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 January 1 – March 31, 2025.

Workflows, Equipment, and Personnel

Most GLOBAL institutions continued steady GLOBAL progress during 2025-Q1.

At ASU, specimen digitization continued with images for 307 lichen specimens and their labels added (total number of labels 464, because some annotation labels are typically also imaged as part of the digitization routine). They also have now completely imaged their small collection of bryophyte specimens, an additional 264 specimens (again the total number of 358 labels imaged is larger than those of the specimens).

BISH entered data for 1,292 bryophyte specimens and barcoded and imaged 1,562 bryophyte specimens.

[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

COLO is finding it increasingly difficult to staff student positions due to salary limitations. They interviewed and offered a position to a student for the spring semester, but the student did not start working. One of their work study students graduated in December and was offered a temporary position in January. He has primarily been working on imaging remaining specimen packets and label transcription. COLO captured 542 lichen and 7,248 bryophyte packet images with skeletal records and 449 specimen images for the lichen collection. 542 lichen and 6,748 bryophyte specimens were barcoded. 913 lichen and 1,158 bryophyte transcriptions were completed. COLO is evaluating if another no cost extension will make sense. They are aiming to finish out their project work before the end of the current project year but will evaluate how much budget is left at the end of the semester to make a final decision.

DUKE barcoded 1,558 bryophyte specimens and 130 lichen specimens. They imaged 1,892 bryophyte labels and 56 lichen labels, and 284 bryophyte plants and 2 lichens. All images and skeletal data have been uploaded to the bryophyte portal. They fully transcribed 101 bryophyte specimens and 130 lichen specimens. They georeferenced 38 bryophyte records.

F imaged over 7,000 bryophyte specimens, including labels and specimens, as well as 352 lichen specimens and labels. Over 5,000 bryophyte records were partially databased and over 2,400 records fully transcribed. 352 lichen specimens were fully transcribed.

FLAS continued barcoding, imaging, and transcribing bryophytes and also barcoded a number of lichen specimens.

MO barcoded 3,404 bryophyte specimens and imaged 5,726 bryophyte labels. They created 5,726 skeletal records and fully transcribed 508 labels. They also georeferenced 128 specimens.

OSC barcoded and imaged 651 lichen labels and specimens.

At PTBG, digitization is complete for their previously catalogued specimens. They continue to digitize any new specimens that have been added to their collection.

At TENN, five new herbarium technicians were trained during the Winter Mini-Term in January. Work continued on transcribing and georeferencing specimens.

UC completed lichen transcription and has moved onto bryophyte transcription.

At WIS, georeferencing began on the Hawaiian collections this quarter: BISH 5,029 bryophytes and 436 lichens; PTBG 194 bryophytes. They are transferring image files to partner institutions on the WIS grant for their long term storage (WTU, BRU). They continue to send finished csv files to snapshot institutions (MIN, MO).

YU continued transcribing label data. Undergraduate students and volunteers generated 452 fully transcribed records.

Digitization

Eleven GLOBAL institutions (ASU, COLO, DUKE, F, FLAS, MO, OSC, TENN, UC, WIS, and YU) reported progress on digitization deliverables, with a total of 14,633 specimens barcoded (12,098 bryophytes and 2,535 lichens), 28,652 labels imaged (26,351 bryophytes and 2,311 lichens), 14,634 specimens imaged (11,622 bryophytes and 3,012 lichens), 17,542 specimen records uploaded to the portal (13,622 bryophytes and 3,920 lichens), 20,337 skeletal records created (19,549 bryophytes and 788 lichens), 14,067 labels fully transcribed (11,626 bryophytes and 2,441 lichens), and 4,911 specimens georeferenced (3,649 bryophytes and 1,262 lichens) (See Table 1 & Figure 1).

PEN partners BISH and PTBG reported a total of 1,682 specimens barcoded (1,659 bryophytes and 23 lichens), 1,720 labels imaged (1,699 bryophytes and 21 lichens), 1,720 specimens imaged (1,699 bryophytes and 21 lichens), 2,244 specimen records uploaded to the portal (814 bryophytes and 1,431 lichens), 1,292 skeletal records created (all bryophytes), and 1,412 labels fully transcribed (97 bryophytes and 1,315 lichens).

Table 1: Digitization progress by GLOBAL collaborators in 2025-Q1, 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	358	464	358	464	264	464	358	464			264	464		
BRY														
CINC & MU														
COLO	6,748	542	7,248	542		449	7,248	542	7,248	542	913	1,158		
DUKE	1,558	130	1,892	56	284	2	2,176	189	1,558		101	130	38	
F		352	7,277	352	7,234	352			5,017		2,411	352		352
FLAS	30	150	3,840		3,840		3,840				2,012			
ILL & ILLS														
LSU														
MICH														
MIN														
MO	3,404		5,726						5,726		508		128	
MSC														
NY														
OSC		651		651		651								
PH														
TENN											165	1	621	11
UC											4,800			
WIS		246		246		1,094		2,725		246		336	2,862	899
YU											452			
Totals	**12,098**	**2,535**	**26,341**	**2,311**	**11,622**	**3,012**	**13,622**	**3,920**	**19,549**	**788**	**11,626**	**2,441**	**3,649**	**1,262**
B+L Totals		**14,633**		**28,652**		**14,634**		**17,542**		**20,337**		**14,067**		**4,911**

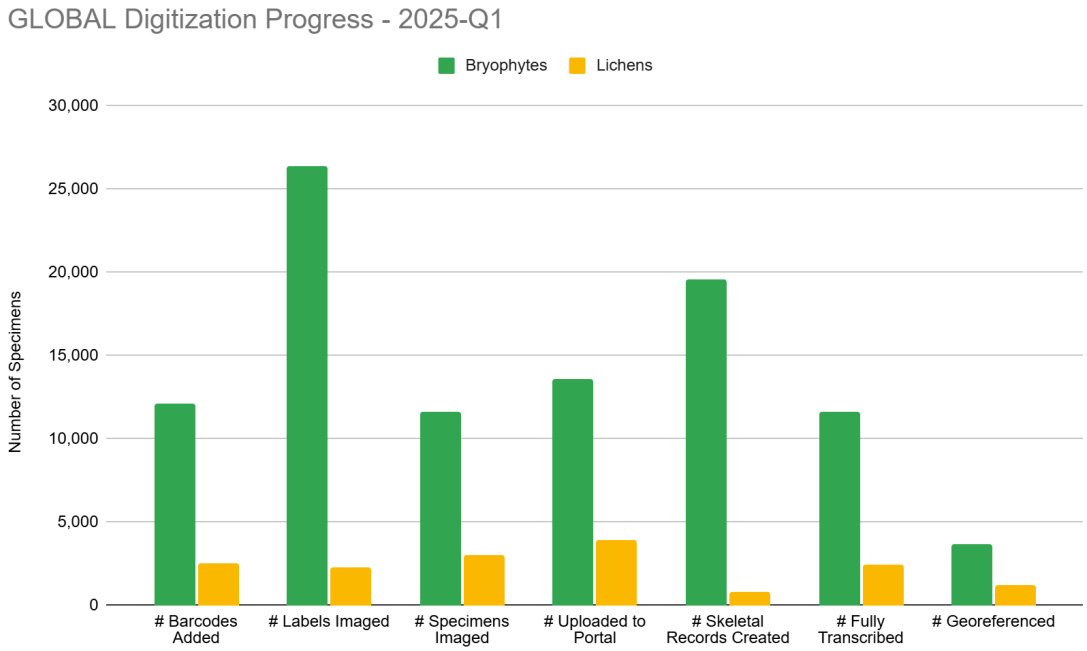

Figure 1: Digitization progress for the GLOBAL collaboration in 2025-Q1, separated by Bryophyte and Lichen specimens.

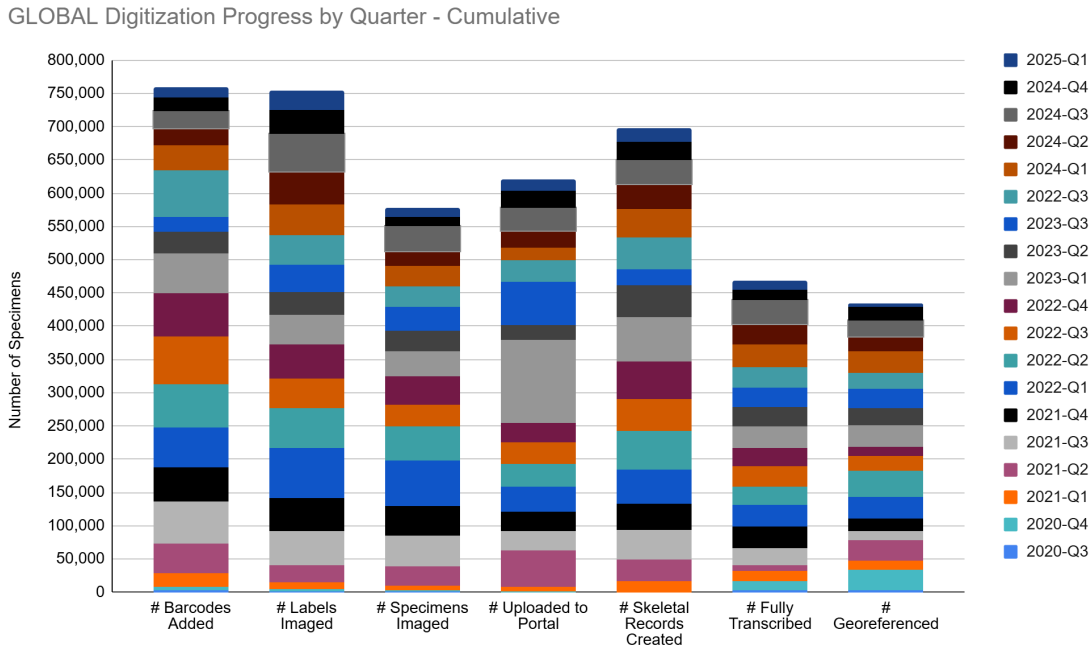

Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.

Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

The GLOBAL teams continued to make use of flexible digitization workflows in 2025-Q1, including a mixture of virtual and on-site work.

At COLO, they started capturing raw images to create a stacked image for their cryptogams. The process involves capturing 8 images of each specimen and will use depth composting tools to combine these series into a single image. This should allow for a better quality specimen image with all of the specimen in focus. They are still working on a process to automate the process to minimize the human time needed to process the bracket stacking.

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 and lichens from Polynesia, Micronesia, Melanesia. They are also transcribing specimens from Sweden and Norway for their Bryophytes 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.

At UC, students who are transcribing are able to flag any blurry or missing images, which they will work over the summer to update.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2025-Q1. New collaborators and students were given access to Basecamp group resources. A Management Committee Meeting was held in February open to all GLOBAL members to review progress from 2024-Q4, and to provide an open forum to the GLOBAL team.

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

While the monthly Symbiota Support Hub meetings are now organized by the team from the University of Kansas continue; the Help & Resources pages of the Lichen Consortium continue to be updated by ASU. Since March 2025, the Lichen Flora of the Greater Sonoran Desert Region is now available for purchase as well as free digital download from the site. New versions of the programs BCRWatcher & LichenLabler were also made available in March. Both programs now use the Symbiota API (developed with GLOBAL project funds) for updating directly accessing data from the Consortium database online.

Version 3.2

Symbiota Version 3.1 was launched in March 2024 and in April applied to the Lichen and Bryophyte Consortium. The new version adds few additional features, adding for example a new option to parse taxonomic records directly to add them to the thesaurus, changing the way other catalog numbers are packaged and uploaded to GBIF, improving the map module, etc.

Compared to the previous 3.1. update installation of this new version was relatively smooth, with few bugs (updating the map module required users to clear their browser cache).

For both Symbiota portals, the Lichen and Bryophyte Consortium a French language locale has now been added with the launch of version 3.2.

A list of minor bug fixes and recommended incremental improvements to the Symbiota software has been shared with Jenn Jost and the Symbiota Support Hub team and is currently in review.

Taxonomic Thesaurus

John Brinda (Bryophyte Consortium), Scott Bates (Mycoportal), Mousa Shaya, and Frank Bungartz (Lichen Consortium) finalized formatting requirements for adding unique identifiers to the taxa table, with the option to tag taxon names according to whether these names are legitimate, invalid, orthographic errors, etc. Update scripts are now being written to add the identifiers in CURIE format to the new field ‘sourceIdentifier’ in

the taxa table of the MySQL backend databases of both Symbiota portals. As an example, in the Lichen Consortium the identifier 'mycobank:380715' will then uniquely identify the taxon '*Buellia spuria* (Schaer.) Anzi'. In the Bryophyte Consortium 'tropicos:35116382' uniquely identifies 'Bryum argenteum Hedw.' Adding these source identifiers will be used in cleaning up the taxonomic thesaurus, removing erroneous taxon names and facilitating updating the thesaurus from name repositories in the future, thus standardizing taxon names across Symbiota portals. The hope is that the update and adding the identifiers will be completed by the next quarterly reporting deadline.

Literature Management

ASU and team are currently assessing how records parsed from Recent Literature of Lichens can be loaded into the literature tables in the MySQL backend of the Lichen Consortium database. Volunteer programmer Mousa Shaya is reviewing a local copy of the database, which fields are available, working on a script to load the data into the live database.

Data Exchange between Platforms

With version 3.1 a new map module has been launched that makes use of the Symbiota API (developed with GLOBAL project funds) to facilitate cross-portal searches. This new functionality allows users to search for occurrence records in both the Lichen and the Bryophyte Consortium, thus generating distribution maps based on occurrence records from both portals.

Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) and Georeferencing Manager (WIS) continued compiling resources during 2025-Q1 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/.

For the annual ABLS meeting at BOTANY 2025 in July, ASU PI Frank Bungartz is organizing a workshop on Building advanced Checklists in the Consortium of Lichen Herbaria.

DUKE staff continued training one undergraduate work-study student in herbarium curation techniques and specimen digitization and started training one new volunteer.

At TENN, five new herbarium technicians were trained on herbarium practices including specimen digitization.

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

ASU's collaboration with the Grupo Latinoamericano del Liquenologos (GLAL) continues. ASU recently applied for funding from the Mitsubishi Corporation Foundation for a project on capacity building by "Establishing Biodiversity Inventories for Lichenized Fungi throughout Latin America", using the Lichen Consortium as its database management platform - a collaboration with key institutions in Argentina, Brazil, Ecuador Mexico, and Peru. No progress has been made moving Ecuador's National Biodiversity Database to a Symbiota server, but the new API now facilitates exchanging data across different platforms.

COLO is also a member of the SoRo TCN and the All-Asia TCN. They will 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. With the University of Kansas and the Bryological and Lichenological Society (ABLS), the team continues to work on a sustainable strategy, where the portals are best hosted, discussing maintenance and programming priorities.

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 their data.

Long-Term Planning

F is increasing crowdsourcing and volunteer efforts to support project activities.

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 February 2025 at ASU, Mexican student Eduardo Gutierrez, with thesis director Frank Bungartz, graduated with a licenciatura at the Universidad de Sonora in Hermosillo, Mexico. Eduardo will be presenting his research at Botany 2025 in July. In August he will start his master's program at Arizona State University.

DUKE provided a herbarium tour to a group of DUKE undergraduate naturalists, and a Duke Divinity School lecturer. At the Blomquist Foray 2025 in South Carolina, DUKE staff assisted regional amateur bryologists with field and lab identification of bryophytes.

F's ongoing outreach activities including tours highlighting the digitization efforts and the Quarterly Collections Club held in January, 2025.

Tours of the TENN herbarium were conducted for a Science Communication group, students from Architectural Design, a visiting botanist, and the McClung Museum internship program. A Specimens and Scones open house was hosted in March.

UC provided tours to multiple research groups on campus, including a tour of their digitizing lab.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was utilized by 309 users during 2025-Q1, including 93 from Asia, 44 from Europe, 15 from South America, and 2 from Oceania, and 1 from Central America (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. 14,000 users visited the Bryophyte Portal, and 20,000 users visited the Lichen Portal during 2024-Q4 (see Figures 4 & 5).

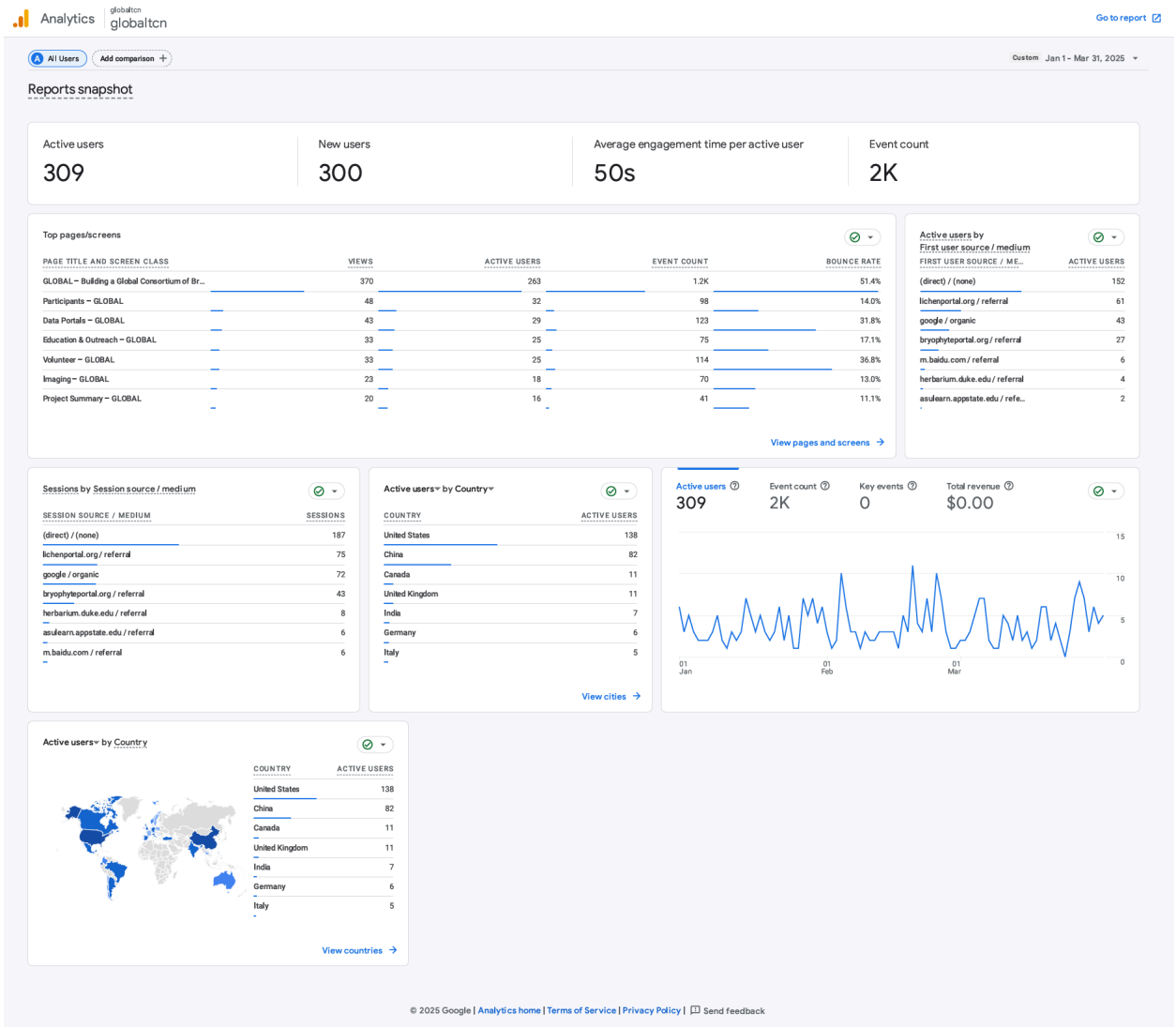

Figure 3: Use metrics for the GLOBAL project website (https://globaltcn.utk.edu) from January 1 – March 31, 2025.

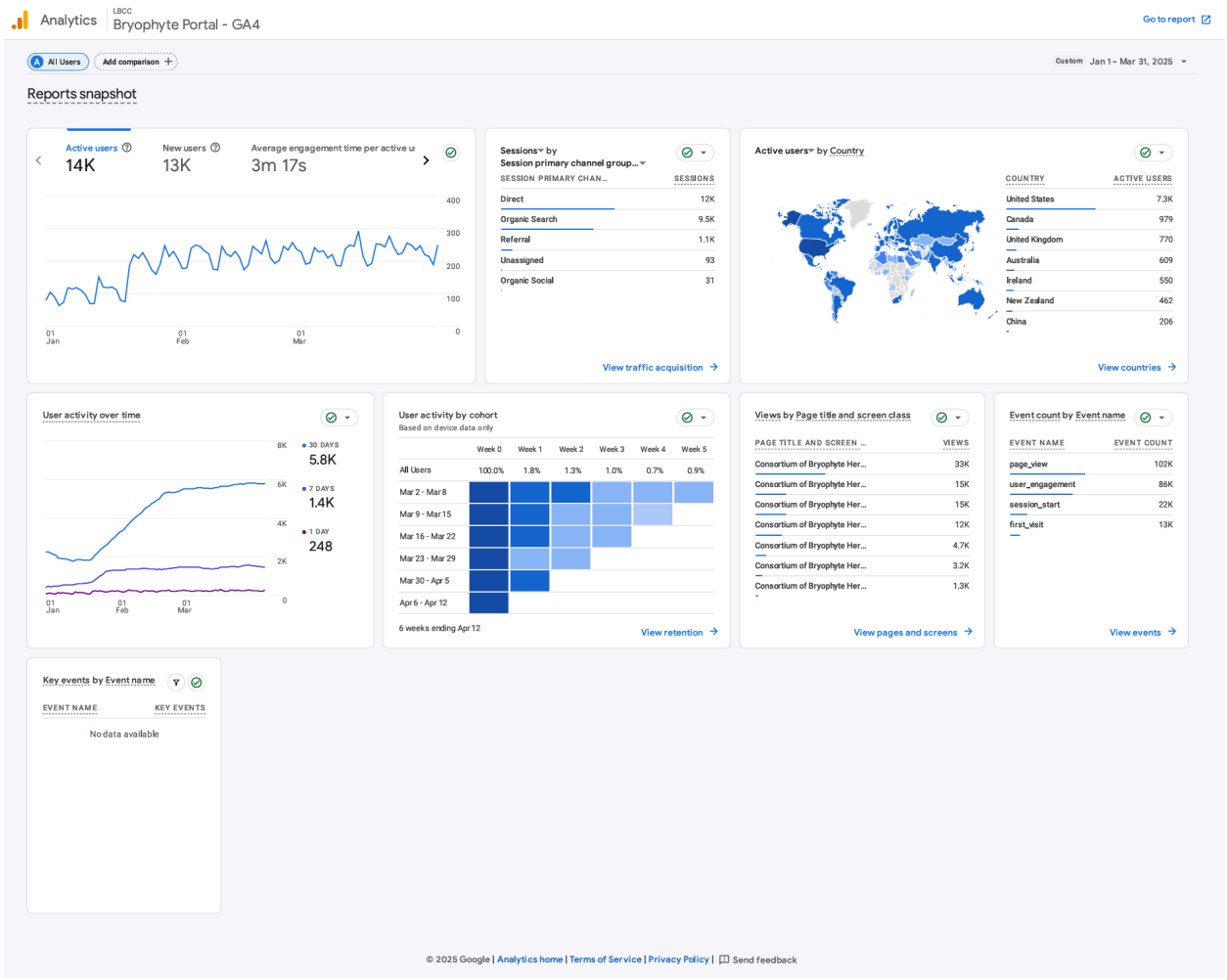

Figure 4: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from October 1 – December 31, 2024.

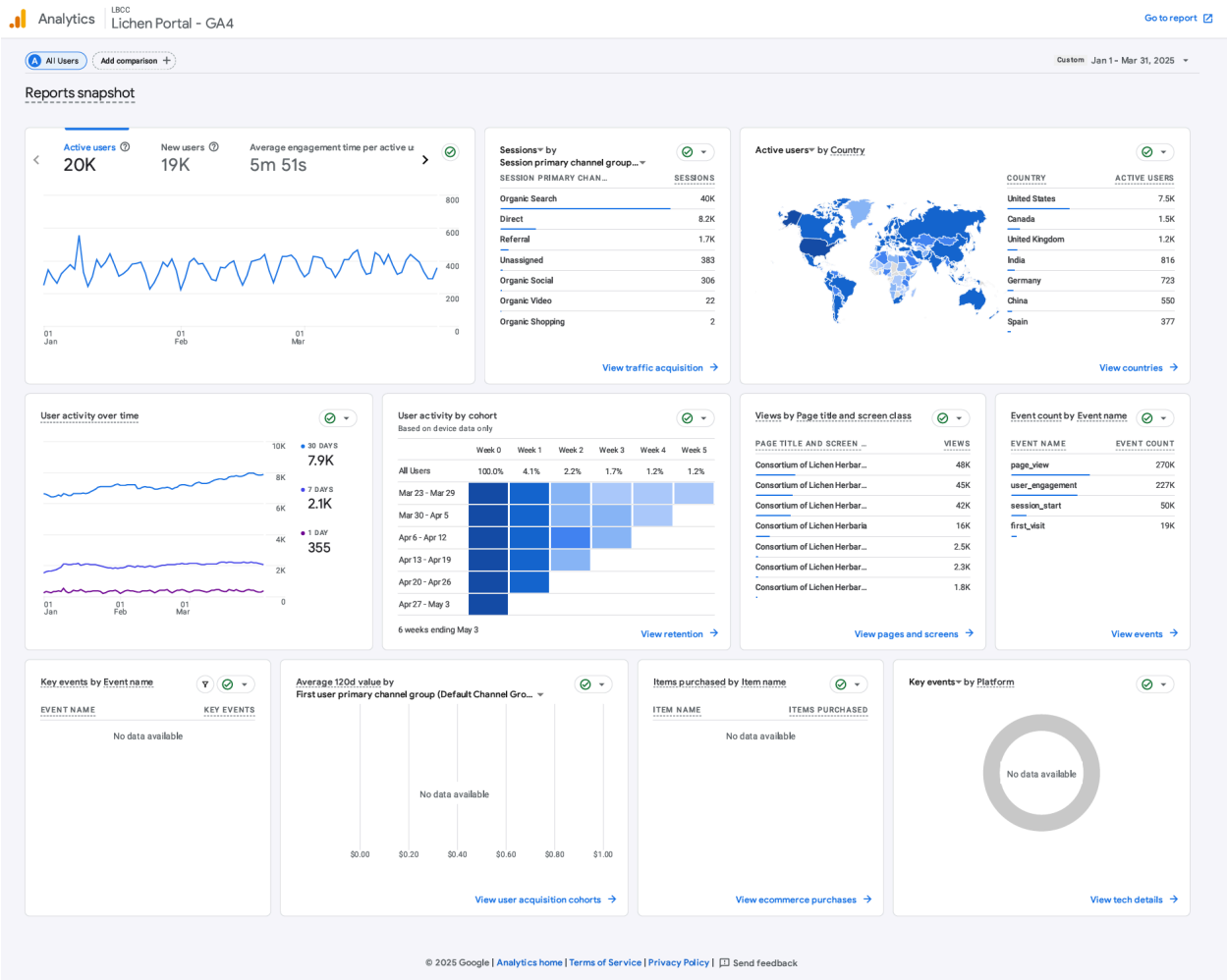

Figure 5: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from January 1 – March 31, 2025.

Share Other Activities and/or Progress

At ASU, an additional 8,000+ images from Felix Schumm were uploaded to the Lichen Consortium and linked to specimen records in the Private Herbarium of Felix Schumm (hb. Schumm).

The Lichen Glossary continues to be updated, with new illustrations added. All terms have been exported to build a Controlled Vocabulary for image tagging, which we eventually hope to share through the Consortium Help & Resources site. Routine workflow and best practices for collecting, curating, databasing and studying lichen specimens will also be made available there as part of ASU's capacity building initiative in collaboration with our Latin American partners.

DUKE is preparing stacked field macroimages of bryophytes for upload to the Bryophyte portal to improve illustrations on species profile pages. They are also manually updating Bryophyte Portal thesaurus - adding newly published taxa and editing synonymies as requested.

F had a paper accepted entitled: Unlocking the Past: The Potential of Large Language Models to Revolutionize Transcription of Natural History Collections, in the journal Data Intelligence.

PTBG has been working to collect and image specimens for their field guide to common mosses of the Hawaiian Islands.