TCN Quarterly Progress Report

TCN Name

Building a global consortium of bryophytes and lichens: keystones of cryptobiotic communities (GLOBAL)[1]

Person Completing the Report

Miranda Zwingelberg (GLOBAL Project Manager)

Share Progress in Digitization Efforts

This report covers progress completed during the period of October 1 – December 31 2024.

Workflows, Equipment, and Personnel

Most GLOBAL institutions continued steady GLOBAL progress during 2024-Q4.

ALA has completed their digitization commitments.

At ASU, specimen digitization continued through the fall with images for 273 lichen specimens and their labels added (total number of labels 289, because some annotation labels are typically also imaged as part of the digitization routine).

CINC imaged and added 1,841 bryophyte and 115 lichen records to the portals, which brings them up to a total of 64,270 bryophyte and 7,690 lichen records. The CINC CSBR project continues to move specimens from backlog into the collection, and the bryophyte and lichen

[1] Throughout this report, herbaria are referred to by their Index Herbariorum acronyms, which correspond to institutional names as follows: ALA = University of Alaska, Fairbanks, ASU = Arizona State University, BISH = Bishop Museum, BRY = Brigham Young University, CINC & MU = University of Cincinnati & Miami University, COLO = University of Colorado, DUKE = Duke University, F = The Field Museum, FLAS = University of Florida, ILL & ILLS = University of Illinois at Urbana-Champaign & Illinois Natural History Survey, LSU = Louisiana State University, MICH = University of Michigan, MIN = University of Minnesota, MO = Missouri Botanical Garden, MSC = Michigan State University, NY = New York Botanical Garden, OSC = Oregon State University, PH = The Academy of Natural Sciences of Drexel University, PTBG = National Tropical Botanical Garden, TENN = University of Tennessee, Knoxville, UC = University of California, Berkeley, WIS = University of Wisconsin, YU = Yale University

specimens move into the GLOBAL pipeline. Availability of student workers was very limited over the past few months of 2024, and productivity dwindled as the semester came to a close. They have met with students and hope to have better commitment, and greater productivity this semester.

Lichens: COLO captured 359 lichen packet images and skeletal records. 359 specimens were barcoded. Images and all skeletal data captured through 12/31/2024 have been uploaded to the portal. 776 transcriptions were completed. Bryophytes: COLO captured 5,793 bryophyte packet images and skeletal records. 5,793 specimens were barcoded. Images and all skeletal data captured through 12/31/2024 have been uploaded to the portal. 731 transcriptions were completed. They are finding it increasingly difficult to staff student positions. They used to pay above the campus minimum, but with the campus going to a $16 minimum they do not have the budget to compete with higher paying campus and off campus jobs. They hired one new student at the end of last quarter and hope to hire one more student for the spring semester. One of their work study students graduated in December and was offered a temporary position to work on transcription and specimen imaging starting in January 2025. They hope to have him focusing on these two much needed components of the project.

DUKE barcoded 1,967 bryophyte specimens and 109 lichen specimens. They imaged 2,239 bryophyte labels and 106 lichen labels, and 102 bryophyte plants and 1 lichen. All images and skeletal data have been uploaded to the bryophyte portal. They fully transcribed 185 bryophyte specimens and 86 lichen specimens. They georeferenced 10 bryophyte records.

At F, almost 1,000 lichens were imaged for labels and specimens with almost 200 specimens databased; over 5,000 bryophyte specimens and labels have been imaged with 3,632 bryophyte records variously database - partially or fully transcribed.

FLAS's collection on the bryophyte portal is now at 56,580 specimen records.

In 2024-Q4, MO barcoded 6,949 bryophyte specimens and imaged 14,036 bryophyte labels. They created 14,036 skeletal records and fully transcribed 471 labels. They also georeferenced 2 specimens.

OSC barcoded and imaged 869 lichen specimens.

PTBG imaged 121 bryophytes and 138 lichens this quarter. To date, PTBG has imaged a total of 7,761 bryophyte and lichen specimens. Imaging is now complete for their current collection and they will continue to image any newly acquired specimens.

TENN's new Collections Manager began work at the herbarium in October. Five new herbarium technicians were recruited to be trained during the Winter Mini-Term in January 2025.

UC has essentially completed their skeletal data and imaging for their lichen and bryophyte specimens. They are continuing to add small batches of bryophyte specimens that were not captured in the first round of digitizing efforts due to being in mixed-locality folders or mixed-species folders. They have now transitioned to transcribing, beginning with the lichen specimens.

WIS students continued to image specimens and transcribe label data from the collection. WIS continues to harvest localities for collaborative georeferencing. WIS continues to send corrected georeferences via csv files to snapshot collections for their data management.

Digitization

Eleven GLOBAL institutions (ASU, CINC & MU, COLO, DUKE, F, FLAS, MO, OSC, TENN, UC, and WIS) reported progress on digitization deliverables, with a total of 20,653 specimens barcoded (16,934 bryophytes and 3,719 lichens), 35,992 labels imaged (32,009 bryophytes and 3,983 lichens), 13,044 specimens imaged (9,959 bryophytes and 3,085 lichens), 25,238 specimen records uploaded to the portal (22,821 bryophytes and 2,417 lichens), 26,606 skeletal records created (24,627 bryophytes and 1,979 lichens), 15,071 labels fully transcribed (6,838 bryophytes and 8,233 lichens), and 14,194 specimens georeferenced (11,161 bryophytes and 3,033 lichens) (See Table 1 & Figure 1).

PEN partners BISH and PTBG reported a total of 1,325 specimens barcoded (1,182 bryophytes and 143 lichens), 259 labels imaged (121 bryophytes and 138 lichens), 259 specimens imaged (121 bryophytes and 138 lichens), 8,795 specimen records uploaded to the portal (all bryophytes), and 93 labels fully transcribed (33 bryophytes and 60 lichens).

Table 1: Digitization progress by GLOBAL collaborators in 2024-Q4, separated by Bryophyte (B) and Lichen (L) specimens.

	# Barcodes Added		# Labels Imaged		# Specimens Imaged		# Uploaded to Portal		# Skeletal Records Created		# Fully Transcribed		# Georeferenced	
	B	L	B	L	B	L	B	L	B	L	B	L	B	L
ALA														
ASU		273		289		273		273				273		
BRY														
CINC & MU	1,841	115	1,484	86	1,484	86	1,841	115	1,096	2	745	113	2,859	1
COLO	5,793	359	5,793	359			5,793	359	5,793	359	731	776		
DUKE	1,967	109	2,239	106	102	1	2,341	107	1,967		185	86	10	
F		263	5,170	843	5,170	843	9,559		1,651	187	1,980	76		76
FLAS	300	300	3,203		3,203		3,203				2,726			
ILL & ILLS														
LSU														
MICH														
MIN														
MO	6,949		14,036						14,036		471		2	
MSC														
NY														
OSC		869		869		869								
PH														
TENN													790	
UC												5,300		
WIS	84	1,431	84	1,431		1,013	84	1,563	84	1,431		1,609	7,500	2,956
YU														
Totals	**16,934**	**3,719**	**32,009**	**3,983**	**9,959**	**3,085**	**22,821**	**2,417**	**24,627**	**1,979**	**6,838**	**8,233**	**11,161**	**3,033**
B+L Totals		**20,653**		**35,992**		**13,044**		**25,238**		**26,606**		**15,071**		**14,194**

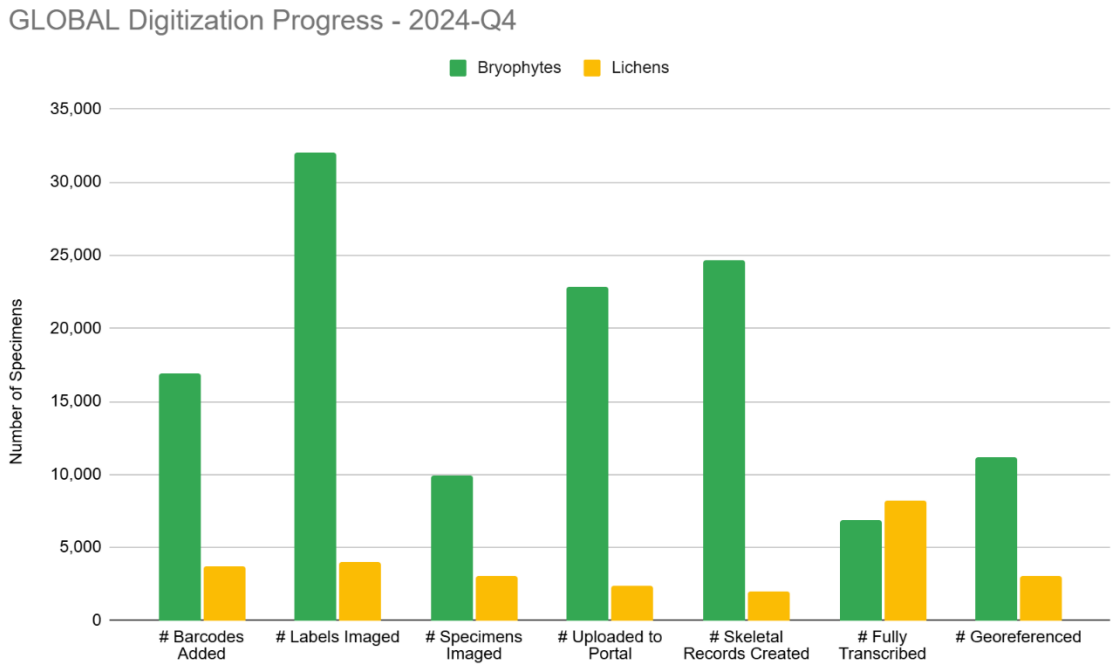

Figure 1: Digitization progress for the GLOBAL collaboration in 2024-Q4, separated by Bryophyte and Lichen specimens.

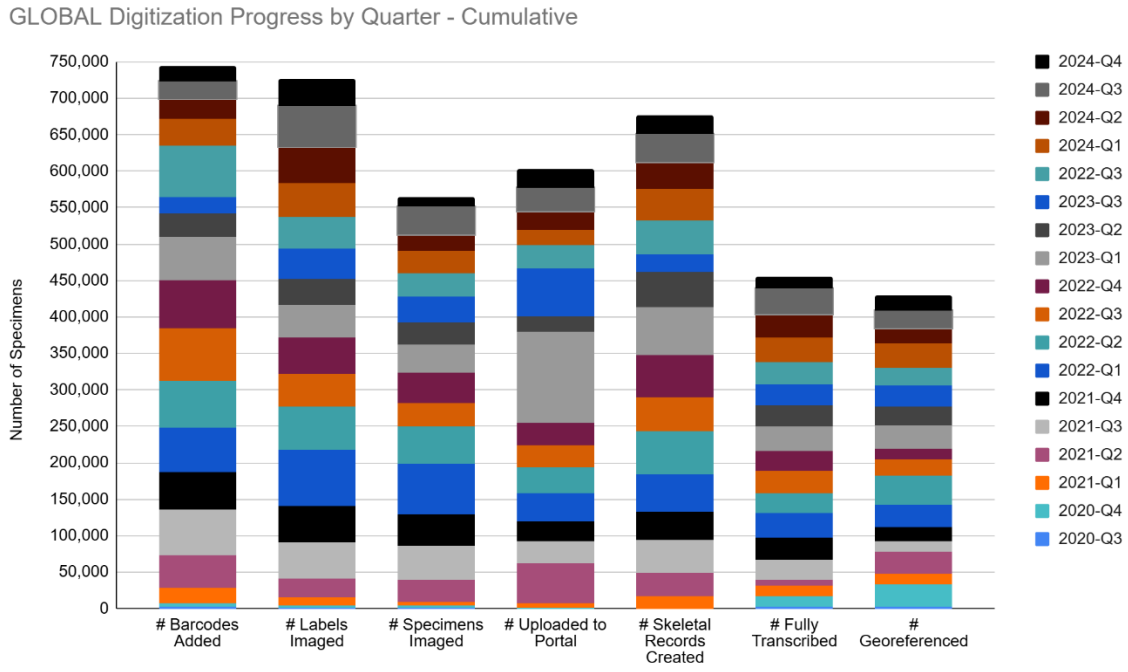

Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.

Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

The GLOBAL teams continued to make use of flexible digitization workflows in 2024-Q4, including a mixture of virtual and on-site work.

At COLO, since no transcription work was completed on their non-North American specimens before the project, they did not have records for the first wave of georeferencing work at WIS. They have been prioritizing records from Australia, Chile, England, Finland, France, Japan, Norway, Scotland, Sweden and Wales for transcription to build sets for georeferencing. They have now added Central America, South America and Africa to our focus regions. They have also been adding transcriptions for Lichens from Polynesia, Micronesia, Melanesia in advance of that region being georeferenced in mid-January 2025. They are also transcribing bryophyte specimens from Sweden and Norway as they are added to the database. They are continuing to work with the team at University of Michigan in the hope of incorporating VoucherVision into future transcription work. COLO requested and was approved for a second no cost extension to focus on transcription and specimen images. The computer running the imaging station is no longer functional and they had to transfer the computer targeted for capturing specimen images to the packet station.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2024-Q4. New collaborators and students were given access to Basecamp group resources. A Management Committee Meeting was held in November open to all GLOBAL members to review progress from 2024-Q3, and to provide an open forum to the GLOBAL team. A second meeting with the IT and Taxonomy and Nomenclature Groups to discuss updating the taxonomic thesaurus in the Bryophyte and Lichen Portals was held in November.

WIS continued its collaborative georeferencing, creating new communities in the CoGe interface and georeferencing as fully transcribed records become available. The GLOBAL Georeferencing Manager (WIS) and Portal Manager (ASU) continued to consult on georeferencing workflows, especially those involving GEOLocate CoGe.

Share Identified Gaps in Digitization Areas and Technology

New Software Tools

Version 3.1:
Symbiota Version 3.1 launched in July 2024 and first applied to the Lichen Consortium required extensive testing and troubleshooting. Numerous bugs of the new version were filed with the Symbiota Support Hub and have largely been resolved. The new version is sufficiently stable that it has been rolled out to most other Symbiota portals.

Mytabolites:

A new version of Mytabolites is being developed that will use Symbiota's own built- in API and thus be platform independent. The current version uses a standalone custom-built API that only connects to the ASU server and would no longer work if the installation of the Lichen Consortium was moved to the University of Kansas (currently not planned).

Taxonomic Thesaurus:
In November, another GLOBAL meeting was held on updating the taxonomic thesauri in both the Lichen and Bryophyte Consortium. Attendees agreed to add unique identifiers to the databases for both portals. For the Lichen Consortium, both Mycobank numbers and Index Fungorum UUIDs will be added. For the Bryophyte Consortium unique identifiers from John Brinda's Bryophyte Nomenclator will be used. Names not matching any of these repositories will be removed. Scott Bates (MycoPortal), John Brinda (Bryophyte Consortium), Frank Bungartz (Lichen Consortium) are currently working on updating the names that have been exported, adding the unique identifiers. The updated files with their identifiers will then be reimported, replacing and updating the current taxonomy.

ASU recruited Mousa Shaya as a programming volunteer. Once regular update routines have been established, they plan to share also reference files of the taxonomy of lichenized fungi via Checklistbank.

Literature Management:

Mousa Shaya helped parsing out literature records from Recent Literature of Lichens (the most comprehensive database on lichen literature) to be imported into the database of the Lichen Consortium. Unfortunately, developing a front-end citation module that permits accessing and

using these records is currently not available and developing such a module is beyond the scope of the current grant. ASU continues searching for other possible funding sources that would sponsor developing this resource

Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) and Georeferencing Manager (WIS) continued compiling resources during 2024-Q4 to share on Basecamp and all resources were posted to the project website (https://globaltcn.utk.edu).

Monthly Symbiota Support Hub meetings have now moved with the Symbiota Support Hub team to the University of Kansas. Symbiota tutorials continue to be added to the Symbiota Documentation at https://biokic.github.io/symbiota-docs/.

Checklist Workshop:
October 26-27, 2024 ASU Lichen Collections manager Dr. Bungartz taught an in-person a workshop at the XVI International Meeting of the Grupo Latinoamericano del Liquenólogos (GLAL) in Mexico City. This workshop focused on training Latin American Lichenologists to create species checklists of Latin American countries using the tools provided by the Lichen Consortium, using the recently published Ecuador Checklist as an example. A detailed workflow both in English and Spanish is available from the Help & Resources Site of the Consortium; shared also with the GLOBAL community.

Round Table:
At the GLAL XVI in Mexico City ASU organized a Round Table to discuss how participation of Latin American institutions in the Lichen Consortium can be improved. They are now planning to organize regular online workshops in Spanish similar to the monthly meetings offered by the Symbiota Support Hub.

DUKE trained one undergraduate work-study student in herbarium curation techniques and specimen digitization.

F continues to train volunteers, students, and interns.

UC hired a recent graduate to help supervise projects in their Digitizing Lab space. She is helping to provide training in imaging and transcribing to multiple undergraduate students. They are

also providing her with professional development and research opportunities while in her position.

Share Collaborations with other TCNs, Institutions, and/or Organizations

GLAL:
ASU's collaboration with the Grupo Latinoamericano del Liquenologos (GLAL) continued (see **Opportunities to Enhance Training Efforts**).

INABIO (Ecuador):
In collaboration with the Symbiota Support Hub Team at the University of Kansas, ASU also supports Ecuador's National Biodiversity Database hosted by the Instituto Nacional de Biodiversidad (INABIO). Ecuador has recently been plagued by extensive power outages. For electricity the country relies almost exclusively on hydroelectric power and during the summer months reservoirs have not had sufficient water levels to generate enough power. The server hosting the National Biodiversity Database had to be shut down frequently and it is now planned to move the database to a Symbiota server to guarantee better and uninterrupted service.

COLO is also a member of the SoRo TCN and the All-Asia TCN. They continue to share info and technology between projects to help optimize workflows.

Share Opportunities and Strategies for Sustainability

Portal Management

As of September 2024, the Symbiota Support Hub team has moved to the University of Kansas. Until now, both the Lichen and Bryophyte Consortium continue to be hosted and supported at ASU and they are closely collaborating with the Support Hub to assure long-term sustainability and support. Discussions are underway with the GLOBAL community and the American Bryological and Lichenological Society (ABLS).

Back-Ups

At COLO, raw images and JPGs are being uploaded to the University of Colorado Research Computing. These images are in addition to the local copies housed in the CU Herbarium. The

hope is that these images will never need to be accessed, but to serve as a catastrophic backup if we have a computer or hard drive failure. Monthly backups of the COLO database in the Lichen and Bryophyte portals are made on the first working day of the month. These files are housed locally and will be archived on Research Computing in case we ever need a point in time backup of our data.

Strategic Planning

Digitization is part of the Field Museum strategic planning process and these discussions have been ongoing.

Share Education, Outreach, Diversity, & Inclusion (EODI) Activities

The GLOBAL TCN website (https://globaltcn.utk.edu) was maintained and updated with additional links to developed protocols and workflows. Social media accounts belonging to collaborators continued using #GlobalTCN as a way to share progress with the community.

In November 2024, the Biocollections at ASU experienced a major disruption, when the building hosting the collection was flooded. Fortunately, specimens were not affected, but building repairs of the floor and drywalls are currently ongoing. Thus, any outreach activities have been suspended until the facilities will again be restored (anticipated for end of February 2025).

Mexican student Eduardo Gutierrez, accepted into the master's program at ASU, will now start at ASU in the fall of 2025; unfortunately finishing his licenciatura thesis in Hermosillo, Mexico, got delayed by the bureaucracy there.

F hosted WeDigBio in October 2024 that included bryophyte curation and inventory that is associated with this project. In December they also published a paper that highlighted this TCN and several other TCNs. The direct URL is here https://nhcm.pensoft.net/article/138247/ .

> **Abstract:** A comprehensive overview of volunteer-driven public programs focused on activities to enhance natural history collections (NHCs) is provided. The initiative revolves around the WeDigBio events and the Collections Club at the Field Museum, aiming to deepen the public's connection with scientific collections, enhance participatory science, and improve data associated with natural history specimens. The implementation and journey of these programs are outlined, including surveys

conducted from 2015 through 2021 to gauge participant motivation, satisfaction, and the impact of these events on public engagement with NHCs. Results show trends in on-site and virtual volunteer participation over the years, especially during the peak period of the COVID-19 pandemic. The majority of participants expressed high satisfaction, indicating a willingness to continue participating in similar activities. The surveys revealed a shift towards more altruistic motivations for participation over time, with increased emphasis on supporting the Field Museum and contributing to the scientific community. The success of participatory science events demonstrates the potential of volunteer-driven programs to contribute meaningfully to the preservation, digitisation, and understanding of biodiversity collections, ultimately transforming spectators into stewards of natural history. From 2015 to present participants celebrate a significant milestone, with over a thousand community scientists contributing to the inventorying, collection care, curation, databasing, or transcription of 286,071 specimens, objects or records. We also discuss accuracy and quality control as well as a checklist and recommendations for similar activities.

The TENN Herbarium held “Specimens and Scones” open house events on October 2 and November 12, welcoming faculty, staff, students, and other off-campus groups to visit and tour the herbarium. The Collections Manager and TENN PI conducted tours of the herbarium for the One Health Initiative Advisory Board, a public horticulture class, and two Field Botany classes.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was utilized by 333 users during 2024-Q4, including 77 from Asia, 36 from Europe, 9 from South America, 2 from Africa, 1 from Central America, 1 from Oceania, and 1 from the Middle East (see Figure 3).

The Bryophyte and Lichen Portals, created as part of the original LBCC grant, host new images and data produced by the GLOBAL collaborators. 12,000 users visited the Bryophyte Portal, and 23,000 users visited the Lichen Portal during 2024-Q4 (see Figures 4 & 5).

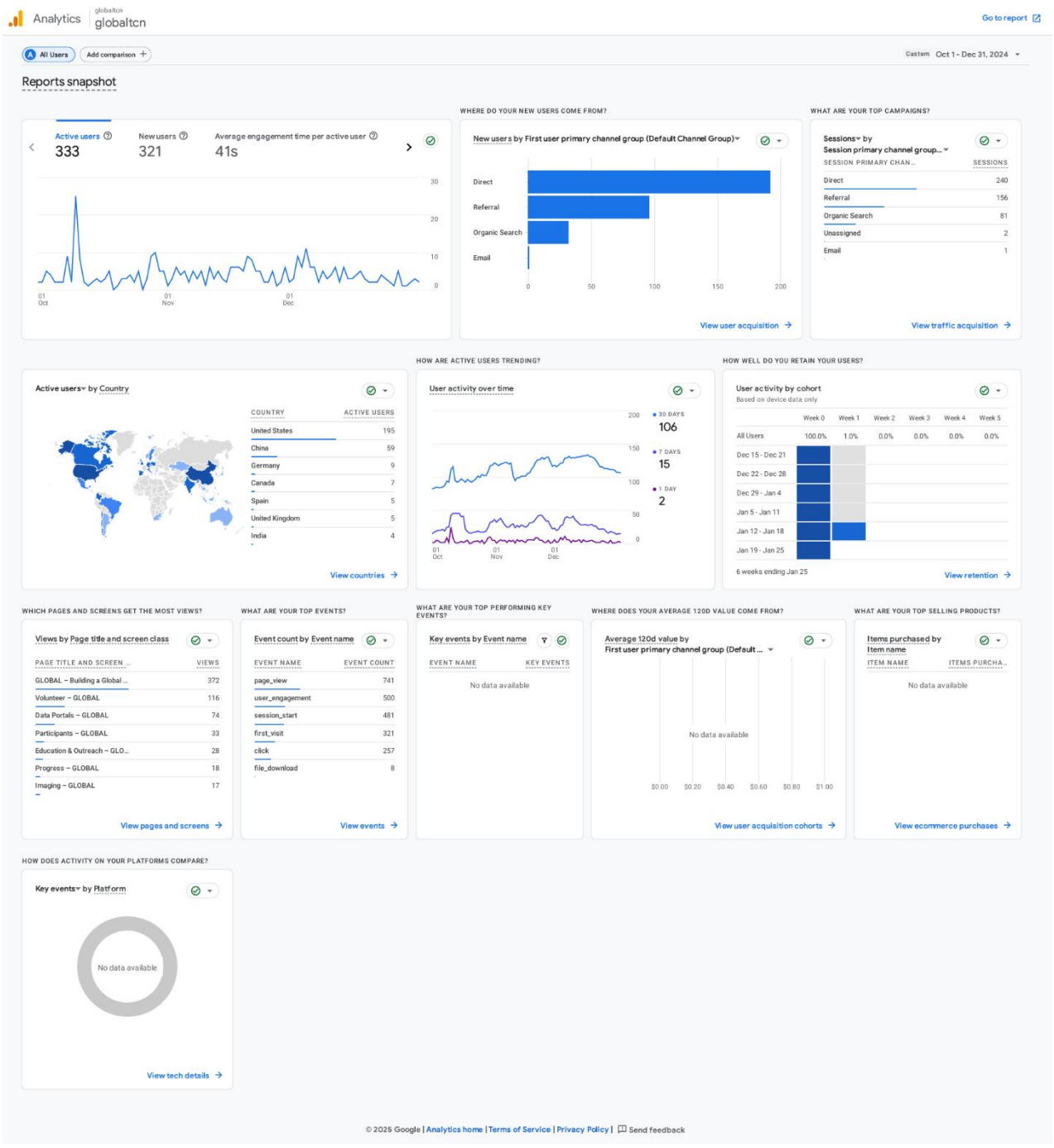

Figure 3: Use metrics for the GLOBAL project website (https://globaltcn.utk.edu) from October 1 – December 31, 2024.

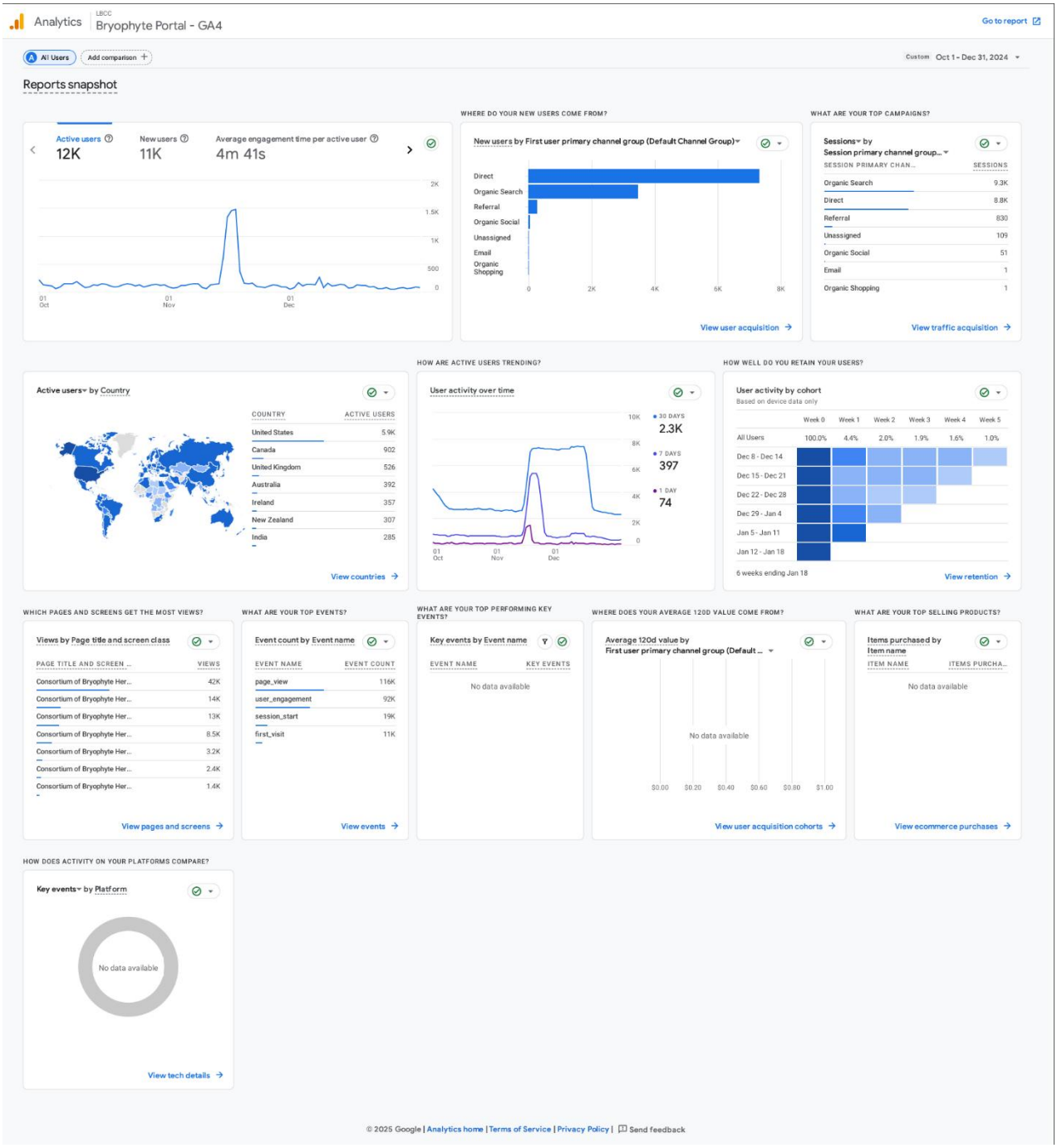

Figure 4: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from October 1 – December 31, 2024.

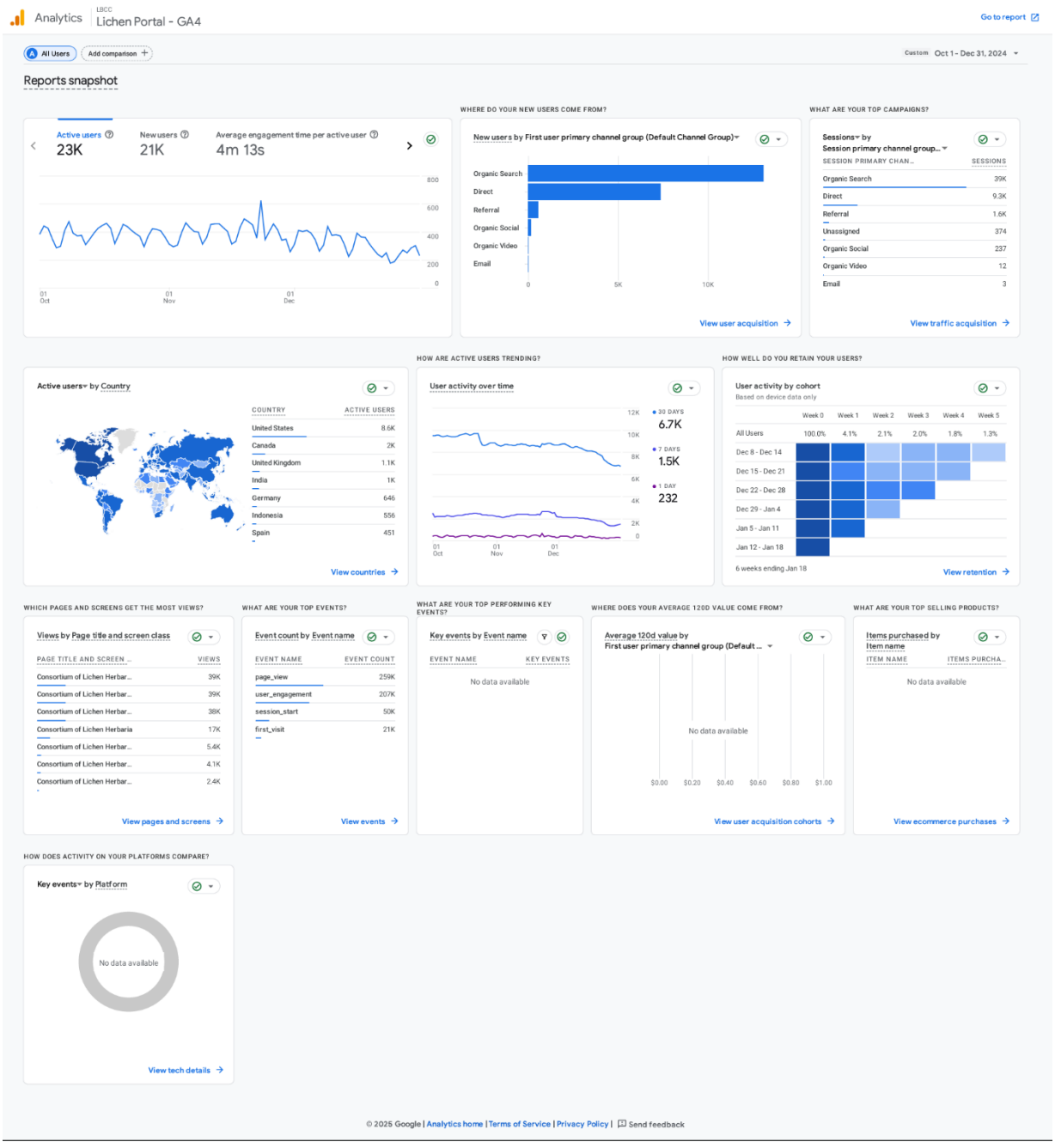

Figure 5: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from October 1 – December 31, 2024.

Share Other Activities and/or Progress

Nothing to Report