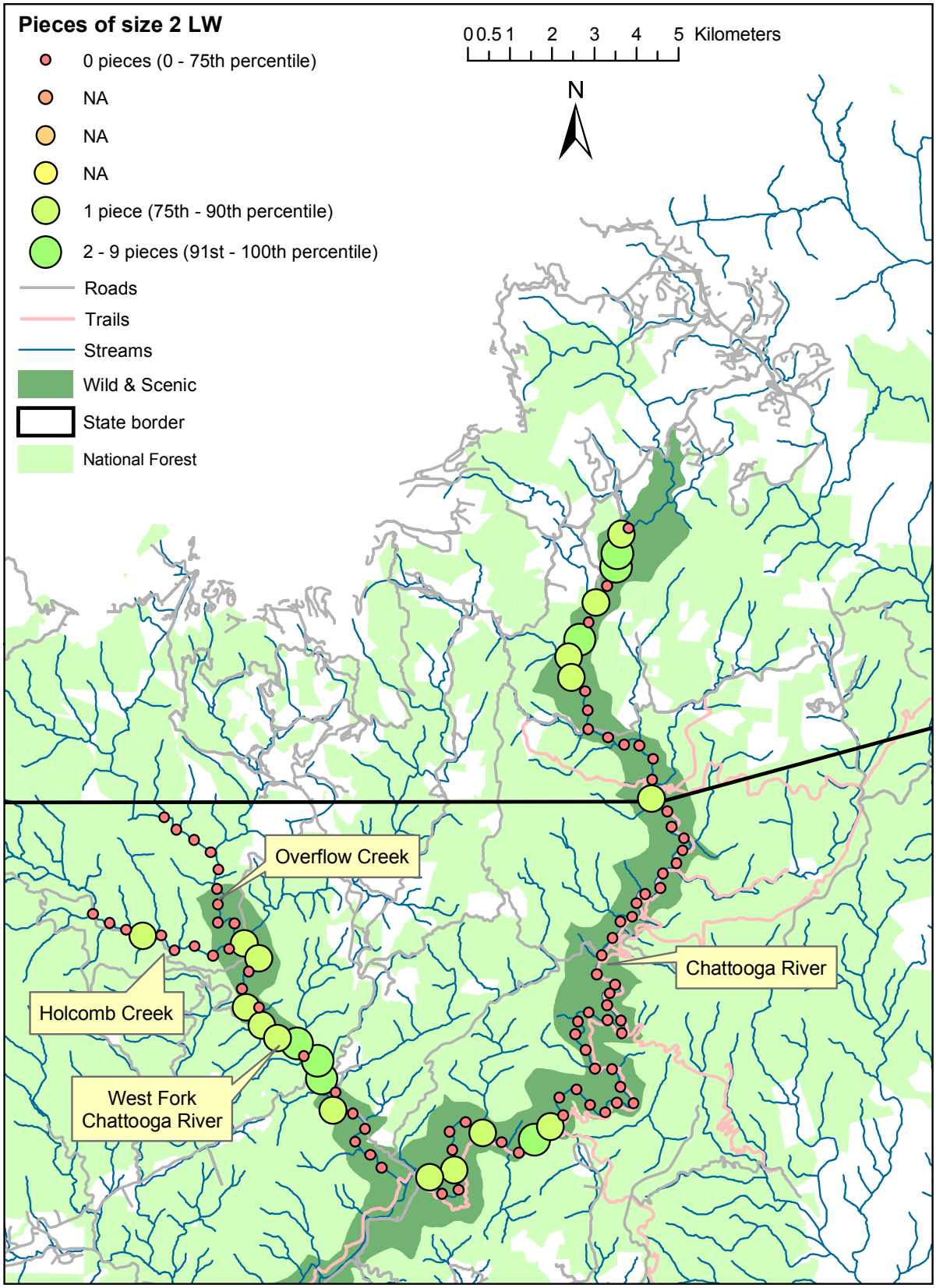

Figure 4. Pieces of size 2 LW (1 - 5 m long, > 55 cm diameter) counted in 0.5 km reaches, November 2007. Seventy-five percent of reaches contained no size 2 LW.

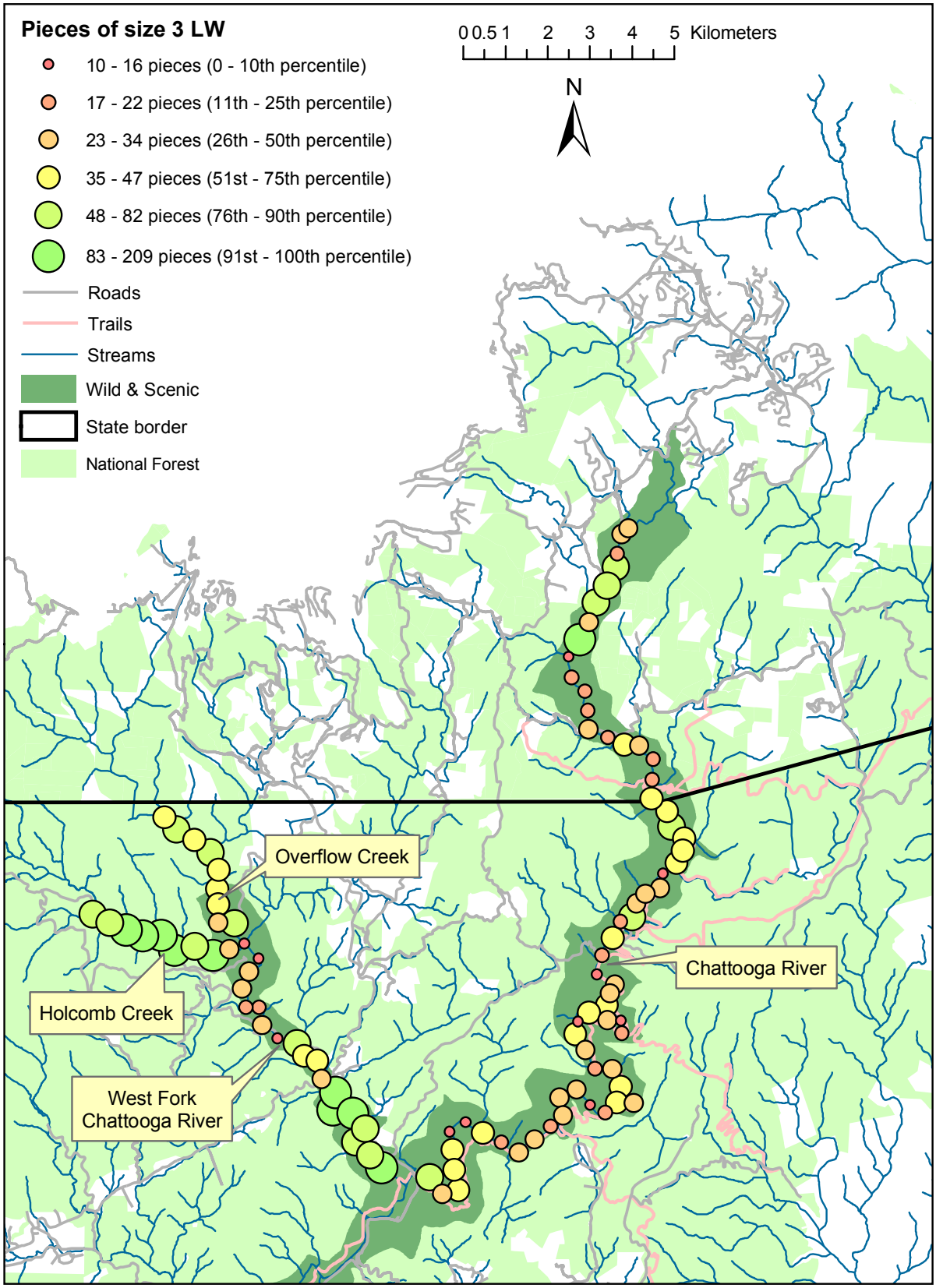

Figure 5. Pieces of size 3 LW (>5 m long, 10-55 cm diameter) counted in 0.5 km reaches, November 2007.

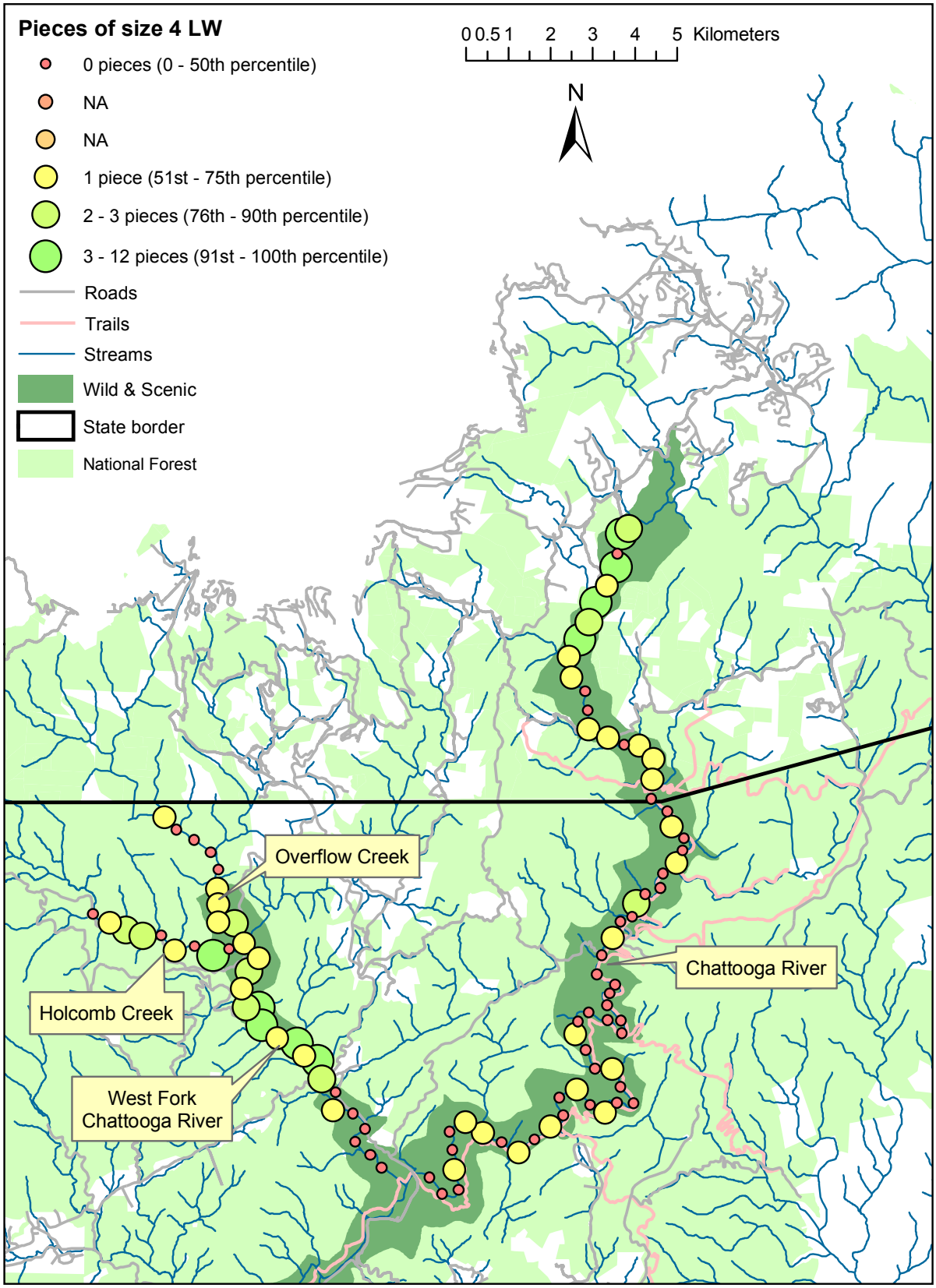

Figure 6. Pieces of size 4 LW (> 5 m long, > 55 cm diameter) counted in 0.5 km reaches, November 2007. Half of all reaches contained no size 4 LW.

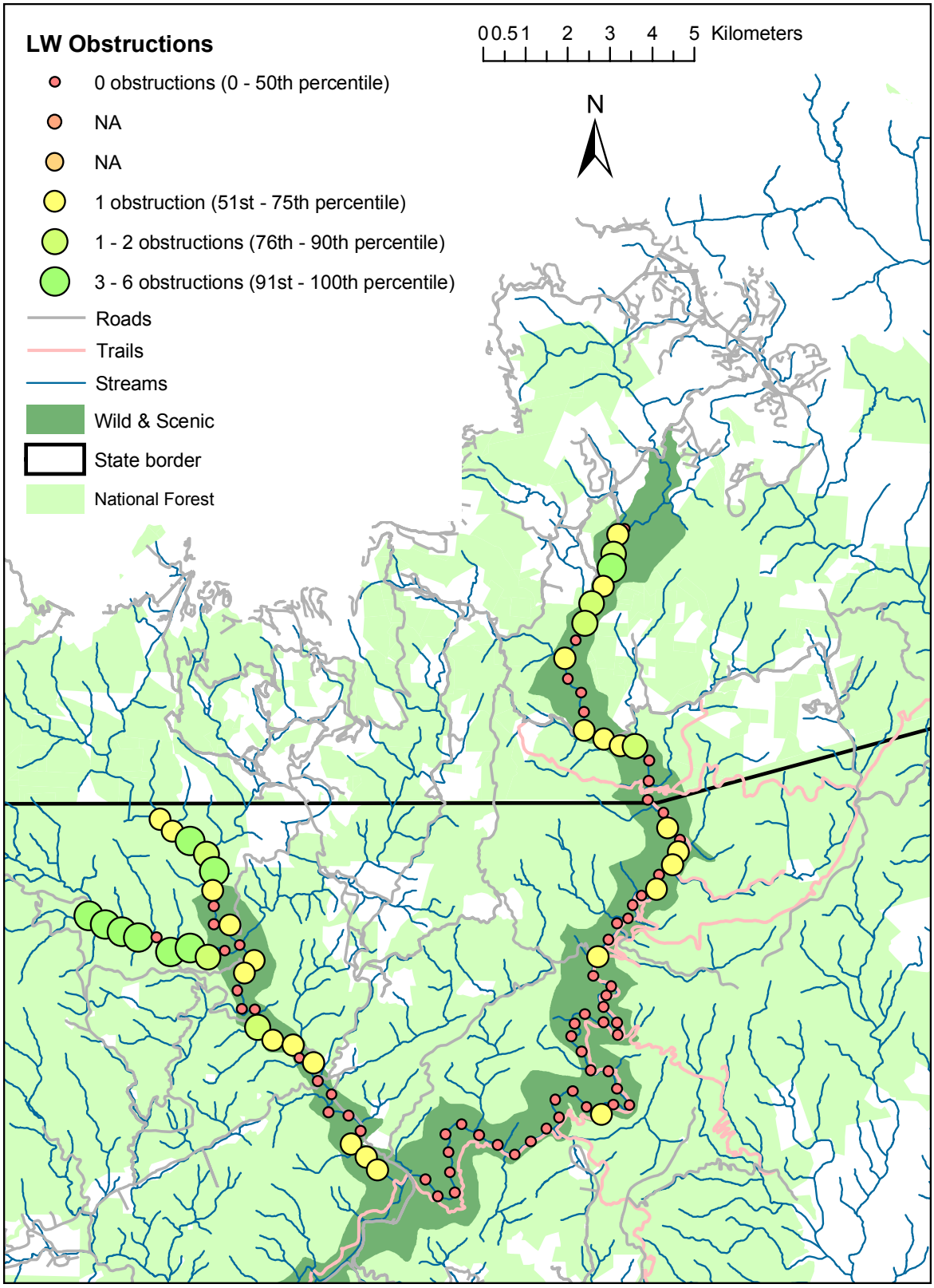

Figure 7. LW obstructions encountered in 0.5 km reaches, November 2007. Obstructions are single or multiple pieces of LW spanning at least 50% of the bankfull channel. Over half of all reaches contained no obstructions.

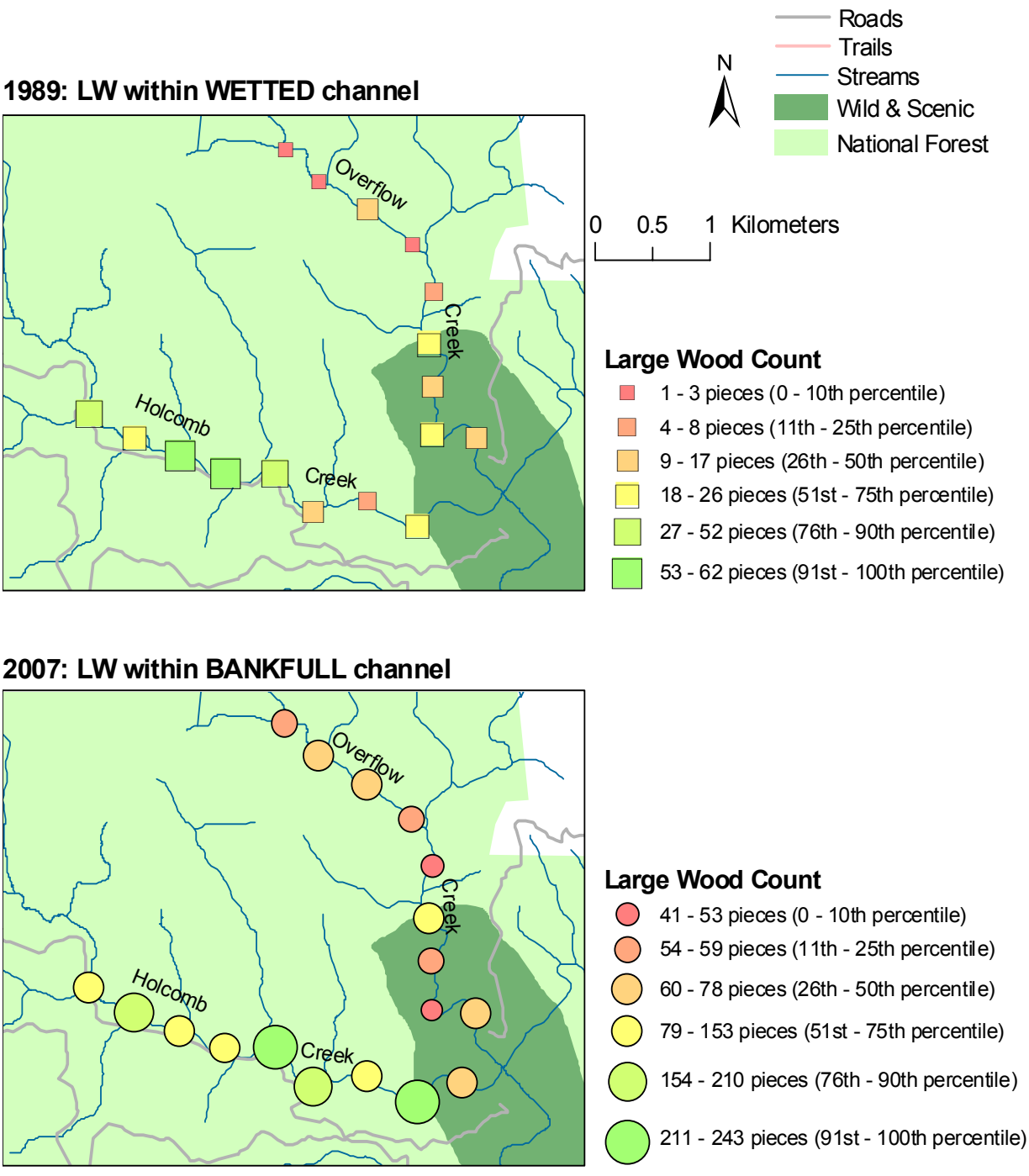

Figure 8. LW counts in 0.5 km reaches on Overflow Creek and Holcomb Creek in 1989 and 2007. In 1989, pieces within the wetted channel were counted. In 2007, pieces within the bankfull channel were counted.

Appendix A: Chattooga River Data

Table A1. Large wood (LW) counts in the Chattooga River, November 2007. River km 0.0 is at the confluence with West Fork. See table 2 for LW size categories. Total LW is sum of sizes 1 – 4.

Reach ID	River km	Length (km)	LW 1	LW 2	LW 3	LW 4	Total LW	Rootwads	Obstructions
23	33.0	0.5	33	0	32	2	67	7	0
24	32.5	0.5	46	1	33	5	85	3	1
25	32.0	0.5	43	2	20	0	65	4	2
26	31.5	0.5	102	4	67	7	180	6	6
27	31.0	0.5	68	0	55	1	124	2	1
28	30.5	0.5	67	1	61	11	140	3	2
29	30.0	0.5	41	0	33	2	76	2	2
30	29.5	0.5	132	5	133	12	282	2	0
31	29.0	0.5	26	1	10	1	38	1	1
32	28.5	0.5	43	1	22	1	67	1	0
33	28.0	0.5	17	0	20	0	37	0	0
34	27.5	0.5	19	0	18	0	37	0	0
35	27.0	0.5	17	0	31	1	49	2	1
36	26.5	0.5	19	0	21	1	41	0	1
37	26.0	0.5	28	0	42	0	70	1	1
38	25.5	0.5	34	0	33	1	68	1	2
39	25.0	0.5	19	0	17	1	37	0	0
40	24.5	0.5	24	0	17	1	42	2	0
41	24.0	0.5	37	1	38	0	76	2	0
42	23.5	0.5	38	0	41	0	79	4	0
43	23.0	0.5	42	0	60	1	103	1	1
44	22.5	0.5	34	0	42	0	76	0	0
45	22.0	0.5	18	0	37	0	55	2	1
46	21.5	0.5	18	0	44	1	63	3	1
47	21.0	0.5	19	0	11	0	30	3	0
48	20.5	0.5	26	0	34	0	60	4	1
49	20.0	0.5	23	0	28	0	51	2	0
50	19.5	0.5	29	0	30	2	61	6	0
51	19.0	0.5	89	0	64	0	153	7	0
52	18.5	0.5	2	0	20	0	22	4	0
53	18.0	0.5	10	0	37	1	48	3	0
54	17.5	0.5	4	0	19	0	23	1	1
55	17.0	0.5	11	0	16	0	27	2	0
56	16.5	0.5	8	0	34	0	42	0	0
57	16.0	0.5	8	0	26	0	34	0	0
58	15.5	0.5	15	0	45	0	60	0	0
59	15.0	0.5	12	0	10	0	22	1	0
60	14.5	0.5	9	0	18	0	27	0	0
61	14.0	0.5	5	0	32	0	37	0	0
62	13.5	0.5	18	0	45	0	63	2	0
63	13.0	0.5	13	0	16	0	29	0	0
64	12.5	0.5	4	0	35	1	40	3	0
65	12.0	0.5	12	0	24	0	36	0	0

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Table A1 (continued).

Reach ID	River km	Length (km)	LW 1	LW 2	LW 3	LW 4	Total LW	Rootwads	Obstructions
66	11.5	0.5	2	0	22	0	24	0	0
67	11.0	0.5	7	0	25	1	33	0	0
68	10.5	0.5	17	0	45	0	62	1	0
69	10.0	0.5	17	0	27	0	44	0	0
70	9.5	0.5	16	0	37	0	53	1	0
71	9.0	0.5	24	0	19	1	44	1	1
72	8.5	0.5	24	0	13	0	37	0	0
73	8.0	0.5	31	0	23	1	55	0	0
74	7.5	0.5	38	0	26	0	64	2	0
75	7.0	0.5	11	0	25	0	36	2	0
76	6.5	0.5	28	1	22	1	52	4	0
77	6.0	0.5	35	2	26	0	63	4	0
78	5.5	0.5	61	0	32	1	94	3	0
79	5.0	0.5	20	0	20	0	40	6	0
80	4.5	0.5	56	1	35	1	93	7	0
81	4.0	0.5	11	0	15	1	27	1	0
82	3.5	0.5	20	0	16	0	36	0	0
83	3.0	0.5	49	0	37	0	86	0	0
84	2.5	0.5	47	1	37	1	86	5	0
85	2.0	0.5	37	0	38	0	75	7	0
86	1.5	0.5	55	0	33	0	88	4	0
87	1.0	0.8	85	1	71	0	157	8	0
Total:		32.8	1974	24	2118	65	4171	143	26
Total per km:		--	60	1	65	2	127	4	1

Table A2. Photos taken during large wood (LW) inventory on the Chattooga River, November 2007. Photo numbers correspond to last three digits of photo ID.

Reach ID	Photo number / description
23	017-019
24	None
25	020
26	021 log weir under tree; 022 - 024
27	None
28	025-026
29	027-028
30	029-046
31	047-051
32	052-054
33	None
34	055
35	296, 297 obstruction
36	294 adelgid photo, 295 obstrutction
37	292 obstruction, 293 waterfall
38	285-286 obstruction; 287 obstruction; 88-89 size 4 LW; 290-91
39	282-284; 284 is out of bankfull channel
40	None
41	280-281; photo at waypoint 042
42	None
43	None
44	None
45	276-278; photo 277 at waypoint 045
46	274-275; pitch pine obstruction at East Fork tributary
47	None
48	267-273
49	265-266
50	261-264
51	259-260
52	None
53	None
54	327 obstruction
55	None
56	None
57	None
58	None
59	326 campsite
60	None
61	324 Big Bend Falls; 325
62	None
63	None
64	323
65	322
66	321 fog

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Table A2 (continued).

Reach ID	Photo number / description
67	316 fog water; 317-318 big cascade; 319 size 4 LW; 320 more cascade
68	313 small fall 2m high at 250 m, 314 looking down from fall, 315 falls
69	311-312 gorge
70	309-310
71	306-looking down at reach 072; 307 size 4 LW obstruction; 308 cliff near waypoint 071
72	305-306
73	304 looking at waypoint 073
74	None
75	298-300 at Nicholson parking; 301-302 camp at waypoint 076; 303 Licklog Falls
76	None
77	065-066
78	None
79	None
80	064
81	None
82	063
83	062
84	None
85	None
86	059-061
87	056-058

Table A3. Date, crew members, and comments recorded for large wood (LW) inventories on the Chattooga River, November 2007. Section notes were prepared prior to field work.

Reach ID	Date	Crew	SectionNotes	Comments
23	13-Nov-07	Krause, Dolloff	tributary west = Green Creek; access = Greens Creek Cemetery Rd 1108; Upstream most point on Forest Service	Started at waterfall upstream of Forest boundary (at Green Creek confluence) which is 135 m downstream waypoint 023
24	13-Nov-07	Krause, Dolloff		Major hemlock overstory, rhododendron understory
25	13-Nov-07	Krause, Dolloff		Cabin on left bank facing downstream
26	13-Nov-07	Krause, Dolloff		Log weir submerged. Overshot waypoint 027 by 80m
27	13-Nov-07	Krause, Dolloff	road west = Garnet Hill Lane 1109 is thru private land	Saw 3 trout
28	13-Nov-07	Krause, Dolloff	tributary west = Norton Mill Creek	
29	13-Nov-07	Krause, Dolloff		
30	13-Nov-07	Krause, Dolloff	tributary west = Cane Creek	Large log jam, waypoint 'logjam' 2 trout redds
31	13-Nov-07	Krause, Dolloff		Gorge with near vertical rock face
32	13-Nov-07	Krause, Dolloff		2 trout on redd
33	13-Nov-07	Krause, Dolloff		
34	13-Nov-07	Krause, Dolloff	tributary west = Ammons Branch; access = Bullpen Rd. 1603 near waypoint 35	
35	13-Nov-07	Roghair, Steele		Low gradient
36	13-Nov-07	Roghair, Steele	tributary west = Glade Creek	
37	13-Nov-07	Roghair, Steele	tributary east = Scotsman Creek	
38	13-Nov-07	Roghair, Steele		Gradient increasing
39	13-Nov-07	Roghair, Steele	tributary west = unnamed	
40	13-Nov-07	Roghair, Steele	tributary east = Fowler Creek; first reach entirely in NC	deep pool, stay right here, left is a bad climb

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Table A3 (continued).

Reach ID	Date	Crew	Section notes	Comments
41	13-Nov-07	Roghair, Steele	tributary west = unnamed; NC/SC border; trail east = Fork Mtn to SC107; trail west = Ellicot Rock to Bull Pen Rd 1603; both several km hikes	
42	13-Nov-07	Roghair, Steele		
43	13-Nov-07	Roghair, Steele		Channel splits just upstream of waypoint 044; gps taken at split start, end of split channel; obstruction only in right channel; left side clear; lunch 12:15
44	13-Nov-07	Roghair, Steele	tributary east = Bad Creek	
45	13-Nov-07	Roghair, Steele		Obstruction has beaver chew on branches but natural felling
46	13-Nov-07	Roghair, Steele	tributary east = East Fork Chattooga River	Wide channel
47	13-Nov-07	Roghair, Steele		Trail immediate right at start; fire rings; lots of cut LW and live trees
48	13-Nov-07	Roghair, Steele		1st obstruction is hemlock killed by adelgids; causing wood jam; more cut wood here
49	13-Nov-07	Roghair, Steele	tributary west = unnamed	2 cut wood here; landslide west side; fire rings east side
50	13-Nov-07	Roghair, Steele	tributary east = unnamed - Spoon Auger Falls	1 piece cut near flat camp area; hemlocks dead; wood at edges of stream
51	13-Nov-07	Roghair, Steele	tributary west = Harden Creek; entering Ellicot Rock Wilderness	Hemlocks dead or dying; all wood at edge of bankfull
52	14-Nov-07	Roghair, Steele	tributary east = unnamed	Last reach today; end at 708 bridge = waypoint 052
53	14-Nov-07	Roghair, Steele	tributary east = King Creek; access = Burrels Ford Rd. 708	

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Table A3 (continued).

Reach ID	Date	Crew	Section notes	Comments
54	14-Nov-07	Roghair, Steele	tributary west = unnamed; access = Burrels Ford Rd.	
55	14-Nov-07	Roghair, Steele		
56	14-Nov-07	Roghair, Steele		Split channel just downstream waypoint 056
57	14-Nov-07	Roghair, Steele		
58	14-Nov-07	Roghair, Steele		Flat and straight; trail on immediate right
59	14-Nov-07	Roghair, Steele	tributary east = unnamed; access Chattooga Trail to Big Bend Trail	Lower gradient and wide
60	14-Nov-07	Roghair, Steele	Big Bend Falls are near waypoint 61	
61	14-Nov-07	Roghair, Steele	Big Bend Falls are near waypoint 61	Lunch 12:15 at Big Bend Falls; waypoint 061 at bottom of falls
62	14-Nov-07	Roghair, Steele	tributary west = unnamed	
63	14-Nov-07	Roghair, Steele		
64	14-Nov-07	Roghair, Steele		
65	14-Nov-07	Roghair, Steele		Can walk on trail
66	14-Nov-07	Roghair, Steele	tributary west = unnamed and almost at waypoint 66	
67	14-Nov-07	Roghair, Steele	tributary east = unnamed	Some hemlocks with most needles
68	14-Nov-07	Roghair, Steele		Elliptio relic 100 m upstream waypoint 069; some hemlocks down here; campsites east-cutting LW in stream
69	14-Nov-07	Roghair, Steele		More rock gorge in this reach; ends 300 m into reach
70	14-Nov-07	Roghair, Steele		More gradient here; bedrock, cliffs, big boulders for about half; sign of beaver upstream
71	14-Nov-07	Roghair, Steele		
72	14-Nov-07	Roghair, Steele		Straight, shallow; can see whole reach at once
73	14-Nov-07	Roghair, Steele		Deep pools

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Table A3 (continued).

Reach ID	Date	Crew	Section notes	Comments
74	14-Nov-07	Roghair, Steele		Hemlocks 30-50 percent of needles; yesterday was less than 30 percent
75	14-Nov-07	Roghair, Steele	tributary east = Lick Log/Pig Pen; access = Chattooga-Foothills trail to Nicholson Ford Rd. 50	Hemlocks with more needles here than upstream of King creek
76	14-Nov-07	Krause, Metzger		Lots of trout
77	14-Nov-07	Krause, Metzger		
78	14-Nov-07	Krause, Metzger	tributary west = unnamed; tributary east = Ira Branch	
79	14-Nov-07	Krause, Metzger		Trout on redds
80	14-Nov-07	Krause, Metzger	tributary west = Reed Creek	Trout on redds
81	14-Nov-07	Krause, Metzger		
82	14-Nov-07	Krause, Metzger		
83	14-Nov-07	Krause, Metzger		1 mussel shell, redd with trout, overshot end by 89 m
84	14-Nov-07	Krause, Metzger		
85	14-Nov-07	Krause, Metzger		
86	14-Nov-07	Krause, Metzger		
87	14-Nov-07	Krause, Metzger	start reach at confluence with West Fork Chattooga; tributary west = Mose Branch; hwy 28 crosses; Chattooga trail crosses	Started at confluence with West Fork

Appendix B: West Fork Data

Table B1. Large wood (LW) counts in the West Fork, November 2007. River km 0.0 is at the confluence with Chattooga River. See table 2 for LW size categories. Total LW is sum of sizes 1 – 4.

Reach ID	River km	Length (km)	LW 1	LW 2	LW 3	LW 4	Total LW	Rootwads	Obstructions
101	10.0	0.5	31	1	13	1	46	0	0
102	4.5	0.5	30	1	12	1	44	0	1
103	9.5	0.5	36	0	26	2	64	0	1
104	9.0	0.5	26	0	28	1	55	0	0
105	8.5	0.5	22	1	18	3	44	3	0
106	8.0	0.5	28	0	20	4	52	1	0
107	7.5	0.5	29	1	30	4	64	3	2
108	7.0	0.5	46	1	12	1	60	0	1
109	6.5	0.5	112	3	58	9	182	4	1
110	6.0	0.5	46	0	39	1	86	1	0
111	5.5	0.5	85	5	37	5	132	2	1
112	5.0	0.5	195	9	32	2	238	5	0
113	4.0	0.5	90	0	187	0	277	0	0
114	3.5	0.5	40	1	209	1	251	4	0
115	3.0	0.5	46	0	102	0	148	2	0
116	2.5	0.5	28	0	57	0	85	1	0
117	2.0	0.5	9	0	67	0	76	1	1
118	1.5	0.5	11	0	55	0	66	3	1
119	1.0	0.7	44	0	140	0	184	7	1
Total:		9.7	954	23	1142	35	2154	37	10
Total per km:		--	98	2	118	4	222	4	1

Table B2. Photos taken during large wood (LW) inventory on the West Fork, November 2007. Photo numbers correspond to last three digits of photo ID.

Reach ID	Photo number / description
101	780-787 fresh cut pieces of LW
102	788-789
103	790-791
104	None
105	None
106	None
107	792-794
108	795-797
109	798-801
110	None
111	802-808
112	None
113	328- 29 old crossing
114	330
115	331; 333-35; 337 beaver
116	338 fungus
117	339 old ford
118	None
119	340-41 obstruction

Table B3. Date, crew members, and comments recorded for large wood (LW) inventories on the West Fork, November 2007. Section notes were prepared prior to field work.

Reach ID	Date	Crew	Section notes	Comments
101	13-Nov-07	Dolloff, Cole	access south = 3 Forks Trail; upstream extent of West Fork inventory; confluence of Holcomb, Overflow, Big Creeks	10 pieces cut hemlock from new obstruction. Sawdust on exposed rock and sand bars. Found quart container of oil; black with red cap. Large hardwood also cut.
102		Dolloff, Cole		Missed this waypoint during fieldwork; split data from totals for section 101 in office
103	14-Nov-07	Dolloff, Cole		
104	14-Nov-07	Dolloff, Cole		
105	14-Nov-07	Dolloff, Cole	tributary south = Tottery Pole Creek	
106	14-Nov-07	Dolloff, Cole	tributary north = unnamed	
107	14-Nov-07	Dolloff, Cole	tributary south = unnamed; access = Overflow Creek Rd crossing	
108	14-Nov-07	Dolloff, Cole		Debris pile left bank face upstream on gravel bar. Bridge; down oak spans channel 20 m above bridge.
109	14-Nov-07	Dolloff, Cole	tributary north = Reed Mill Creek	
110	14-Nov-07	Dolloff, Cole	tributary south = unnamed	
111	14-Nov-07	Dolloff, Cole	mostly private ownership	
112	14-Nov-07	Dolloff, Cole	tributary north = Laurel Creek; tributary north = Law Ground Creek nearly at waypoint 112; access = Warwoman Rd.	

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Table B3 (continued).

Reach ID	Date	Crew	Section notes	Comments
113	15-Nov-07	Steele, Riley	private ownership for over half of reach; tributary south = Page Branch	
114	15-Nov-07	Steele, Riley	private ownership	Lots underwater. Get on bank, water is deep!
115	15-Nov-07	Steele, Riley	private ownership; tributary north = Camp Branch	Continue on bank
116	15-Nov-07	Steele, Riley	private ownership	Deep pools thick brush
117	15-Nov-07	Steele, Riley	private ownership; tributary south = Pigpen Branch	Follow old road bed unwadeable
118	15-Nov-07	Steele, Riley	private land starts half way thru this reach; goes to waypoint 113	
119	15-Nov-07	Steele, Riley	start reach at confluence with mainstem Chattooga; Chattooga River trail crosses	

Appendix C. Overflow Creek Data

Table C1. Large wood (LW) counts in Overflow Creek, November 2007. River km 0.0 is at the confluence with West Fork (Three Forks). See table 2 for LW size categories. Total LW is sum of sizes 1 – 4.

Reach ID	River km	Length (km)	LW 1	LW 2	LW 3	LW 4	Total LW	Rootwads	Obstructions
201	4.5	0.5	14	0	42	1	57	1	1
202	4.0	0.5	15	0	61	0	76	1	1
203	3.5	0.5	28	0	38	0	66	0	3
204	3.0	0.5	6	0	48	0	54	0	2
205	2.5	0.5	11	0	38	0	49	0	3
206	2.0	0.5	36	0	42	1	79	1	1
207	1.5	0.5	18	0	35	1	54	0	0
208	1.0	0.5	7	0	33	1	41	1	0
209	0.5	0.6	21	0	52	2	75	1	1
Total:		4.6	156	0	389	6	551	5	12
Total per km:		--	34	0	85	1	120	1	3

Table C2. Photos taken during large wood (LW) inventory on Overflow Creek, November 2007. Photo numbers correspond to last three digits of photo ID.

Reach ID	Photo number / description
201	842 cut log; 843 obstruction, all hemlock
202	839 cut log; 840 down hemlock; 841 obstruction
203	835 obstruction; 836 cut log; 837-8 obstructions at waypoint 203
204	833 obstruction; 834 hemlock obstruction
205	828 rock face; 829 trib west; 830 beaver chew; 831-2 obstructions
206	824 falls; 825 cut log; 826-827 obstruction
207	815 old cut log; 816 small cut log; 817-820 lichen; 821 cut log near waypt; 822-823
208	810-811, 812 falls, 813-814 falls with cliff at waypoint
209	809 at confluence

Table C3. Date, crew members, and comments recorded for large wood (LW) inventories on Overflow Creek, November 2007. Section notes were prepared prior to field work.

Reach ID	Date	Crew	Section notes	Comments
201	15-Nov-07	Roghair, Cole	furthest upstream waypoint on Overflow; end at confluence with unnamed tributary to west; access = road 86b just upstream of end	Done 16:45
202	15-Nov-07	Roghair, Cole	tributary east (north) = unnamed	Snow at 16:15
203	15-Nov-07	Roghair, Cole		
204	15-Nov-07	Roghair, Cole	tributary east = clear creek	Lots of dead hemlocks and pines
205	15-Nov-07	Roghair, Cole	tributary west = unnamed; tributary east = unnamed	Several beaver signs
206	15-Nov-07	Roghair, Cole		Hemlocks 30 percent or less needles
207	15-Nov-07	Roghair, Cole		Can't get in stream first part of section, bedrock gorge; lichen in several spots; one hemlock size 4 down
208	15-Nov-07	Roghair, Cole		Old log cut in cascade; trail with cut logs to top of falls on right; lots of falls cascades
209	15-Nov-07	Roghair, Cole	start Overflow at 3 Forks; confluence with Holcomb, Big Creek	Left 3 forks trail head at 10:30; took trail to top of Holcomb Creek falls then hiker made footpath along crazy Holcomb Creek gorge; dangerous path; at 3 Forks by 11:30

Appendix D. Holcomb Creek Data

Table D1. Large wood (LW) counts in Holcomb Creek, November 2007. River km 0.0 is at the confluence with West Fork (Three Forks). See table 2 for LW size categories. Total LW is sum of sizes 1 – 4.

Reach ID	River km	Length (km)	LW 1	LW 2	LW 3	LW 4	Total LW	Rootwads	Obstructions
301	4.5	0.5	54	0	82	0	136	3	4
302	4.0	0.5	76	0	82	1	159	8	4
303	3.5	0.5	66	0	83	3	152	3	3
304	3.0	0.5	47	1	103	2	153	3	3
305	2.5	0.5	106	0	105	0	211	0	0
306	2.0	0.5	63	0	145	1	209	2	5
307	1.5	0.5	57	0	62	0	119	3	3
308	1.0	0.5	142	0	97	4	243	5	2
309	0.5	0.4	35	0	29	0	64	1	0
Total:		4.4	646	1	788	11	1446	28	24
Total per km:		--	147	0	179	3	329	6	5

Table D2. Photos taken during large wood (LW) inventory on Holcomb Creek, November 2007. Photo numbers correspond to last three digits of photo ID.

Reach ID	Photo number / description
301	122-125 obstructions
302	116-121 obstructions
303	113-115 obstructions
304	111-112 obstructions
305	103-107 cut logs along water's edge, 108 bridge, 109-110 K-dam
306	88-90 splash-dam looking upstream, 91-94 top of splash-dam, 95-96 splash-dam looking downstream, 97 obstruction, 98-102 obstructions and change to sandy substrate due to splash-dam holding sediment
307	79-83 obstructions and rebar in log probably from splash-dam, 85-86 deer carcass, 87 footprint beside carcass
308	71-73 logs on top of boulder showing flood level, 74 obstruction, 75-76 view of stream, 77-78 obstruction viewed from up and downstream
309	67-70 gorge extending approx. 500 m up from confluence with West Fork

Table D3. Date, crew members, and comments recorded for large wood (LW) inventories on Holcomb Creek, November 2007. Section notes were prepared prior to field work.

Reach ID	Date	Crew	Section notes	Comments
301	15-Nov-07	Krause, Metzger	furthest upstream waypoint on Holcomb; end at confluence with Addie Branch/Bailey Branch; access = road 86 just upstream on Addie/Bailey	
302	15-Nov-07	Krause, Metzger	tributary south = unnamed	
303	15-Nov-07	Krause, Metzger	tributary north = unnamed	
304	15-Nov-07	Krause, Metzger	tributary north = Billingsly Creek; tributary south = unnamed; tributary north = unnamed	
305	15-Nov-07	Krause, Metzger		Many old cut logs
306	15-Nov-07	Krause, Metzger	tributary north = Burrell Branch	Old splash dam now becoming log jam; counted logs in dam as large wood pieces
307	15-Nov-07	Krause, Metzger		
308	15-Nov-07	Krause, Metzger		
309	15-Nov-07	Krause, Metzger	start Holcomb at 3 Forks; confluence with Overflow, Big Creek	Gorge at lower end of 500 m section near confluence; can't survey first 400 m of Holcomb from channel-too steep, all bedrock cascade