HIGHLANDS BIOLOGICAL STATION UPDATE

HBS Board of Directors

Jim Costa, Executive Director
15 June 2024

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1. Budget

Our budget is strong in some ways, but also imbalanced in others. Since our fall 2023 meeting HBS revenue has continued to be strong, exceeding our target of $144,373 by just over 60%! Total revenue to date for this fiscal year is $231,207 — the strongest our revenue has ever been. I attribute this to (1) vastly improved marketing and communications regarding HBS courses and programs thanks to Sarah Vickery in our Univ. Program Associate position; (2) with completion of key improvement projects, not least the Cottages dorms, word is steadily getting out about the quality of HBS facilities for teaching & learning, research, visiting classes, etc.; and (3) return of the IE program, with a greatly updated fee structure for use of facilities.

Our base Operating budget, on the other hand, is still underfunded in certain pools. We will be unable to carry forward or "bank" most of the $86,833 revenue overage this year because it is needed to fill deficits in Utilities and contracted services (in particular reliable housekeeping, the cost of which is astronomical here). Operating continues to be underfunded in several pools, owing to the high cost of doing business in Highlands, and we will need to request yet another revenue target increase to address this. With this in mind Katie has recently had productive meetings with budget and finance colleagues in the Provost's Office.

2. Current and Planned Facilities, Equipment, & Infrastructure Projects

• Current/Ongoing Projects:

i. Weyman Building improvements. We continue to make progress in renovating the Weyman Building into a Commons space, spearheaded by HBS Facilities Manager Mike McMahan. Complete: insulation, HVAC (minisplit units), bamboo flooring, interior and exterior paint, foundation skirting, LED lighting, kitchenette, sidebar, interior stock room door w/ sidelight, and screen and projector. A great "friend of the Station," RB Haynes, whose family was involved in the founding of HBS, has generously donated $150,000 toward an outside back deck and patio at the entrance (planning in progress), and new furnishings. WCU ran a nice story about the donation, also running in the 30 May 2024 issue of *The Highlander* — see:

https://www.wcu.edu/stories/posts/highlands-biological-station-receives-150000-gift-to-continue-renovation-of-historic-building.aspx

As this BOD meeting demonstrates, we are already utilizing the building! Thus far this season we have held several meetings and two workshops in Weyman, and the 2024 HBS Summer Seminars are held here as well. In related news, we recently had the pleasure of meeting the granddaughter of Samuel Weyman, Ms. Fontaine Draper, who turns out to be a life-long friend of Dollie Swanson, long-time Garden volunteer at HBS. Fontaine visited HBS last week and gave us a host of photographs and other documents for the Archives! Fontaine, who lives in Atlanta, was delighted to learn of the family connection with HBS, and wishes to become more engaged.

ii. Environmental Chambers. Our new walk-in environmental chambers officially passed NC State Construction Office inspection in late May! A technician is now fine-tuning to ensure full functionality in terms of environmental parameters. This has been a long process owing to missteps by the vendor, Darwin Chambers, requiring 2 no-cost extensions from NSF. We're very grateful to Daniel Fiskeaux (WCU Facilities Management), Jerome Hay of Sud Associates (electrical engineers, Asheville), Jeff Lyle of StarTek (electrical contractor, Waynesville) for helping bring the project to a successful conclusion. The new state-of-the-art chambers *greatly* expand our research capacity in Coker — we now have 3 units instead of 2, each with precision control of photoperiod (timeclock controlled diurnal on/off, vapor proof LED), temperature (range: 0°C to 40°C; temperature control at sensor: ±0.2°C), and humidity (5°C @ 50% RH; 40°C @ 80% RH; within a dewpoint of -5°C to 35°C).

iii. Nature Center. In fall of 2020 SKA Consulting Engineers assessed the deteriorated north "window wall" of the Nature Center. Their report of 5 Feb 2021 provided a preliminary estimate of $300K-$350K for structural repairs to the supporting timber columns and replacing the windows — a figure considered low even then by our colleagues on campus. This past year Facilities Management at WCU allocated $250,000 for this project via SCIF (State Capital Infrastructure Fund), with the plan to first complete an Architectural/Engineering design, which will provide a more accurate and up-to-date cost estimate for actually doing the repairs. The solicitation for the design project has gone out, with a closing date of 28 June 2024.

iv. Equipment. We were fortunate to receive another $60K year-end equipment grant award from the UNC System Office, supporting the purchase of a wide variety of equipment:

General research support:

Mettler Toledo XPR105DR Micro-balance, 41 g x 0.01 mg
Leitz Microlab Fluorescence microscope
Song Meter Mini Bat 2 Li-Ion
Binoculars (10)
HOBO Temp/Humidity Sensors
Onset Data Logging Rain Gauge
ISCO submerged probe

Supporting microplastics research:

DataQ EL-USB-5 data logger
Blue LED flashlight
Aluminum tripod
Filters, petri dishes, & watch glasses
DWK Life Sciences Kimble Ultra-ware microfiltration assembly
Filtration pump

Supporting our environmental sensor network project:

45Drives storage drives
Paragon IT - 45Drive service

• Project Planning

i. Valentine House. The first step toward replacement of Valentine is design work, which would also allow us to come up with a cost estimate. Facilities Management would like to see how the Nature Center designer works out, and if pleased with their performance we will discuss with them general ideas regarding the Valentine House, to get their thoughts as a design firm. We would then seek funding to support the design work and put out a solicitation for proposals.

ii. Backup Generators for HBS Residences. In FY23 we invested $22,500 to engage Sud Associates (Asheville) to develop an electrical design for backup generators for the HBS residences (Cottages, Duplex, Valentine). The design was submitted in May 2023, and estimated cost of implementation is ~$190K. Funding for this project was unavailable this year, but we will continue to seek support for this important project. In the meantime the design work will have to be re-submitted to SCO for any updates and re-approval.

iii. Flooding and Erosion Mitigation Project. In FY23 we invested $36,800 to engage Larry A. Lackey Jr. of CETech Associates (Franklin) to develop a comprehensive drainage and (potential) paving plan for the HBS campus. The design was submitted in October 2023, and estimated cost of implementation is ~$400K. Funding for this project was also out of reach this year. Again, we will continue to seek support for this project, and next year or the year after this design too will have to be re-submitted to SCO for any updates and re-approval.

iv. Environmental sensor network project. In addition to these facilities and infrastructure projects, we are revisiting the collaborative NSF grant we first started writing a couple of years ago, to develop a common portal for the management and dissemination of environmental sensor data from a regional network of partners, including WCU/NRCM Hydrological Station, WCU/HBS, Coweeta Hydrologic Lab, and Bent Creek. Collectively this network spans significant elevational and precipitation gradients, making for a valuable environmental observatory in one of the wettest and most biodiverse regions in North America. In pursuit of this project, we have now acquired a server and hard drives from 45Drives, and we have a plan for shared responsibility for managing the sensors.

v. HBS EV Charging. In February Jason and I met virtually with Lauren Bishop (WCU Chief Sustainability Officer) and Joe Walker (Associate Vice Chancellor for Facilities Management) to discuss the idea of installing one or more EV charging stations at HBS — learning about costs, maintenance, payment approaches, etc. With increasing numbers of HBS visitors driving EVs, and given the conservation ethic of field stations like HBS, it makes sense for us to make charging stations available (potential locations: Coker/Weyman parking area, Valentine/Duplex parking area, and perhaps the Lower Lake Rd. entrance). Chargepoint is the most common POS software used in the marketplace, but it is expensive (making the cost of an EV charging station go from $7K-$10K to $25K-$30K we are told), and so best applied to high traffic areas with lots of turnover. An alternative might be a solar-powered charging system. Asheville-based Brightfield Transportation Solutions has a system that integrates solar power with electric vehicle charging, and WCU has one of these on campus. We are exploring the costs and benefits of a Brightfield system for HBS.

3. HBS Research & Related Activities

• The Board of Scientific Advisors met at HBS on Saturday 16 March to review 7 Grant-in-Aid proposals. 6 of these were recommended for funding (a total of $10,850, with thanks to the HBF and donors to our named scholarship funds):

Alvis, Tayton (Undergraduate, 3rd year, UNC-Chapel Hill, working with Jason Meador, Mainspring Conservation Trust). "Assessing environmental characteristics that may govern trends in Smoky Dace (*Clinostomus* sp.) presence in the Little Tennessee watershed." 10 weeks (26 May – 3 August 2024); $3,500.

Breault, David (MS student, University of Alabama). "Using shotgun sequencing to infer diet of a dominant shredding caddisfly, *Pycnopsyche* spp. (Trichoptera: Limnephilidae)." 2 weeks (within period 1 May – 1 July 2024); $700. *Recipient of the Lindsay S. Olive Memorial Scholarship.

Kework, Cooper (MS student, Kennesaw State University). "Contribution of spatial heterogeneity to the maintenance of alternative reproductive strategies in Blue Ridge Two-Lined Salamander (*Eurycea wilderae*)." 4 weeks (18 June – 16 July 2024); $1,400. *Recipient of the Bruce Family Scholarship in Herpetology.

Jordan, Jenna (MS student, UNC-Greensboro). "Characterization of ultrasonic vocalizations produced by wild *Napaeozapus* (woodland jumping mouse)." 12 weeks (between 1 May – 1 December 2024); $4,200.

Muhammad, Baaqeya (PhD student, University of Connecticut). "A second look at salamanders: Re-analyzing the evolution of direct development in Plethodontidae (Lungless Salamanders)." 2 weeks (20 – 31 May 2024); $700.

Nicolosi, Paul (PhD student, Ohio State University). "A biochemical characterization of plethodontid skin secretions." 2 weeks (28 July – 11 August 2024); $700. *Recipient of the Ray Semlitsch Memorial Scholarship.

• We have an excellent group of summer research assistants on board:

Heather Pratt (2024 graduate of WCU in Natural Resources Conservation & Management), who will continue working on a project looking at dragonflies and invertebrate communities in reference vs. degraded wetlands in fluvial wetlands along the Little Tennessee River. Funded through HBF.

Reagan Jarrett (UNC-CH graduate spring 2023 and 2022 Highlands IE student 2022) helped with several projects, including microplastics, wetlands, and research looking at occupancy of abandoned mines by bats. Funded through HBF.

Leah Morrisey (UNC-CH student and 2022 Highlands IE student) will be assisting with all projects, with a focus on analyzing the acoustic files of frogs and songbirds from our wetland study. Funded through UNC-CH IE program.

Georgeanna Randall (WCU student and 2022 Highlands IE student) will be primarily working on the microplastics project. Funded through the NC Water Resources Research Institute.

Additionally, we will once again have students from NCSSM (North Carolina School of Science & Math) join us for a 5-week program during they will assist with a wide variety of research projects going on this summer. Two students will take part this year, living on the WCU campus and commuting to HBS each day.

• Visiting research, educational, and other groups hosted at HBS since the last meeting, between January 2024 and present, apart from HBS courses and workshops:

Researchers/Research Groups

Eric Riddell & Braulio Assis, Dept. of Biology, UNC-CH
Lydia McGregor & Jon Benstead, University of Alabama
David Breault, University of Alabama, GIA recipient
Jorge Santiago-Blay, Smithsonian Institution
Kimberly Cook, University of Kentucky, GIA recipient
Jenna Jordan, UNC-Greensboro, GIA recipient
Claire Crookston, University of South Florida
Elizabeth Jockusch, University of Connecticut
Baaqeyah Muhammad, University of Connecticut, GIA recipient
Morgan Vis-Chiasson, Ohio University
Tayton Alvis, UNC-CH, GIA recipient

Visiting classes or workshops, overnight stays

Macon Co. Early College
Breanna Ondich, University of Georgia
John Cummings, Clemson University
Brady Rochford, Francis Delany New School for Children, Asheville
Brian Byrd, School of Health Sciences, WCU

Other visitors, overnight stays except where indicated

Drew Coleman and Alexis Lopez, UNC-CH IE
Leadership Highlands, Highlands Chamber of Commerce (day visit)
Jennifer Kovaks, Agnes Scott College [Board of Scientific Advisors]
Rebecca Hale, UNC-Asheville [Board of Scientific Advisors]
Allan Strand, College of Charleston [Board of Scientific Advisors]
Olivia Hall, Hemlock Restoration Initiative
Mark Hopey et al., MAPS Bird Banding staff
Wildlife Techniques class, Clemson University (day visit)
Jim Benedict and Lily Kuonen, artists (Samara Sculpture installation)
Kathy Mathews, Plant Pressing Workshop (day visit)

• We're aware of just one HBS-supported publication out in 2024 thus far (GIA recipient in bold):

Paulsen, J.; **J. L. Allen**, N. Morris, J. Dorey, J. B. Walke, and S. E. Alter. 2024. Geography, climate, and habitat shape the microbiome of the endangered Rock Gnome Lichen (*Cetradonia linearis*). *Diversity* 16: 178. https://doi.org/10.3390/ d16030178.

• Research Collaborations. HBS is a formal collaborator on the following funded and submitted proposals to NSF and NIH:

– Todd Pierson, Kennesaw State University: "Salamander Speciation Genomics & Phylogeography" (NSF, submitted)
– Brian Byrd, WCU: "Socioeconomic Impacts of La Crosse Virus in Western NC" (NIH R15 Research Enhancement Award, submitted)
– Damien Wilburn & Karen Kiemnec-Tyburczy: "Mechanistic Investigations of a Rapidly Coevolving Signaling System" (NSF, submitted)

• Ongoing HBS-based research:

– *Microplastic concentrations and dynamics in southern Appalachian headwater streams* with Jason Love (WCU/HBS), Jerry Miller (WCU), Austin Gray (VT), and Robert Youker (WCU). Last summer the team deployed 3 atmospheric deposition collectors to quantify abundance and type of microplastics falling from the atmosphere. The collectors, which differentiate between wet and dry deposition, were placed along a precipitation gradient: one was deployed at HBS (~90 inches of rain/year), one at Coweeta Hydrologic Laboratory (~70 inches of rain/year), and another in the Richland Creek watershed in Haywood County (~50 inches of rain/year). The collectors were purchased as part of our $60K end-of-year equipment funding. With the IE students, the team has also been collecting stream water samples to assess concentrations and loads, and have been assessing microplastics found in caddisflies in the family Hydropychidae (net-spinning caddisflies). Jason and colleagues have been invited to submit a manuscript to the journal *Environments* for a special issue on microplastics.

– *Bird banding* as part of the *Monitoring Avian Productivity and Survivorship (MAPS)* program is now in its 5th year at HBS. As part of MAPS, we also continued to participate in the *CaterpillarsCount!* project led by Allan Hurlbert at UNC-CH. The HBS MAPS project is spearheaded by Jason Love and Mark Hopey of the Blue Ridge Bird Observatory, with a commitment of 7 years of funding through HBF.

– *Using multiple criteria to assess degraded vs. reference wetlands in the Little Tennessee River floodplain*. Jason and Rada Petric are working with WCU student/summer research assistant Heather Pratt and former IE students/summer research assistants Reagan Jarrett and Leah Morrisey to conduct surveys of odonates (both adults and nymphs), other flying insects (using malaise traps), butterflies, wetland macroinvertebrates, invasive exotic plants (including Marsh Dewflower, *Murdannia keisak*, a newly established wetland exotic that is quite aggressive), and water quality. They also deployed sonic bat detectors and bird/frog detectors, as well as wildlife cameras. There are 6 sites total, with 2 of the sites serving as references. Heather used a portion of this research as her WCU senior thesis project. The degraded wetlands are slated for restoration over the next few years, so the team will be collecting "pre-treatment" data as well as comparing degraded and reference wetlands. End-of-year equipment funding was used to purchase song/frog recorders for this project. Two IE students (Rose DeConto and Susie Cantonwine) took part in this research last fall and focused on analyzing data from the acoustic bird and frog recorders, as well as data from the trail cameras.

– *Assessing bat use of abandoned mine shafts*. Rada Petric and Jason Love are working with US Forest Service biologist Johnny Wills and NC Wildlife Resources biologist Katherine Etchison to locate and survey abandoned mines in the area for bats, using acoustic bat recorders. Most bats that use these mines are either federally listed or soon will be due to White Nose Syndrome. They deployed some of the detectors last summer and the rest were deployed last fall by Juliet, Reagan, and two IE students (Zöe Heard and Sydney Sibillia) who analyzed the first batch of data for their independent research

projects. We were approved/awarded approximately $25K of additional end-of-year money last year to purchase the bat detectors and associated accessories for this research project. Reagan Jarrett is taking the lead in maintaining the monitoring equipment over the summer.

– Reagan Jarrett is also coordinating backpacking trips along the Appalachian Trail for the *Batpacking* project. Acoustic bat recorders are deployed at camp to assess the diversity of bats foraging along the trail. This initiative is being spearheaded by Rada Petric.

• Grant proposal: *More than movement – a new model of animal-mediated dispersal.* This past April my collaborators Robert Warren (Buffalo State), and John Tooker and Andy Deans (Penn State) and I resubmitted our NSF proposal to examine the ecology of wasp gall dispersal by ants, a relatively recently discovered phenomenon. Our project has three main goals: First, we aim to gain a better understanding of evolutionary convergences between ant-mediated seed and gall dispersal; Second, we seek to explore the potential for dispersed galls to benefit from ant defenses against pathogens; Third, we plan to share our research results and knowledge of gall biology broadly, through several planned outreach, education, and mentoring experiences. If funded, the proposal will support 2 WCU undergraduate research assistants for 3 years, including academic year and summers.

• HBS IACUC. This winter we finalized the new HBS IACUC (animal care and use oversight) process in collaboration with colleagues at WCU, Garrett Davis (Research Compliance Officer, Sponsored Research) and Mallory Ball (Program Manager, Sponsored Research). We obtained valuable input from a wider working group including myself and Jason, Barbara Ballantine (WCU Biology and Chair of the WCU IACUC committee), Joe Pechmann (WCU Biology and IACUC committee member), Carmen Huffman (Associate Provost), and Kelly Tornow (WCU legal office).

In the new procedure the HBS ED is a member of the WCU IACUC, and the group that had been serving as the HBS IACUC is effectively a subcommittee. Just FYI I have provided the new SOP documents to the Board, and the new procedures and necessary forms can be viewed on our website: https://highlandsbiological.org/information-for-researchers/. The research season now underway has afforded a test run of the new process. It has been working smoothly thus far, while revealing areas that could benefit from clarification to make the process even smoother for prospective HBS researchers.

4. Gardens & Grounds

• We have two excellent Botanical Garden assistants this summer, funded through HBS/WCU:

– Tara Henderson (senior at WCU, Natural Resources Conservation & Management)
– Jake Thompson (senior at NC State); Jake will be surveying HBS *Sarracenia* populations as part of his senior thesis.

• Progress continues, sometimes very slowly, on HBS Gardens & Grounds related projects; please see Committee Chair Ken Conover's report. Here are noteworthy activities, guided by the Botanical Garden "roadmap" planning document:

– Wayfinding signage project. WCU Facilities Management deemed it necessary for our signage designers, Equinox Environmental, to submit the signage plans to the State Construction Office for review. This introduced an unexpected delay for Phase II (construction/installation), but just this week we received word that the plans were approved by State Construction, and we're now **very close** to being able to proceed with bidding. This project is funded with special grant support through the NC Science Museums Program.

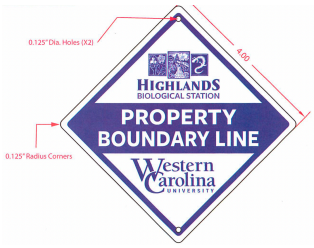
– "South Gateway" Garden project. Thanks to Gardens & Grounds Committee member Liz Sargent, landscape architects Warren Byrd and Sue Nelson of Charlottesville, VA are working pro bono on a design concept for the new "south gateway" entrance to HBS, adjacent to the Nature Center, in consultation with the HBS Gardens & Grounds Planning and Advisory Committee. The design is coming together nicely, and Warren and Sue will be sharing a draft design concept in a Zahner Lecture on Thursday July 11th.

– Garden and Grounds improvements:

i. Nature Center "east bed" makeover (complete)
ii. Duplex front bed makeover (complete)
iii. Southern Appalachian Ethnobotanical Garden improvements (ongoing)

• Botanical Garden Donation Guidelines. The Gardens & Grounds Committee endorsed draft donation guidelines to benefit the HBS Botanical Gardens. Based on research into tribute and memorial donation policies at other botanical gardens and arboreta, these guidelines will help us handle the requests we receive from potential donors who wish to commemorate someone with a tree, bench, or other garden feature consistently, and in a way that benefits the HBS Botanical Gardens (through our Advancement Fund). Given the size of our site and ecology of our Gardens we cannot accept new trees or benches willy nilly, so our new guidelines will set parameters on accepting memorial donations. After meeting with Advancement and receiving initial feedback I incorporated some clarifying language and submitted the guidelines to WCU Advancement for endorsement. Once approved we will add a section on the Botanical Garden webpage presenting the new guidelines.

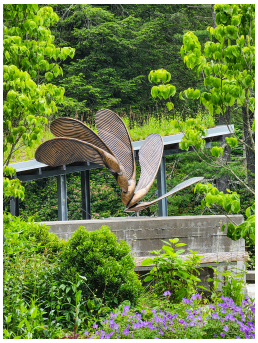
• Property Boundary marking. To prevent incursions onto WCU/HBS property like those we experienced in 2022 and 2023 we will be marking the property boundary. To this end Facilities Management at WCU engaged a surveyor to complete a comprehensive boundary survey, and we have finalized a boundary marker design identifying WCU/HBS property:



• HBS Gardens and Grounds brochure. Our new brochure is now complete! Incorporating our new HBS map developed by Concept3D, the new brochure highlights trails, noteworthy seasonal flowers in bloom, buildings, and parking areas. The brochure is now being printed, and it will also be downloadable from our website.

• Planning and marketing are now gearing up for the 2024 HBS Native Plant Symposium, scheduled for 13-14 September! This major educational and fundraising event that benefits our Botanical Garden fund is held every other year. This year's event will feature speakers Charlie Williams, Joey Shaw, and Barbara Sullivan, with short talks spotlighting research that takes place in the HBS Botanical Gardens as well as Garden improvement projects and plans. The NPS will also feature silent and live auctions, book sales, and more. For more information and to register, see https://highlandsbiological.org/2024-native-plant-symposium/

• Sculpture installation. Just a few weeks ago Florida-based artists Jim Benedict and Lily Kuonen installed their beautiful sculpture *Samara's Grace* at the HBS "North Campus" entrance on Lower Lake Rd.! This was made possible by HBF's fundraising efforts. Jim and Lily's design was selected in a public competition overseen by WCU's Public Art Committee of the Fine Arts Museum, chaired by Greg McPherson, Professor of Practice and Exhibitions Designer at WCU.



5. Education, Outreach, and Public Engagement

• HBS Summer 2024 academic program. Our experiment with shifted course scheduling, moving to a Tuesday-Sunday timeframe allowing for a weekday (Monday) arrival for students, is working well. Most teaching faculty are happy with the new schedule, and having staff on site on arrival day for students is helpful. The 2024 course lineup is unchanged, but in a couple of cases teaching faculty have changed as some faculty had issues arise and bowed out. Enrollments are thus far strong to moderate —

Two-week courses:

Biology of Southern Appalachian Salamanders (Joe Pechmann, Western Carolina University & Kristin Cecala, University of the South), 28 May-9 June
Southern Appalachian Mayflies, Stoneflies, and Caddisflies (John Morse & Matt Green, Clemson University), 11-23 June
Fish of the Southern Appalachians (Keith Gibbs, Western Carolina University), 18-30 June
Spiders of the Southern Appalachians (Sarah Stellwagen, UNC-Charlotte & Mercedes Burns, Univ. of Maryland, Baltimore Co.), 23 July-4 August

Introduction to the Flora of the Blue Ridge (Paul Manos, Duke University), with a new two-part structure:
Section 1: Introduction to Flora of the Highlands Plateau (23-28 July)
Section 2: Exploring the Flora of the Blue Ridge (29 July - 4 August)
Comparative Temperate/Tropical Ecology & Biogeography (Jim Costa, WCU & HBS, with Travis Knowles, Francis Marion University):
Highlands Biological Station: 9-15 July
Wildsumaco Biological Station, Ecuador: 15-29 July

One-week courses:

Wetland Plant Identification (Joey Shaw, UT-Chattanooga), 14-19 May
Bryophytes: An Ecological Approach (Sue Studlar, UNC-Asheville), 28 May-2 June
Cliff and Rock Outcrop Communities (Laura Boggess, Mars Hill Univ., & Gary Kaufmann, USFS), 4-9 June
Introduction to Southern Appalachian Millipede Diversity (Bruce Snyder, Georgia College and State University) 11-16 June
Identification of Southern Appalachian Grasses (Paul McKenzie, USFWS), 6-11 August

• We are once again offering a number of workshops and special programs to benefit the HBS Botanical Gardens fund (proceeds go into our Trust fund, earmarked for Garden-related use):

Oconee Bells program – Jim Costa, 17 March
Paper Botanicals workshops – Cynthia Woodsong, 14 & 16 May
Geology of the Highlands Plateau – Bill Jacobs, 11 July
Lichens workshop – Sue Studlar, 25 June
Mushrooms of the s. Appalachians – Alan & Arleen Bessette, 18-24 August

• IE Program. We once again have a full house of 15 excellent students enrolled in the fall IE program, slated to arrive in mid-August. Jason will give an overview of this year's program.

• HBS Nature Center and School Outreach program. Our extensive public engagement / outreach program, provided by Patrick Brannon as well as Foundation staff, serves communities of western North Carolina near and far. See the accompanying Outreach Annual Report for 2023; highlights:

– 13,416 people served in 344 programs (STEM school outreach, adult workshops, community service)
– The 344 programs served 66 regional schools and other organizations, including programs off-site (94%), on-site (3%), and virtual (3%).
– Counties served: 12 in North Carolina, and 1 each in Georgia, South Carolina, and Virginia. Most-served counties: Macon Co. (244 programs, 32 schools/organizations); Jackson Co. (48 programs, 15 schools/organizations); Swain Co. (19 programs, 3 schools/orgs); Clay Co. (18 programs in 1 school), and Rabun Co., GA (18 programs in 2 schools).
– Outreach support: **$72,759**, including our $60K NCSM program grant, $7K in other grants, $3K in STEM contracts, and $2,759 in program fees.

6. Foundation

• The Foundation recently welcomed a new director, Jamie Creola, and new Nature Center educator, Julie Thompson. They (HBF) will also soon vacate their office space in the Howell Admin Building at HBS, moving to their own newly renovated space on the Cashiers Rd.

• The MOU between WCU/HBS and the HBF has been completed. We have a 5-year term of agreement defining roles and responsibilities. The HBF will now contribute to HBS operations with a $25K annual grant. A Facilities Use Agreement pertaining to Nature Center programming has also been completed: WCU/HBS continues as the ultimate authority over the Nature Center, with the HBF operating the building and programs.

• The Zahner Lecture Series, spearheaded by the HBF, start up this week. HBF is also once again running summer camps for kids ages 5-12. All camps are full with a waiting list, illustrating the popularity of the camps. Julie will be assisted with the camps this summer by Teacher-Naturalists Ines Nix (junior at Washington Univ., St. Louis), Asia Schmunk (2024 graduate of Ohio Northern Univ.), Alex Waite (2023 graduate of Ohio Northern Univ.), and Ava Ashe (senior Biology major at WCU).

7. Other Initiatives, Activities, Events, Info

• One Day for Western. WCU Advancement is committed to working with us in expanding our fundraising capabilities and reach. One great indication of that is the Station's participation in the 2024 *One Day for Western* fundraising campaign, which took place on April 3rd. One Day for Western is an annual campaign that focuses on a number of priority programs and organizations at the university, and I'm delighted that HBS was selected as a featured program in this year's event — in which we raised over $10,000 for the HBS Advancement Fund!

• Volunteer Hours. There is an impressive record of volunteerism at HBS:

2023	*2024 (through 1 June)*
Archives: 288	Archives: 150
Field or Lab Research: 42	Field or Lab Research: 45
Garden Maintenance: 534	Garden Maintenance: 99.5
Garden Planning: 77.5	Planning Meetings: 93.5
Meeting: 187	Nature Center: 33
Darwin and the Art of Botany book event: 11	
Nature Center: 153.5	
Other: 3	
TOTAL: 1,296 h	**TOTAL to date: 421 h**

According to the latest national survey, mean volunteer "pay" is $31.80/hr, which comes to **$41,212.80** for 2023 and **$13,387.80** for 2024 to date.

• The 2024 season Garden volunteer program is off and running! Volunteers can arrange to help out anytime, but our regular volunteer sessions are Wednesday mornings. Let me know if you would like to be put on our volunteer email list.

• Friends of HBS. On June 6th we hosted an event at WCU for a group of about 20 "friends of HBS" for a tour of the new Apodaca Science Building with Associate Provost Carmen Huffman, a discussion of the building's beautiful botanical artwork by WCU Fine Arts Museum curator Carolyn Grosch, and a tour of the WCU Herbarium with curator and professor (and HBS volunteer) Kathy Mathews. The event was a great success judging from feedback we received. This was a repeat of a similarly successful tour in 2022, and we'll aim to hold this every other year.

• The new WCU-HBS logo was finalized this past winter:

• HBS Archives project. Volunteer Bryding Adams, our wonderful "Honorary Archivist," continues to make great strides in curating and cataloging the HBS Archives including historical correspondence, photographs, maps, blueprints, and more. This summer we hired Cora Bauman, a talented graduate student in the WCU History Dept., to work with Bryding two days weekly. Cora is also working on a special project, putting together a permanent exhibit on Samuel Weyman and the history of the Weyman Building, and will present her findings and exhibit in early August!

• HBS International Travel program. Over the past year we ran two fantastic trips benefitting the Station, on which I served as Study Leader offering lectures and natural history and scientific interpretation:

– **Galápagos Islands** aboard the yacht *La Pinta* – December 6-15, 2023
– **Chile's Lake District & Patagonia: In Darwin's Footsteps at World's End** – February 27-March 10, 2024

Together these trips brought in over $7,000 for the HBS Trust Fund. We are now planning an **Amazon River** adventure for early 2025, in the footsteps of Alfred Russel Wallace from Manaus, Brazil, to the upper Amazon of Peru! Future trips include the Atacama, UK, and more.

8. Director's and Associate Director's Scholarly, Teaching, and Service Activities

• In the spring semester I taught a new Special Topics course, "Darwin and Wallace," structured around a paper I co-authored last year in *Notes and Records of the Royal Society*, analyzing the recently discovered outline by Alfred Russel Wallace's for a book of that title that went unrealized owing to his death in 1913.

• This past spring my colleague Brian Railsback, WCU English Studies professor, and I teamed up to submit an interdisciplinary course proposal to the new Stewart Scholars program of the College of Arts and Sciences. Established by a generous donation by Mary Stewart (Professor Emerita in Art at Florida State and friend of WCU), the Stewart Scholar program seeks to encourage interdisciplinary teaching through support of interdisciplinary course development. Our proposed course, entitled "Nature in the Scientific and Literary Imagination," was not selected this time around, but Brian and I plan to offer this course anyway, in spring 2025.

• *Radical by Nature*, my Wallace biography published by Princeton last year, continues to receive strong reviews, and I'm gratified to report that the book was named the 2024 PROSE Award winner for History of Science, Medicine, and Technology by the American Association of Publishers — https://app.cerkl.com/org/story.php?oid=2825&id=18958668#

• My co-author Beth Yale and I recently completed final manuscript revisions and color plate selections for our book *The Annotated Descent*, an annotated edition of Darwin's *The Descent of Man*, to be published by Princeton University Press in 2025.

• Presentations. This winter I gave three talks on Wallace for Darwin Day 2024, including virtual talks for Lone Star College in Kingwood, TX and Central Washington University in Ellensburg, WA, and an in-person seminar for the WCU Dept. of Biology. More recently I gave a talk on *Darwin and the Art of Botany* at City Lights Bookstore in Sylva, and will give another in Hudson Library in Highlands this August. Finally, later this summer I will give a public talk for the Oconee Bell chapter of the NC Native Plant Society at Gorges State Park.

• Next week I will be traveling to the UK, giving a paper at a conference in Oxford and public talks on *Darwin and the Art of Botany* at the Oxford University Museum of Natural History and at Down House, Darwin's home south of London managed by English Heritage:

https://oumnh.ox.ac.uk/event/darwin-and-the-art-of-botany
https://www.obga.ox.ac.uk/event/darwin-and-the-art-of-botany-tour
https://www.english-heritage.org.uk/visit/whats-on/down-house-the-art-of-botany/

• Committees. I serve on two university committees, the Scholarship and Research Strategic Planning Committee (setting goals and approaches to enhance the campus culture for scholarship, and scholarship and research support), and the "Fill the Western Sky" Campaign Steering Committee.

• This year I was invited to join the E. O. Wilson Biodiversity Foundation's NC Education Advisory Group, a group of educators from across the state tasked with working with the E. O. Wilson Foundation's Half Earth Project in exploring ways to develop and support a network of North Carolina teachers devoted to infusing biodiversity and conservation thinking across the curriculum. Our kick-off meeting was held last February at the Foundation's headquarters in Durham.

• Jason and I will once again be teaching in the fall IE program at HBS. I will co-teach ENEC 256 (Anthropocene impacts) with Rada, and Jason will teach or co-teach ENEC 205 (Seminar: Southern Appalachian Environmental and Cultural History), ENEC 395 (Research in Environmental Sciences and Studies for Undergraduates), and ENEC-698 (Capstone, in which students are looking at microplastics concentrations in the atmosphere, stream, and in caddisflies).

• Jason is serving as Past-Chair of Mainspring Conservation Trust, a local land trust and conservation organization serving the southern Blue Ridge.

• Jason is continuing to serve on the steering committee (Past-Chair) of the Little Tennessee Native Fish Conservation Area Partnership, a consortium of federal, state, university, and non-profit organizations focused on the conservation of the Little Tennessee River.

Highlands Biological Station / Nature Center

OUTREACH: ANNUAL REPORT (2023)

(Patrick Brannon – HBS Outreach Education Specialist)

I. PEOPLE SERVED 2023:

PROGRAM OFFERINGS	# PEOPLE	# PROGRAMS
SCHOOLS - STEM OUTREACH:	11,257	321
EDUCATOR / ADULT WORKSHOPS:	162	9
COMMUNITY SERVICE:	1997	14
TOTALS:	**13,416**	**344**

= Average of **1.8** programs per workday *(excludes summers, weekends, & holidays)*

II. 2023 HBS OUTREACH SUMMARY:

DEMOGRAPHICS:

	# PEOPLE	# PROGRAMS	# CONTACT HRS
PRESCHOOL:	281	11	161
ELEMENTARY (K-5):	9986	230	14,498
MIDDLE (6-8):	1489	48	1703
HIGH SCHOOL (9-12):	1047	32	1707
ADULTS:	253	15	313
FAMILIES:	360	8	360
TOTALS:	**13,416**	**344**	**18,742**

PROGRAM LOCATIONS:

	# SCHOOLS / ORGS SERVED	# OFF-SITE PROGRAMS	# ON-SITE PROGRAMS	# VIRTUAL PROGRAMS
PUBLIC SCHOOLS	29	261	4	6
PRIVATE & HOME SCHOOLS	16	38	2	1
ADULT & OTHER GROUPS:	21	25	3	4
TOTALS:	**66**	**324**	**9**	**11**
		(94%)	(3%)	(3%)

III. 2023 COUNTIES SERVED – OUTREACH PROGRAMS (15):

STATE	COUNTY	# SCHOOLS / ORGS	# PROGRAMS
NC (12)	Macon	32	224
	Jackson	15	48
	Swain	3	19
	Clay	1	18
	Wake	4	4
	Madison	1	4
	Haywood	1	2
	Cherokee	1	1
	Buncombe	1	1
	Henderson	1	1
	Graham	1	1
	Transylvania	1	1
GA (1)	Rabun	2	18
SC (1)	Oconee	1	1
VA (1)	Albemarle	1	1
	TOTAL:	**66**	**344**

IV. OUTREACH REVENUE 2023

Outreach Program Fees = $ 2,759
Macon STEM contracts = $ 3,000
NCSM grant = $ 60,000
Additional grants (2) = $ 7,000

Total Revenue = **$ 72,759**

V. OTHER:

- New lichens/air quality program created
- Virtual Outreach Programs also available (42); with expanded geographic reach
- “HBS Science Short Shows” on YouTube (10)
- “Nature Notes” regular articles in newspaper
- NC Wildlife Programs offerings increased to 21
- Adult / Educator Workshops for HBS, EENC, NC Arboretum & Lake Johnson Park Crowder Ctr -Raleigh
- Collaborations with Macon Co. Schools STEM, including Outreach contract for spring 2024
- Collaborations with various other regional organizations for events and shared resources
- NC Science Festival Sci-Match (“Invite a Scientist”); plus other guest lectures
- STEM-E Elementary & Middle/High Annual Conferences; NC Arboretum Mountain Science Expo
- WNC Regional Science Fair 2023 – keynote speaker
- Afterschool Programs (HBF) = 43 programs, 607 students; HBF Outreach = 68 programs, 1218 students

Highlands Biological Station
Botanical Gardens & Grounds Planning and Advisory Committee
Update for HBS Board of Directors
June 10, 2024

Ken Conover, Chair

The Botanical Gardens & Grounds Planning and Advisory Committee continues to meet monthly and assist the HBS with implementing Gardens and Grounds Roadmap priorities.

Current Committee members are Bryding Adams, Lynda Anderson, Ken Conover, Jim Costa, Jamie Creola, Jason Love, Paul Manos, Kathy Mathews, Liz Sargent, Jeremy Schewe, Dollie Swanson, and Glenda Zahner. Jamie Creola and Jeremy Schewe both recently joined the Committee. Jamie is the new Executive Director of the Highlands Biological Foundation. Jeremy previously worked as a botanist and landscape designer at the Highlands Botanical Gardens. He is the owner/senior scientist of Unaka Environmental, LLC, co-founder of Ecobot, and founder of Enchanted Journeys.

Roadmap Implementation
During the past six months, the HBS and Committee continue to work on several key priorities.

1. Public Engagement

Garden Tours:
Bryding Adams spearheaded organizing public Botanical Garden tours again for this summer. They are scheduled every Wednesday at noon from June 5 to August 7. Many of the Committee members are leading tours of different themes or gardens.

2024 Native Plant Symposium:
The 2024 Native Plant Symposium is scheduled for September 13th and 14th. Charlie Williams will be performing his one-person act impersonation of Andre' Michaux on Friday afternoon in the amphitheater. Our main speakers on Saturday are Ms. Barbara Sullivan, author of "Climate Change Gardening for the South", and Dr. Joey Shaw, University of Tennessee at Chattanooga and Director of the Spring Wildflower Pilgrimage of the Great Smoky Mountains National Park. Saturday's event also includes four short talks on research relating to the Botanical Garden, book sales and signing, and silent and live auctions of native plants. Proceeds will be used to support the Highlands Botanical Gardens.

2. Wayfinding and Interpretative Signage

The wayfinding plans and bid package developed by Equinox had to be reviewed by the State Construction Office (SCO). Plans were approved by the SCO this spring with comments. The bid package has been revised by Equinox. The next step is for WCU Facilities Management to solicit bids.

HBS staff completed a new garden brochure that includes an updated map consistent with the on-line interactive map and other information about the Highlands Botanical Gardens and some of the native plants.

3. South Gateway Entrance Garden

Warren Byrd and Sue Nelson, renowned landscape architects and retired professors and business owners from Charlottesville, VA, have been creating a conceptual design for a new South Gateway Entrance Garden next to the Nature Center on a pro-bono basis. They have twice met with the Committee to present ideas and concepts and receive comments and suggestions.

Warren and Sue are now preparing the final conceptual design. Warren will present the design to the Committee on July 11. He will also be giving a Zahner Conservation Lecture on the evening of July 11 describing his design approach and presenting the South Gateway Garden conceptual design.