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**Table 1: Gauge visits during the spring 2017. Comments: DD=gauge data download, MN=general gauge maintenance (cleaning, re-level), CA= rain gauge calibration, CV = vegetation clearing, and BR = data logger battery replacement.**

Date	Gauges Visited	Technicians	Comments
3/25/2017	1; 3	Doug, Samuel	DD, MN, CV
3/27/2017	2; 5; 8	Doug	DD, MN, CV, CA, BR
4/1/2017	100T, 104, 108, 109	Doug, Bonnie	DD, MN, CV, BR
4/8/2017	106; 109; 110; 105	Doug, Rachel	DD, MN, CV
4/10/2017	101, 102, 103, 107	Doug, Kyle, William	DD, MN, CV, BR
4/15/2017	111, 112, 4, 10	Doug, Ben	DD, MN, CV
4/26/2017	304, 307	Doug, Carly, Zach	DD, MN, CV
4/29/2017	303s, 306, 311	Doug, Jackie	DD, MN, CV
4/30/2017	305, 309, 310	Doug, Kyle, Samuel	DD, MN, CV
5/10/2017	301, 302, 300, 308	Doug, Ethan, Samuel	DD, MN, CV, BR

Gauge visitation in support of the Duke Great Smoky Mountain Rain Gauge Network (GSMRGN) during the spring 2017 occurred over 10 days spanning a period of seven weeks from March – May 2017. The primary purpose of the visits in the spring 2017 was [1] to perform downloads of gauge tip observations since the previous gauge visits in the autumn 2016, [2] to complete maintenance tasks, [3] to clear vegetation and, [4] where necessary, to calibrate rain gauges with three trials using the 50, 100, and 300 mm nozzles and/or replace lithium batteries that had drained to a low voltage over the winter months. Fourteen technicians and volunteers (listed on the front page) made the visits and performed the required work. It is important to note that the volunteers were NOT directly involved in any of the gauge visit tasks, but were volunteering to assist with personal safety should someone get injured during a particular series of gauge visits.

The general tasks completed at **every** gauge visit consisted of (1) gauge data download from the data loggers [DD in Table 1], (2) general gauge maintenance and ML1 logger condition monitoring [MN in Table 1], (3) clear vegetation within a five foot radius of the rain gauge [CV in Table 1], and, (4) if necessary, replacement of lithium data logger or HOBO batteries [BR in Table 1], and/or three calibration trials [CA in Table 1]. Specialized tasks were to figure out what had happened to a rain gauge that was missing (g001), replace an apparently damaged data logger at a location that the gauge cover had been removed in the autumn 2016 (g010), and re-visit a gauge (g109) that had registered a low number of tips during the winter season and troubleshoot the source of missing tip counts. Task (1) merely required a serial port link between the field study laptop and the gauge data logger and consisted of pulling the data (often

in files having raw [\* .txt] and CSV formats) onto a desktop folder on the laptop, checking for completeness of the data, and comparing the data logger time and date to the actual GPS time and date (making a screen capture of the time comparison). The standard that has been chosen for this study is to maintain the clocks on Eastern Daylight Time, since most of the “warm” precipitation will be occurring during the season when EDT is in effect. Most ML1-FL data logger times have been adjusted (using “TA” command) during previous gauge visits to coincide with the EDT given by the GPS locator. The lithium battery life of ML1-420 loggers is much less predictable than the ML1-FL loggers, three had an unacceptably low voltage considering the lithium battery in every data logger was refreshed in the fall 2016. A solution is currently being sought from Hydrological Services of America. The voltage of each battery was tested using a multi-meter to insure an accurate reading. The status voltage provided in the WinComLog software (‘st’) is unreliable and can be subject to additional voltage supplied to the flash memory of the data logger from the laptop itself. Task (2) required the cleaning of debris from the funnel filter, cleaning the tipping buckets of debris (if necessary), cleaning the gauge drain ports and siphon, re-leveling the gauge if it has come unlevelled, and fixing or replacing the gauge mesh if it had been damaged. Task (3) consisted of cutting briars, tree branches, rhododendron, and mountain laurel within a five foot radius of the gauge using clippers or a saw. Three gauge sites (g311, g300, g308) will require a clever solution to remove higher branches starting to encroach over the gauge. If necessary, Task (4) consisted of replacing data logger lithium or HOBO batteries at gauges having a low voltage (HOBO; g005, g008, g010, g108, ML1-420 lithium; g108, g103, g300) and/or involved running three trials using the 50, 100, and 300 mm nozzles using the Duke #2 calibration tube for those gauges where calibration was not possible during the autumn 2016 calibration campaign (g008 and g005).

Challenges encountered during some of the gauge visits in the spring 2016 were; (i) a missing gauge (g001) that had been bulldozed (literally) by personnel of the NC Wildlife organization, working to clear a section of the forest (data loggers from the gauge have been recovered, but the gauge itself is a total loss), (ii) a needed replacement of the data logger at g010 whose funnel cover had been removed by an animal sometime in the late summer or early autumn (unfortunately, the logger battery was completely drained during the 15 April 2017 visit and the most recent reported tip occurred in 6 January 2017), (iii) the switch at g109 was found to have a faulty terminal and functioned properly when the logger cables were changed to the other terminal (unfortunately, rainfall observations at g109 are unreliable between the summer 2016 and the date of the switch fix on 8 April 2017), (iv) extended closure of the Heintooga Loop Rd that required the assistance of Mr. Paul Super to help us gain access to the Balsam Mountain Ridge trailhead on 26 April 2017 to visit g307 and g304, and (v) a locked barbwire fence blocking access to the catwalk at the Mt. Sterling fire tower (g310).

Details of every gauge visit along with precipitation raw and CSV files (and some internal temperature and battery voltage files) and T/RH observations at g310 can be found via Google Drive at <https://drive.google.com/file/d/0B9P8oUaRiBOwRHhrSDg5LXN5Y3c/view?usp=sharing> which contains sub-folders for each gauge that consist of the individual data files (often having at least two different formats), pictures taken at the gauge site during the visit, screenshots of the GPS (laptop) and ML1 logger time comparison, and a MS Word document that mirrors the notes made in the field journal during the visit.

Plans for the summer months of 2017

**Table 2: Planned gauge visits during the summer 2017. Comments: DD=gauge data download, MN=general gauge maintenance (cleaning, re-level), CV = vegetation clearing, and BR = data logger battery replacement (necessary loggers only).**

<b>Date</b>	<b>Gauges Visited</b>	<b>Technicians</b>	<b>Comments</b>
7/??/2017	304, 307	Doug, Student #1, Student #2	DD, MN, CV, BR
7/??/2017	new gauge (#?), 3, 10	Doug, Student #1	DD, MN, CV, BR
7/??/2017	2, 5, 8, 106, 4	Doug, Don, Student #1	DD, MN, CV, BR
7/??/2017	111, 112, 104, 105, 106, 107, 109	Doug, Student #1	DD, MN, CV, BR
7/??/2017	101, 102, 103, 110, 108	Doug, Student #1	DD, MN, CV, BR
7/??/2017	305, 309, 310	Doug, Student #1, Student #2	DD, MN, CV, BR
7/??/2017	303s, 306, 311	Doug, Student #1, Student #2	DD, MN, CV, BR
7/??/2017	300, 301, 302, 308	Doug, Student #1, Student #2	DD, MN, CV, BR

A new gauge location will be found and new rain gauge installed by the end of May 2017 on property near Camp Daniel Boone, not far from the location of the old g001.

Gauge visitation in support of the Duke GSMRGN during the summer 2017 will occur over at least eight days spanning July 2017. The primary purpose of the visits will be to download precipitation observations that were made since the previous gauge visits in March - May 2017 [DD in Table 2], perform maintenance and check if the ML1 logger times have drifted between visits and make the corresponding needed adjustments [MN in Table 2], clear vegetation (and tree branches) from overhanging gauges [CV in Table 2], and replace ML1 or HOBO batteries at the needed rain gauge location [BR in Table 2].

Details of every gauge visit along with each gauge precipitation and calibration data record will be posted online and shall contain sub-folders for each gauge that consist of the individual data files (often having at least two different formats), pictures taken at the gauge site during the visit, screenshots of the GPS (laptop) and ML1 logger time comparison, and a MS Word document that mirrors the notes made in the field journal during the visit.

New undergraduate research students at UNC Asheville will be recruited as field technicians for the Duke GSMRGN project during an informational meeting to be held in the ATMS Department early in the fall 2017 semester. The current technician roster during the academic year consists of William Clark, Rachel Dunn, Ben House, Jackie Hoyle, Carly Narotsky, Kyle Noel, Samuel O'Donnell, Bonnie Thompson, Zachary Tuggle, and Ethan Wright. Students William Clark, Kyle Noel, Bonnie Thompson, and Ethan Wright will be graduating from UNC Asheville in May 2017.

**Table 3: The Duke Great Smoky Mountain Rain Gauge Network is currently (valid as of 12 May 2017) comprised of 32 31 tipping bucket rain gauges.**

Gauge #	Location	Latitude	Longitude	Altitude
RG001	Deep Gap	35°23.8' N	82°54.7' W	3794 ft.
RG002	Lickstone Bald	35°25.5' N	82°58.2' W	5680 ft.
RG003	High Top	35°23.0' N	82°54.9' W	5280 ft.
RG004	Lickstone Ridge S	35°22.0' N	82°59.4' W	6305 ft.
RG005	Deep Gap	35°24.5' N	82°57.8' W	4986 ft.
RG008	Double Spring Gap	35°22.9' N	82°58.4' W	5700 ft.
RG010	Beaty Spring Gap	35°27.3' N	82°56.8' W	4849 ft.
RG100T	Purchase Knob	35°35.1' N	83°04.3' W	4905 ft.
RG101	The Swag	35°34.5' N	83°05.2' W	4986 ft.
RG102	Hemphill Bald	35°33.8' N	83°06.2' W	5365 ft.
RG103	JR Property	35°33.2' N	83°07.0' W	5539 ft.
RG104	Cat. Ski Area	35°33.2' N	83°05.2' W	5208 ft.
RG105	KH Property	35°38.0' N	83°02.4' W	4412 ft
RG106	Pinnacle Ridge	35°25.9' N	83°01.7' W	3969 ft
RG107	Lookout Point	35°34.0' N	82°54.4' W	4459 ft
RG108	Utah Mountain	35°33.2' N	82°59.3' W	4188 ft
RG109	Eaglesnest Ridge	35°29.7' N	83°02.4' W	4922 ft
RG110	JH Property	35°32.8' N	83°08.8' W	5128 ft
RG111	Hurricane Ridge	35°43.7' N	82°56.8' W	4573 ft
RG112	Ore Knob	35°45.0' N	82°57.8' W	3884 ft
RG300	Camel Hump Knob	35°43.5' N	83°13.0' W	5110 ft
RG301	Mt Guyot	35°42.3' N	83°15.3' W	6570 ft
RG302	Snake Den Ridge	35°43.2' N	83°14.8' W	6104 ft

RG303s	Mt Cammerer	35°45.7'N	83°09.7'W	4887 ft
RG304	Big Cataloochee	35°40.2'N	83°10.9'W	5971 ft
RG305	Mt Sterling 1	35°41.4'N	83°07.9'W	5349 ft
RG306	Sunup Knob	35°44.7'N	83°10.2'W	5039 ft
RG307	Balsam Mountain	35°39.0'N	83°11.9'W	5327 ft
RG308	Cosby Knob	35°43.8' N	83°10.9'W	4826 ft
RG309	Mt Sterling 2	35°40.9'N	83°09.0'W	5262 ft
RG310	Mt Sterling 3	35°42.1'N	83°07.3'W	5761 ft
RG311	Big Creek	35°45.9'N	83°08.4'W	3398 ft