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, 2025.

Workflows, Equipment, and Personnel

Most GLOBAL institutions completed their project work before or during 2025-Q4, but a few continued GLOBAL progress during this quarter.

At BISH, 298 lichens had complete data records created, 298 were barcoded, and 298 were imaged. 3,683 mosses had complete data records created, 3,683 were barcoded, and 3,683 were imaged.

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

COLO captured 350 lichen packet images and skeletal records, 1,966 specimen images for the lichen collection. 350 specimens were barcoded. Images and all skeletal data captured through 12/31/2025 have been uploaded to the portal. 1,959 transcriptions were completed. COLO

[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

captured 246 bryophyte packet images and skeletal records, 81 specimen images for the

bryophyte collection. 746 specimens were barcoded. Images and all skeletal data captured through 12/31/2025 have been uploaded to the portal. 457 transcriptions were completed.

In 2025 Q4, DUKE barcoded 1,568 bryophyte specimens. They imaged 1,768 bryophyte labels and 72 bryophyte plants. All images and skeletal data have been uploaded to the bryophyte portal. They fully transcribed 124 and georeferenced 22 bryophyte specimens.

TENN has completed digitization efforts but continues to coordinate the GLOBAL project work. Project Manager completed quarterly reporting in November for 2025-Q3.

At UC, a team of work-study undergraduate students continues to transcribe label data, now focusing on bryophytes.

Digitization

Four GLOBAL institutions (CINC & MU, COLO, DUKE, and UC) reported progress on digitization deliverables, with a total of 4,548 specimens barcoded (4,198 bryophytes and 350 lichens), 3,244 labels imaged (2,894 bryophytes and 350 lichens), 2,999 specimens imaged (1,033 bryophytes and 1,966 lichens), 4,320 specimen records uploaded to the portal (3,970 bryophytes and 350 lichens), 4,050 skeletal records created (3,700 bryophytes and 350 lichens), 10,276 labels fully transcribed (5,850 bryophytes and 1,959 lichens), and 22 specimens georeferenced (all bryophytes) (See Table 1 & Figure 1).

PEN partner BISH reported a total of 3,981 specimens barcoded (3,683 bryophytes and 298 lichens), 3,981 labels imaged (3,683 bryophytes and 298 lichens), 3,981 specimens imaged (3,683 bryophytes and 298 lichens), and 3,981 labels fully transcribed (3,683 bryophytes and 298 lichens).

Table 1: Digitization progress by GLOBAL collaborators in 2025-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														
BRY														
CINC & MU	1,884		880		880		1,884		1,886		1,886			
COLO	746	350	246	350	81	1,966	246	350	246	350	457	1,959		
DUKE	1,568		1,768		72		1,840		1,568		124		22	
F														
FLAS														
ILL & ILLS														
LSU														
MICH														
MIN														
MO														
MSC														
NY														
OSC														
PH														
TENN														
UC											5,850			
WIS														
YU											219			
Totals	**4,198**	**350**	**2,894**	**350**	**1,033**	**1,966**	**3,970**	**350**	**3,700**	**350**	**8,317**	**1,959**	**22**	**0**
B+L Totals		**4,548**		**3,244**		**2,999**		**4,320**		**4,050**		**10,276**		**22**

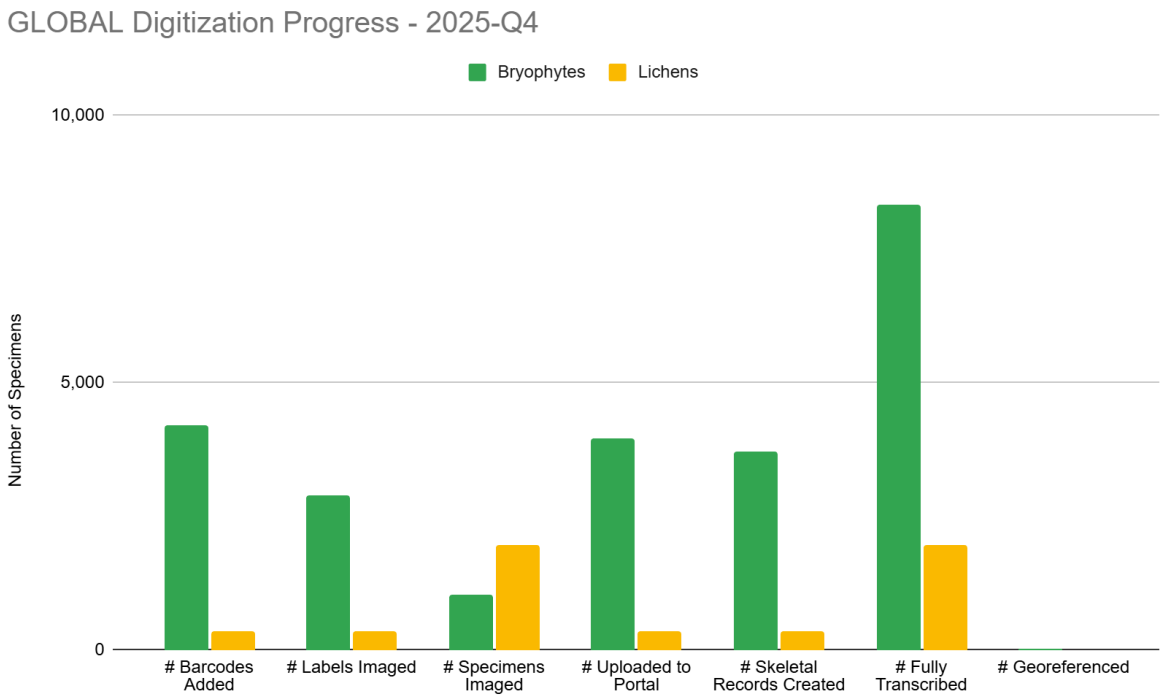

Figure 1: Digitization progress for the GLOBAL collaboration in 2025-Q4, separated by Bryophyte and Lichen specimens.

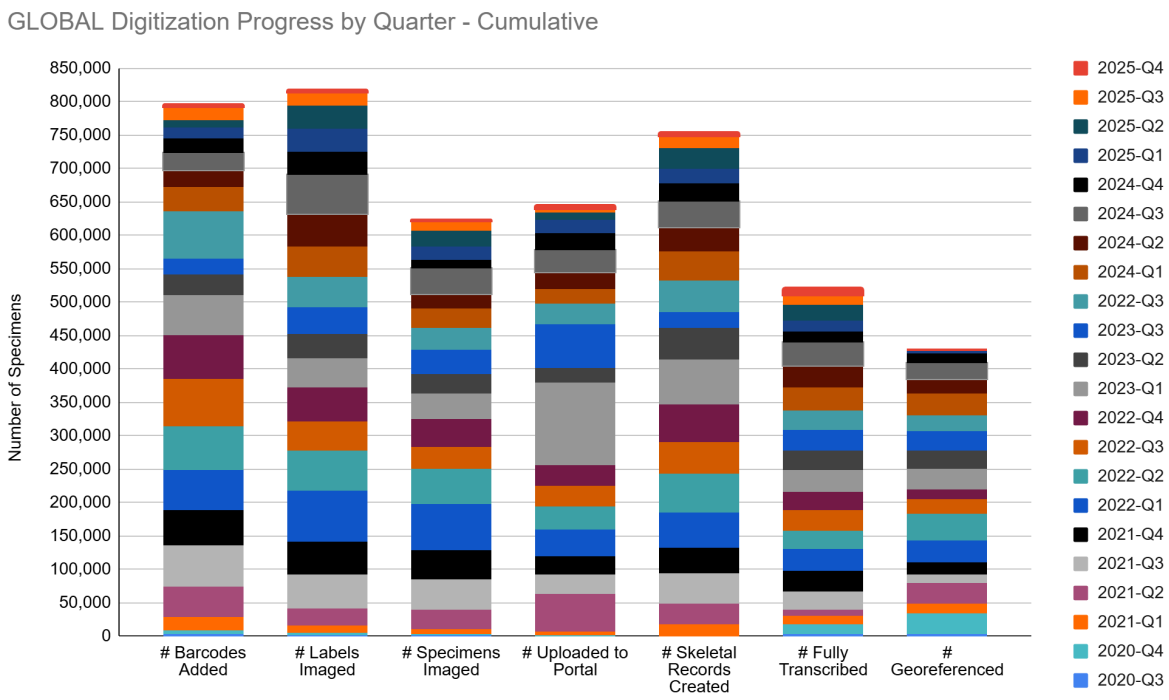

Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.

Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

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.

COLO continued to find it increasingly difficult to staff student positions close to the pay rate proposed in the project. As of July 2025 the campus minimum is now $16.82, which only adds to the problem since they need to advertise above this to attract student help. 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 and Norway and Asia for our Bryophytes as they are added to the database. Moving forward they are starting to target specimens from countries that have the fewest specimens with a goal of getting to 100% transcription for as many countries as possible. They are continuing 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.

At UC, students participated in a trial using an OCR/AI to transcribe label data. They are comparing results.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2025-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 2025-Q3 and to provide an open forum to the GLOBAL team.

Share Identified Gaps in Digitization Areas and Technology

COLO noticed that the taxonomic dropdown for the ImagingWorkflow application was missing many of the names they use in their collection. In Fall of 2021, COLO worked with Katie Pearson to get an export of the lichen taxonomic thesaurus and Ryan Allen reformatted this list so it could be added to the application. It is difficult to quantify the impact since every imaging session is different, but most specimens do not require manual entry. COLO has been exploring a new version of the ImagingWorkflowApp that can run without JAVA. Sully Harrer has been working on this with the hope of including the option of populating the collector field like they add taxonomy to make the app more functional.

At UC, a more integrated way to include the verbatim label data as well as the most up to date versions of, e.g. country names and species names would be a useful tool.

Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) continued compiling resources during 2025-Q4 to share on Basecamp and all resources were posted to the project website (https://globaltcn.utk.edu).

The GLOBAL Project Manager (TENN) completed required Responsible Conduct in Research training for grant-funded projects.

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.

Outreach Videos

Outreach videos from WeDigBio and Friday Volunteer Transcription events were uploaded to

the UTK Herbarium's You Tube channel to provide a long-term storage location and increase access.

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 UTK Herbarium held two Specimen and Scones open houses in October and November. See above for Outreach Videos. GLOBAL Project Manager was contacted with a request to create a Collector Spotlight video on a particular Arizona bryologist. The requestor is compiling research and will share findings for a possible new video.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was utilized by over 1,500 users during 2025-Q3, including 1,565 from Asia, 83 from Europe, 89 from South America, 14 from Africa, 6 from Oceania, 31 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. 34,000 users visited the Bryophyte Portal, and 54,000 users visited the Lichen Portal during 2025-Q4 (see figures 4 & 5).

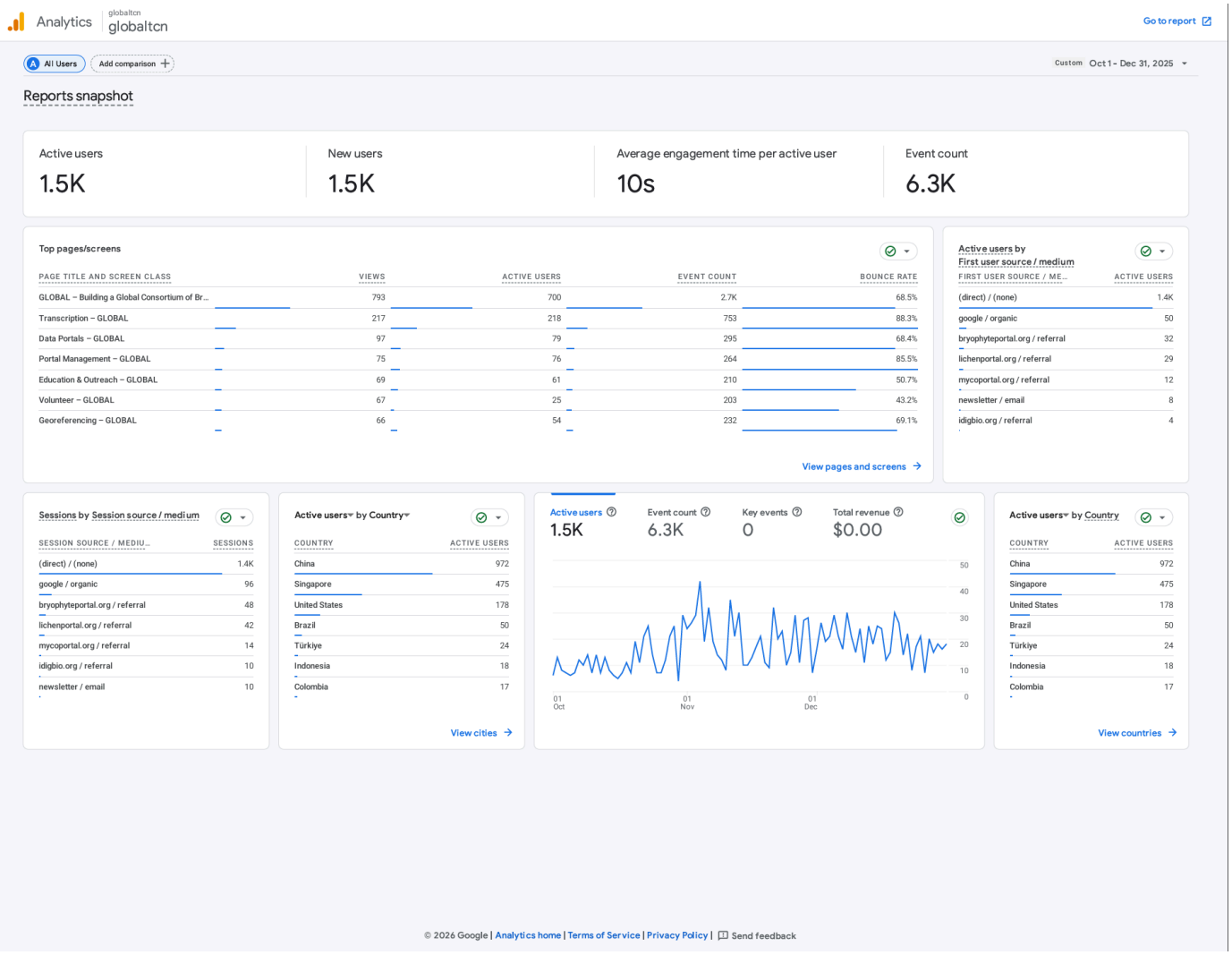

Figure 3: Use metrics for the GLOBAL project website (https://globaltc.utk.edu) from October 1 – December 31, 2025.

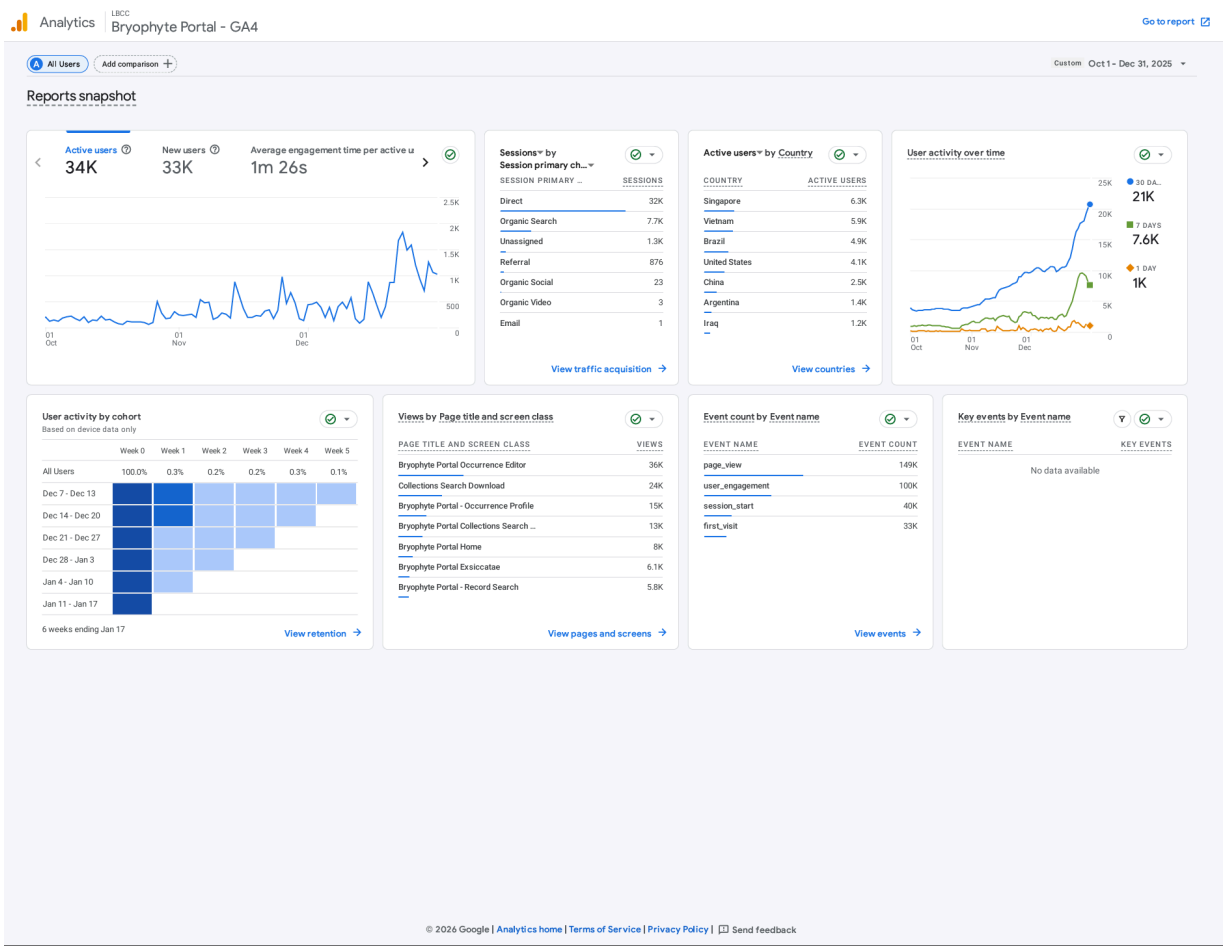

Figure 4: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from October 1 – December 31, 2025.

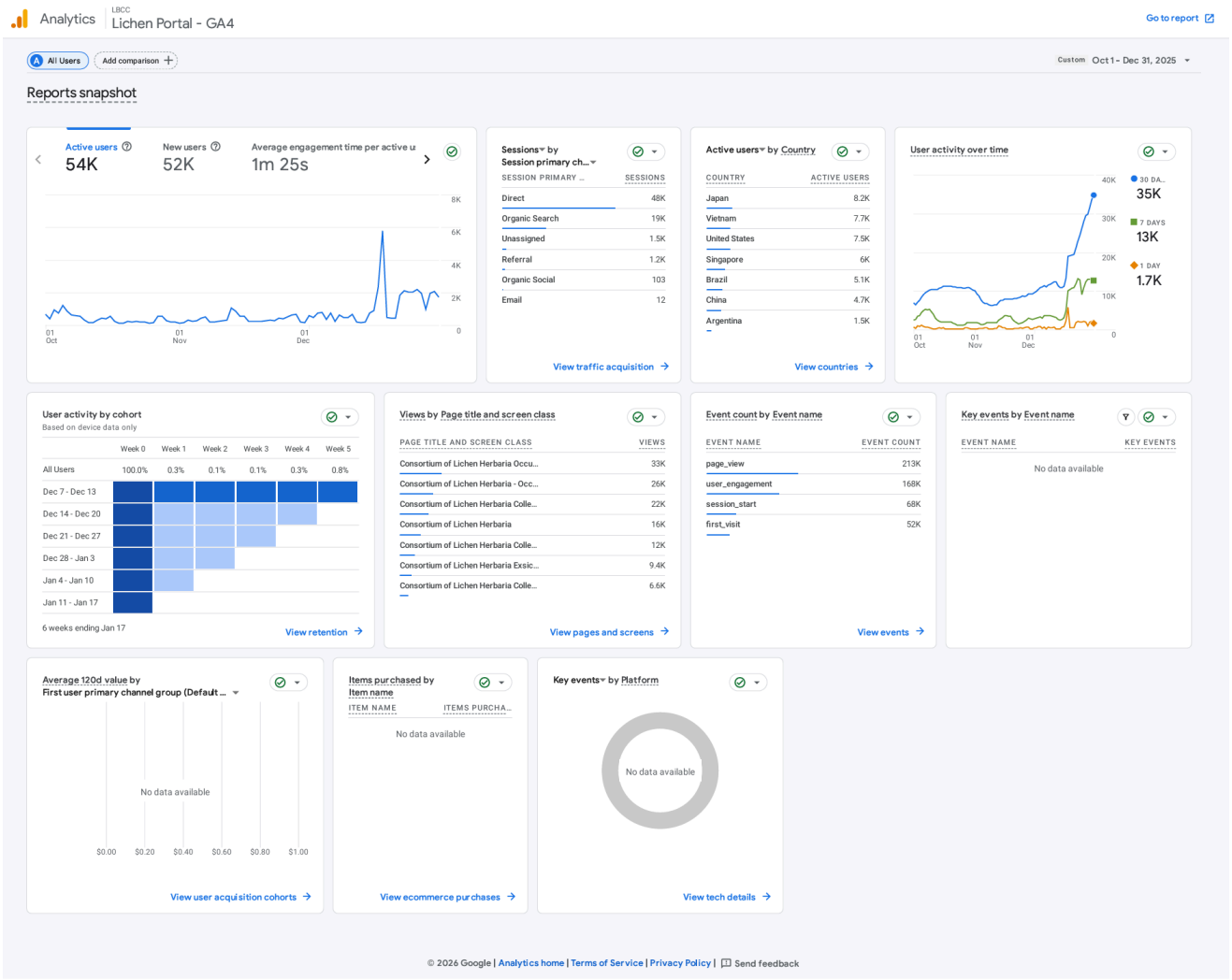

Figure 5: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from October 1 – December 31, 2025.

Share Other Activities and/or Progress

COLO submitted a no-cost extension in July 2025 and were approved for one more project year. Based on their remaining budget they anticipate that they will run out of money in June of 2026.

TENN Project Manager updated BISH's reporting sheets to continue work into their no-cost extension year 3.