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, 2026.

Workflows, Equipment, and Personnel

Most GLOBAL institutions completed their project work by Year 5, but a few continued GLOBAL progress during this quarter.

At BISH, 366 lichens had complete data records created, 366 were barcoded, and 366 were imaged. 3,054 mosses had complete data records created, 3,054 were barcoded, and 3,054 were imaged.

CINC & MU continued barcoding, imaging, and transcription of bryophyte specimens.

COLO captured 456 lichen packet images with skeletal records and 567 specimen images for the lichen collection. 456 specimens were barcoded. Images and all skeletal data captured through 3/31/2026 have been uploaded to the portal. 2,021 transcriptions were completed. COLO captured 1,240 bryophyte packet images with skeletal records and 2,588 specimen images for

[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

the bryophyte collection. 240 specimens were barcoded. Images and all skeletal data captured through 3/31/2026 have been uploaded to the portal. 1,730 transcriptions were completed.

In 2026-Q1, DUKE barcoded 1,735 bryophyte specimens and 25 lichen specimens. They imaged 902 bryophyte labels and 36 bryophyte plants, along with 25 lichen labels. 938 bryophyte and 25 lichen records were uploaded to the portals. Skeletal records for 1,735 bryophytes and 25 lichens were created. They fully transcribed 302 bryophyte specimens.

TENN has completed most digitization efforts but continues to coordinate the GLOBAL project work. Project Manager completed quarterly reporting in February for 2025-Q4.

At UC, their work-study students continue to transcribe label data, focusing on bryophytes. Their museum assistant, Acacia Danza, helped to image and digitize specimens that were missed on the first round of digitizing.

Digitization

Four GLOBAL institutions (CINC & MU, COLO, DUKE, and UC) reported progress on digitization deliverables, with a total of 2,860 specimens barcoded (2,313 bryophytes and 547 lichens), 4,417 labels imaged (3,870 bryophytes and 547 lichens), 4,985 specimens imaged (4,352 bryophytes and 633 lichens), 4,453 specimen records uploaded to the portal (3,906 bryophytes and 547 lichens), 8,450 skeletal records created (7,903 bryophytes and 547 lichens), 11,837 labels fully transcribed (9,745 bryophytes and 2,092 lichens), and 1,238 specimens georeferenced (all bryophytes) (See Table 1 & Figure 1).

PEN partner BISH reported a total of 3,420 specimens barcoded (3,054 bryophytes and 366 lichens), 3,420 labels imaged (3,054 bryophytes and 366 lichens), 3,420 specimens imaged (3,054 bryophytes and 366 lichens), and 3420 labels fully transcribed (3,054 bryophytes and 366 lichens).

Table 1: Digitization progress by GLOBAL collaborators in 2026-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														
BRY														
CINC & MU	338	66	1,728	66	1,728	66	1,728	66	1,728	66	1,913	71	1,238	
COLO	240	456	1,240	456	2,588	567	1,240	456	1,240	456	1,730	2,021		
DUKE	1,735	25	902	25	36		938	25	1,735	25	302			
F														
FLAS														
ILL & ILLS														
LSU														
MICH														
MIN														
MO														
MSC														
NY														
OSC														
PH														
TENN														
UC									3,200		5,200			
WIS														
YU														
Totals	2,313	547	3,870	547	4,352	633	3,906	547	7,903	547	9,745	2,092	1,238	0
B+L Totals		2,860		4,417		4,985		4,453		8,450		11,837		1,238

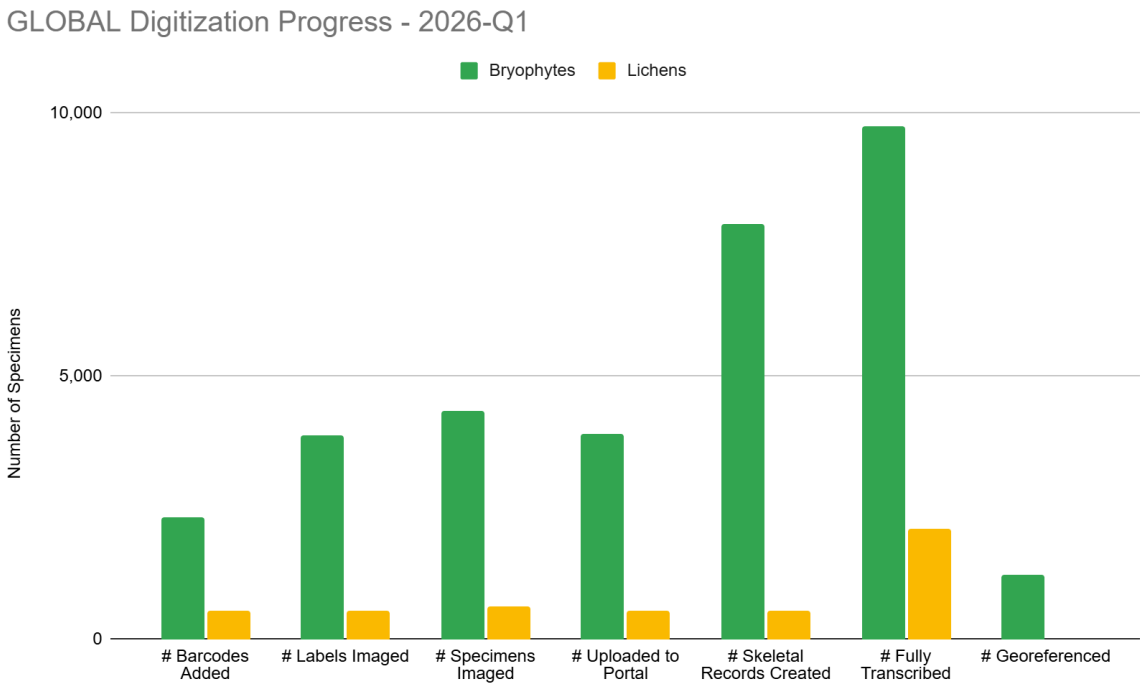

Figure 1: Digitization progress for the GLOBAL collaboration in 2026-Q1, separated by Bryophyte and Lichen specimens.

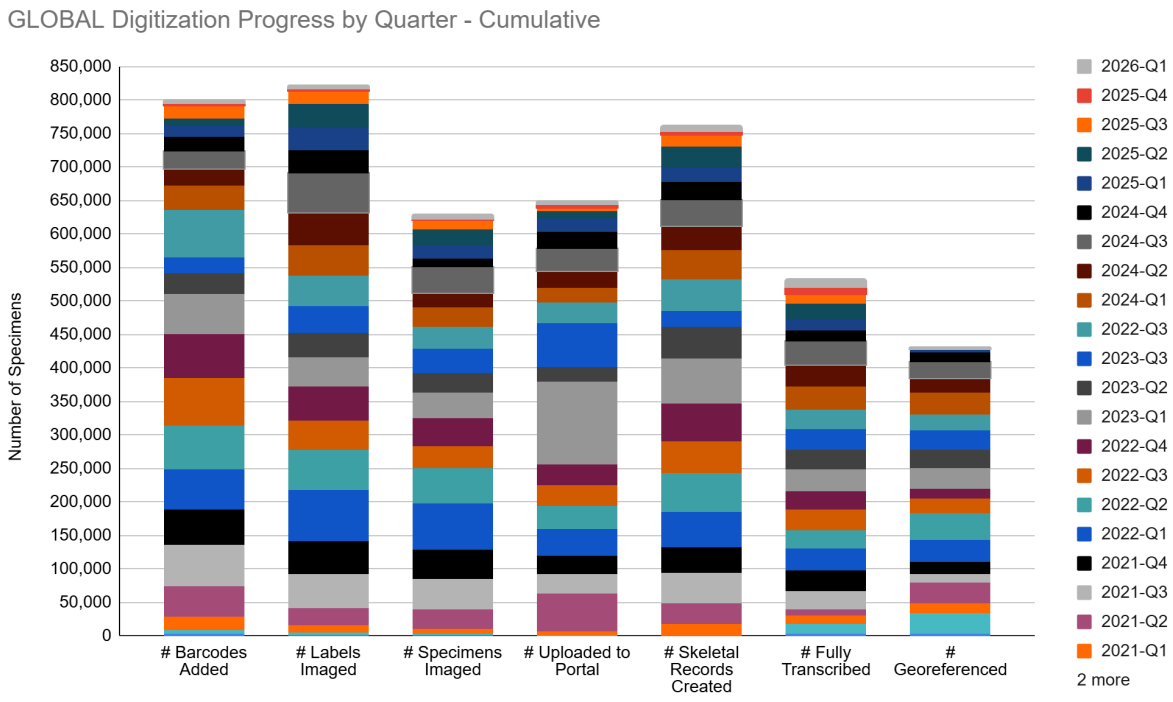

Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.

Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

At COLO, based on preliminary work, the quality of specimen images is hampered by using a fixed imaging system to capture both packet/label data and specimens. They started capturing raw images to create a stacked image for their cryptogams. The workflow in place involves capturing 8 images of each specimen. In a second step they will use depth compositing 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, but also takes more time than it takes to capture an image (4-5 minutes for 8 images to create the composite image), so it does not pair well within the imaging process. They are continuing to focus on getting as many image stacks as possible. They are still working on a process to automate the process to minimize the human time needed to process the bracket stacks into a single image.

Since no transcription work was completed on their non-North American specimens before the project started 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, Africa and Asia to our focus regions. They are also transcribing specimens from Sweden, Norway and Asia for their Bryophytes as they are added to the database and expect to work on Oceana next quarter.

They are also continuing to target transcription work on specimens from countries that have the fewest specimens with a goal of getting to 100% transcription for as many countries as possible. They continue to work with the team at University of Michigan in the hope that VoucherVision will be integrated into future transcription work and specifically advocating for a plugin that will work with Symbiota. Their first wave of VoucherVision processed specimens were added to our database at the end of March. Currently they need to export image links and do a bit of data combination to get data into a state that works with VoucherVision. 1,361 VoucherVision results were added to their database at the end of the quarter.

Given the geographic overlap of this project and the All-Asia project they are finding a few collectors like V. Vašák and A. Vézda that collected vascular plants, lichens and bryophytes across the former Soviet Union where some of these localities are shared across the COLO taxa. They have specifically been targeting Asian specimens in the lichen and bryophyte portals so they can be imported into the botanydb.colorado.edu database so they can be used for duplicate matching in their vascular plant database in our custom Symbiota portal.

Their current plan is to keep working on manual transcription for all lichen specimens and bryophytes from Asia and Oceana. They will add transcriptions from Africa and Central/South America using VoucherVision. The VoucherVision records still need to be proofread so they

want to add them in small batches.

At UC, their students helped to identify images that were blurry or missing from the first round of digitization. Acacia has gone back and re-imaged these.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2026-Q1. New collaborators and students were given access to Basecamp group resources. The Quarterly Report and Management Committee Meeting summary slides were shared with the team in lieu of a virtual meeting, due to the small number of collaborators with ongoing work.

Share Identified Gaps in Digitization Areas and Technology

Nothing to report

Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) continued compiling resources during 2026-Q1 to share on Basecamp and all resources were posted to the project website (https://globaltcn.utk.edu).

Collaborations with other TCNs, Institutions, and/or Organizations

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

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 they 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 they ever need a point in time backup of their data.

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.

The TENN herbarium participated in the campus's Darwin Day on February 8. A Specimens and Scones open house was hosted on February 26. The herbarium provided tours for TNPS, MSAB, and the McClung Museum Internship program in February and March. Collections Manager Garrett Billings provided a virtual tour on Coffee with a Curator, February 27 for the Society of Herbarium Curators - Southeastern USA Chapter. The Herbarium also continued their traditional Herb Madness social media campaign in March.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was utilized by over 1,100 users during 2026-Q1, including 736 from Asia, 58 from Europe, 11 from South America, 7 from Africa, 4 from Oceania, 3 from the Middle East, and 2 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. 174,000 users visited the Bryophyte Portal, and 165,000 users visited the Lichen Portal during 2026-Q1 (see figures 4 & 5).

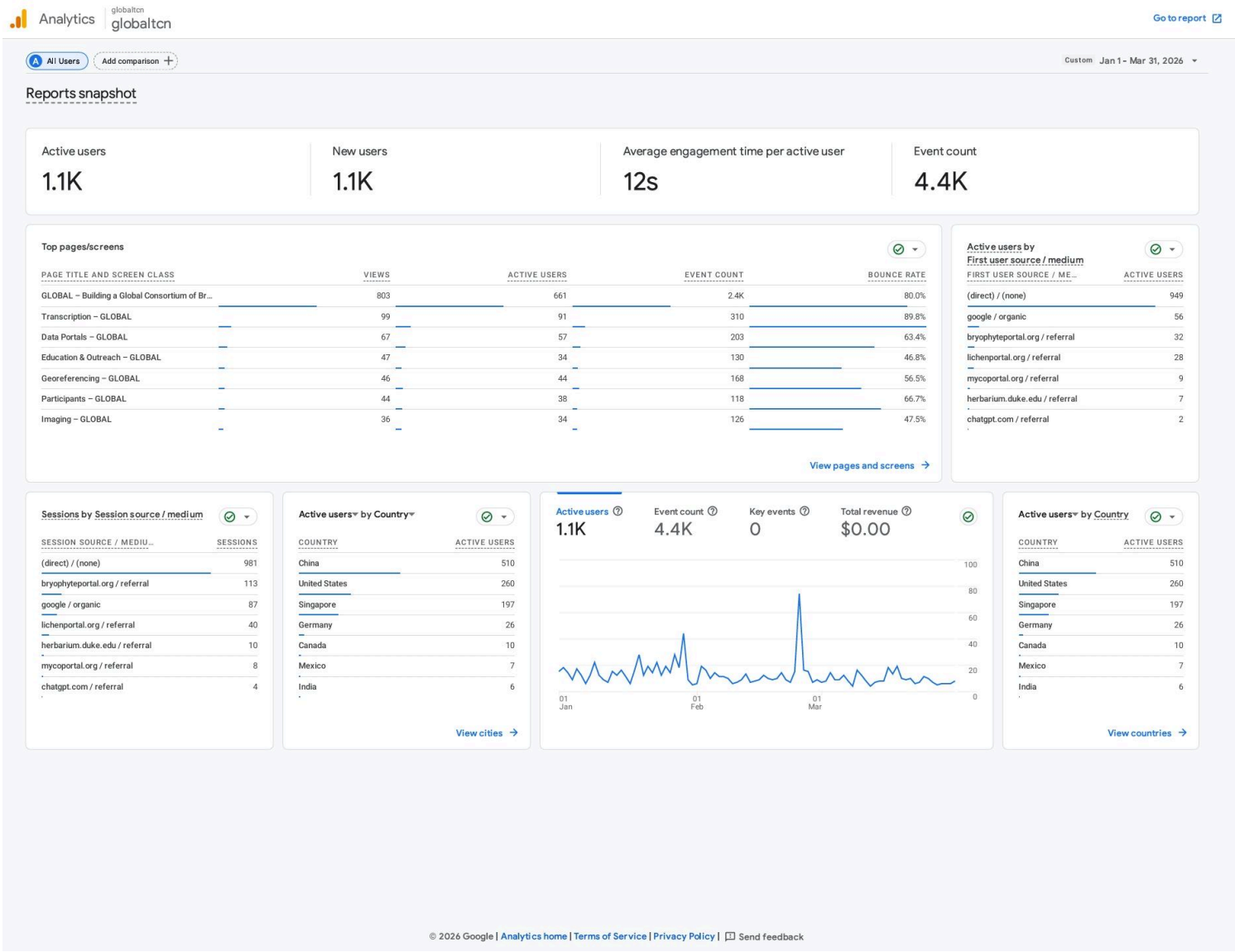

Figure 3: Use metrics for the GLOBAL project website (https://globaltc.utk.edu) from January 1 – March 31, 2026.

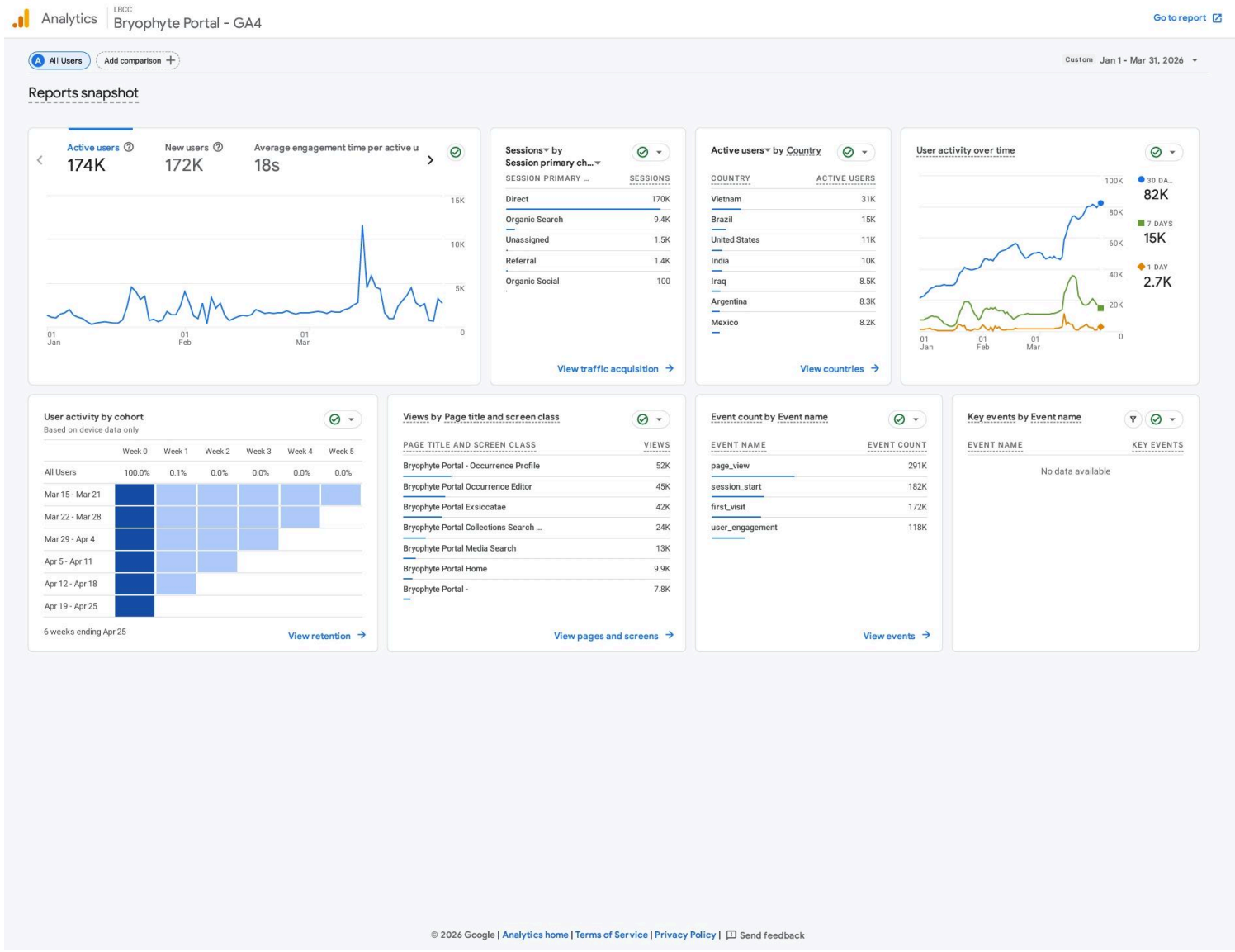

Figure 4: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from January 1 – March 31, 2026.

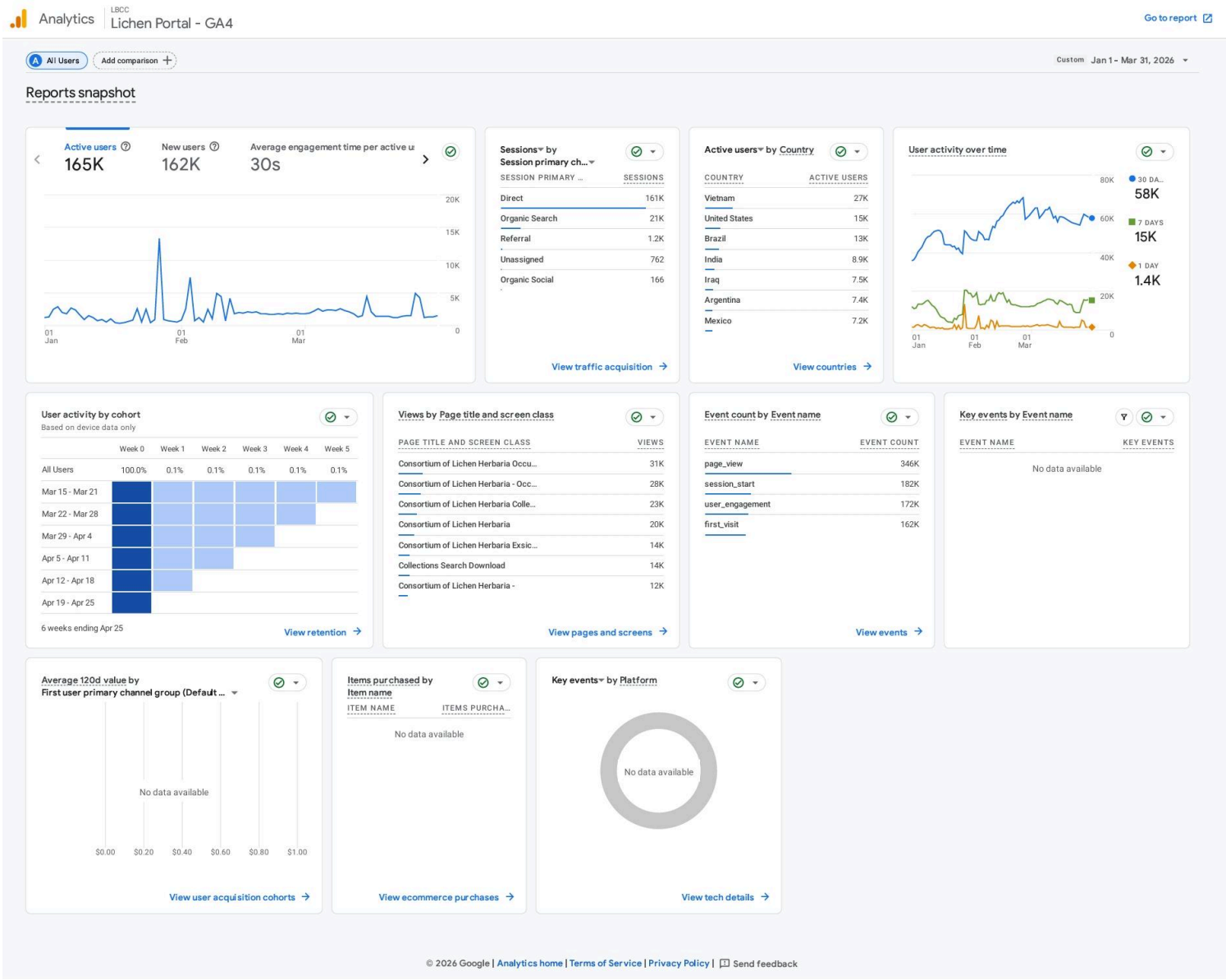

Figure 5: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from January 1 – March 31, 2026.

Share Other Activities and/or Progress

Dr. Cliff Smith, Professor emeritus at the University of Hawaii to transfer his significant Lichen collection to the Bishop Museum from his personal collection stored at the University of Hawaii campus. Dr. Smith continues to identify both BISH collections and his personal collections slowly being accessioned into BISH.

COLO submitted a no-cost extension in July 2025 and we were approved for one more project year. Based on our remaining budget we anticipate that we will run out of money around the end of June or early July 2026. We are expecting to finish imaging Bryophyte packets during the upcoming quarter and will use the remaining time to focus on transcription work and specimen images.

UC expects to reach their transcribing goals for this grant by the deadline.