



TCN Quarterly Progress Report

TCN Name

Building a global consortium of bryophytes and lichens: keystones of crytobiotic 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 April 1 – June 30, 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, 357 lichens had complete data records created, 357 were barcoded, and 357 were imaged. 1,408 mosses had complete data records created, 1,408 were barcoded, and 1,408 were imaged. 223 hepatics had complete data records created, 223 were barcoded, and 223 were imaged.

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

COLO captured 73 lichen packet images with skeletal records and 40 specimen images for the lichen collection. 73 specimens were barcoded. Images and all skeletal data captured through 6/30/2026 have been uploaded to the portal. 1,386 transcriptions were completed. COLO captured 386 bryophyte packet images with skeletal records and 2,311 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. 386 specimens were barcoded. Images and all skeletal data captured through 6/30/2026 have been uploaded to the portal. 3,3741 transcriptions were completed. They were able to hire two work study students for the summer to focus on specimen imaging and transcription. They are down to limited funds that will not be sufficient to proofread all of the labels. Remaining student funding is going towards specimen imaging and transcription in the lichen portal where they have not deployed AI.

TENN has completed most digitization efforts but continues to coordinate the GLOBAL project work. GLOBAL Project Manager compiled quarterly reporting in April for 2026-Q1.

At UC, they completed an entire first pass through the bryophytes in terms of full transcribing. They worked with undergraduate students and a Museum Assistant to identify records that were missing or needed new images.

Digitization

Four GLOBAL institutions (CINC & MU, COLO, TENN, and UC) reported progress on digitization deliverables, with a total of 1,143 specimens barcoded (827 bryophytes and 316 lichens), 1,118 labels imaged (978 bryophytes and 140 lichens), 3,010 specimens imaged (2,903 bryophytes and 107 lichens), 793 specimen records uploaded to the portal (627 bryophytes and 166 lichens), 793 skeletal records created (627 bryophytes and 166 lichens), 6,197 labels fully transcribed (4,721 bryophytes and 1,476 lichens), and 31 specimens georeferenced (all bryophytes) (See Table 1 & Figure 1).

PEN partner BISH reported a total of 1,998 specimens barcoded (1,641 bryophytes and 357 lichens), 1,998 labels imaged (1,641 bryophytes and 357 lichens), and 1,998 specimens imaged (1,641 bryophytes and 357 lichens).



Table 1: Digitization progress by GLOBAL collaborators in 2026-Q2, 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	241	93	592	67	592	67	241	93	241	93	450	90		
COLO	386	73	386	73	2,311	40	386	73	386	73	3,371	1,386		
DUKE														
F														
FLAS														
ILL & ILLS														
LSU														
MICH														
MIN														
MO														
MSC														
NY														
OSC														
PH														
TENN													31	
UC	200	150									900			
WIS														
YU														
Totals	827	316	978	140	2,903	107	627	166	627	166	4,721	1,476	31	0
B+L Totals	1,143		1,118		3,010		793		793		6,197		31	

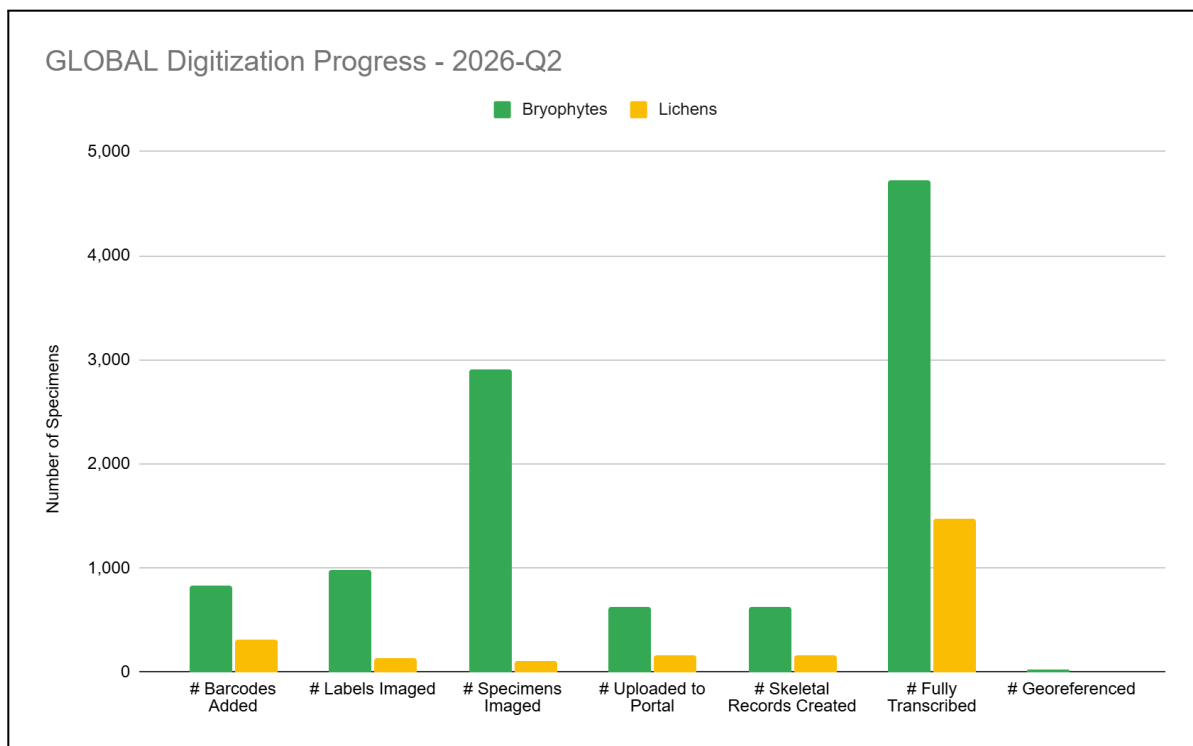


Figure 1: Digitization progress for the GLOBAL collaboration in 2026-Q2, separated by Bryophyte and Lichen specimens.

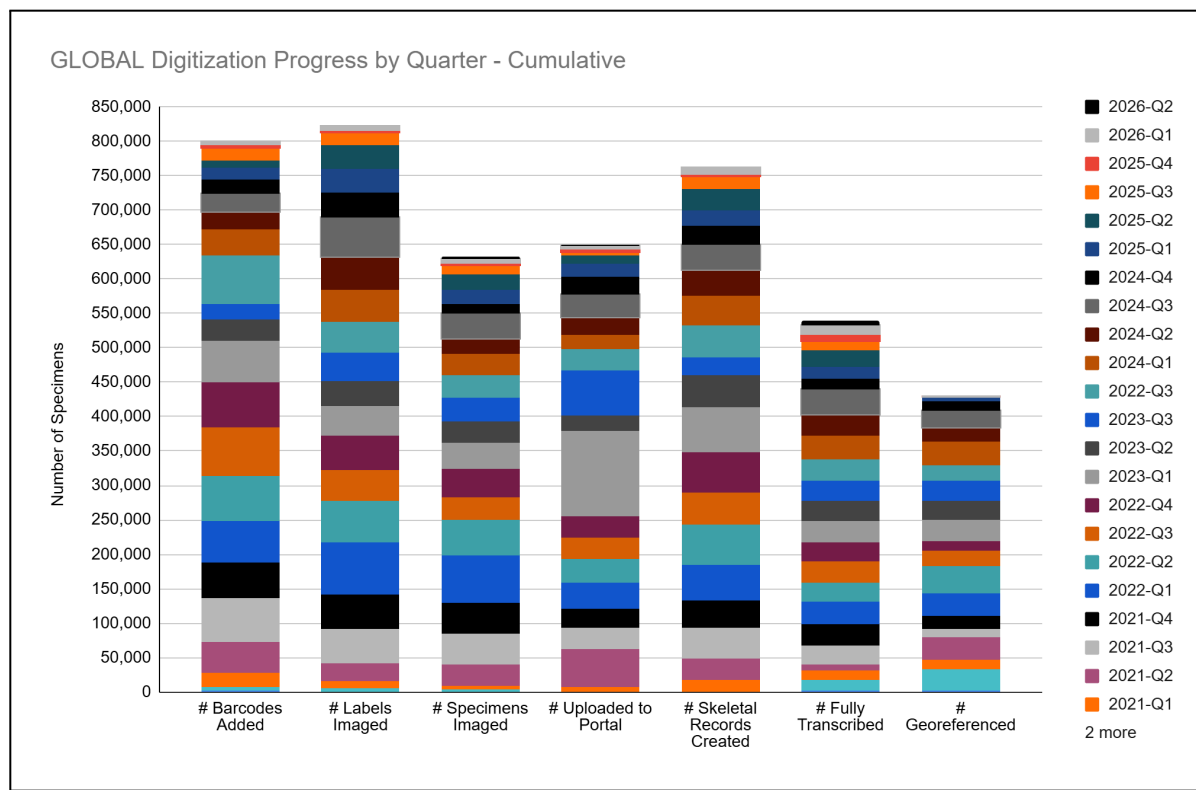


Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.



Share Best Practices, Standards, and Lessons Learned

AI Digitization Tools

COLO is increasingly using VoucherVision to process/transcribe specimens. They are still attempting to “hand transcribe” their Asian specimens to take advantage of duplicate matching with the All-Asia TCN project and they would like to be able to pull georeference work from that project back into the lichen/bryophyte portals. Given the geographic overlap of this project and the All-Asia project at COLO, they are specifically been targeting Asian specimens in the lichen and bryophyte portals 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 Oceania. They added transcriptions from Africa and South America using VoucherVision this quarter and plan to run some Central American and European specimens through the process that they do not expect to have time to complete by hand. They are specifically interested in using a hybrid AI approach to locate prolific collectors and pull “duplicate matching fields” to help speed up manual transcription and reduce the amount of future proofreading required. Future work using the “zero trust” version of VoucherVision where the results can be proofed also seems like a good strategy to employ in the future, but with their funds nearing the end they are going to keep with the specimen by specimen workflow in the lichen portal and these bulk runs.

UC tested a digitization assistance portal developed by one of their own graduate students, called Parsely. It cut time and had comparable or improved accuracy to student entered data, and they will explore adopting this for future transcribing projects.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2026-Q2. 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

Imaging

At COLO, 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.

VoucherVision

VoucherVision at COLO runs well with smaller batches, ~600 labels can be run in about an hour.



They have tested several different models, including the NYBG_Herbarium_Global, SLTPvM_default, SLTPvM_default_v2, SLTPvM_skeletal. Their preference so far is the SLTPvM_default_v2 model. They have found some errors in retrieving the barcode, but using the URL provided and a reverse lookup using xlookup in Excel works well to reunite the original barcode. They are getting errors back in their spreadsheet where special characters are not encoded correctly, particularly with South American due to accents and tilde. Find replace is helpful to swap character sets, but this adds to the processing time.

They are opting to proof read en masse in the Excel file before uploading to try and fix things like punctuation, format, mis encoded characters etc. They are also opting to not include derived coordinates. They are opting to fill the enteredby field with VoucherVision and including a block of text in the locality saying [Transcription generated with AI and has not been proofed.]. They can use this in the future to return to the database and proofread individual records. They would like to also try to use VoucherVision to help locate specific collectors that they know are well represented in their collection and tend to make multiple collections at each locality. They want to explore using this to pull all of the collections from a specific collector in a specific geography and use VoucherVision to fill the fields Symbiota uses for duplicate matching (Collector, Collector number and event date). They suspect this will allow more efficient matching because they will be able to work with sets of data that are likely to have duplicates and will require less proofreading.

Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) continued compiling resources during 2026-Q2 to share on Basecamp and all resources were posted to the project website (<https://globaltcn.utk.edu>).

At UC, undergraduate students helped test Parsely. They also participated in discussions on best practices for Herbarium digitization efforts.

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, continued uploading raw images and JPGs to the University of Colorado Research Computing. 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. Social media accounts belonging to collaborators continued using #GlobalTCN as a way to share progress with the community.

The TENN herbarium hosted a Specimens and Scones open house on April 8. The Herbarium provided tours for MSAB, Dr. Teamrat Ghezzehei, and a UT Field Botany Class. Herbarium staff participated as a guest speaker for the Botanist-in-Training Camp held by the UT Gardens in June.

UC undergraduate students and the Digitizing Lab were featured on multiple Herbarium tours for classes and the public during the spring semester.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, <https://globaltcn.utk.edu>, was utilized by 855 users during 2026-Q2, including 542 from Asia, 51 from Europe, 13 from South America, 3 from the Middle East, 2 from Africa, 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. 394,000 users visited the Bryophyte Portal, and 408,000 users visited the Lichen Portal during 2026-Q2 (see figures 4 & 5).



All Users [Add comparison](#)

Custom Apr 1 – Jun 30, 2026

Reports snapshot

Active users

855

New users

848

Average engagement time per active user

9s

Event count

3.2K

Top pages/screens

PAGE TITLE AND SCREEN CLASS	VIEWS	ACTIVE USERS	EVENT COUNT	BOUNCE RATE
GLOBAL – Building a Global Consortium of Br...	711	636	2.2K	80.6%
Data Portals – GLOBAL	29	25	71	29.0%
Page not found – GLOBAL	25	25	76	96.0%
Georeferencing – GLOBAL	24	21	76	45.5%
Imaging – GLOBAL	23	13	59	36.4%
Volunteer – GLOBAL	23	21	84	58.3%
Education & Outreach – GLOBAL	22	13	43	35.0%

[View pages and screens](#)

Active users by First user source / medium

FIRST USER SOURCE / ME...	ACTIVE USERS
(direct) / (none)	731
google / organic	44
bryophyteportal.org / referral	32
lichenportal.org / referral	22
mycoportal.org / referral	5
herbarium.duke.edu / referral	4
asulearn.appstate.edu / refe...	3

Sessions by Session source / medium

SESSION SOURCE / MEDIU...	SESSIONS
(direct) / (none)	734
google / organic	70
bryophyteportal.org / referral	58
lichenportal.org / referral	33
herbarium.duke.edu / referral	6
mycoportal.org / referral	6
asulearn.appstate.edu / refe...	5

Active users by Country

COUNTRY	ACTIVE USERS
Singapore	417
United States	214
China	62
Vietnam	28
Canada	24
Brazil	9
Japan	8

[View cities](#)

Active users

855

Event count

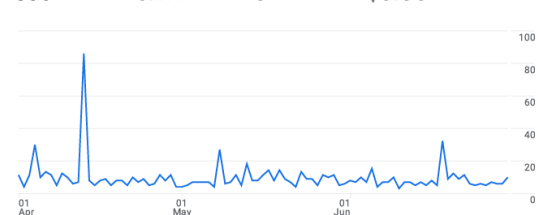
3.2K

Key events

0

Total revenue

\$0.00



Active users by Country

COUNTRY	ACTIVE USERS
Singapore	417
United States	214
China	62
Vietnam	28
Canada	24
Brazil	9
Japan	8

[View countries](#)

Figure 3: Use metrics for the GLOBAL project website (<https://globaltcn.utk.edu>) from April 1 – June 30, 2026.

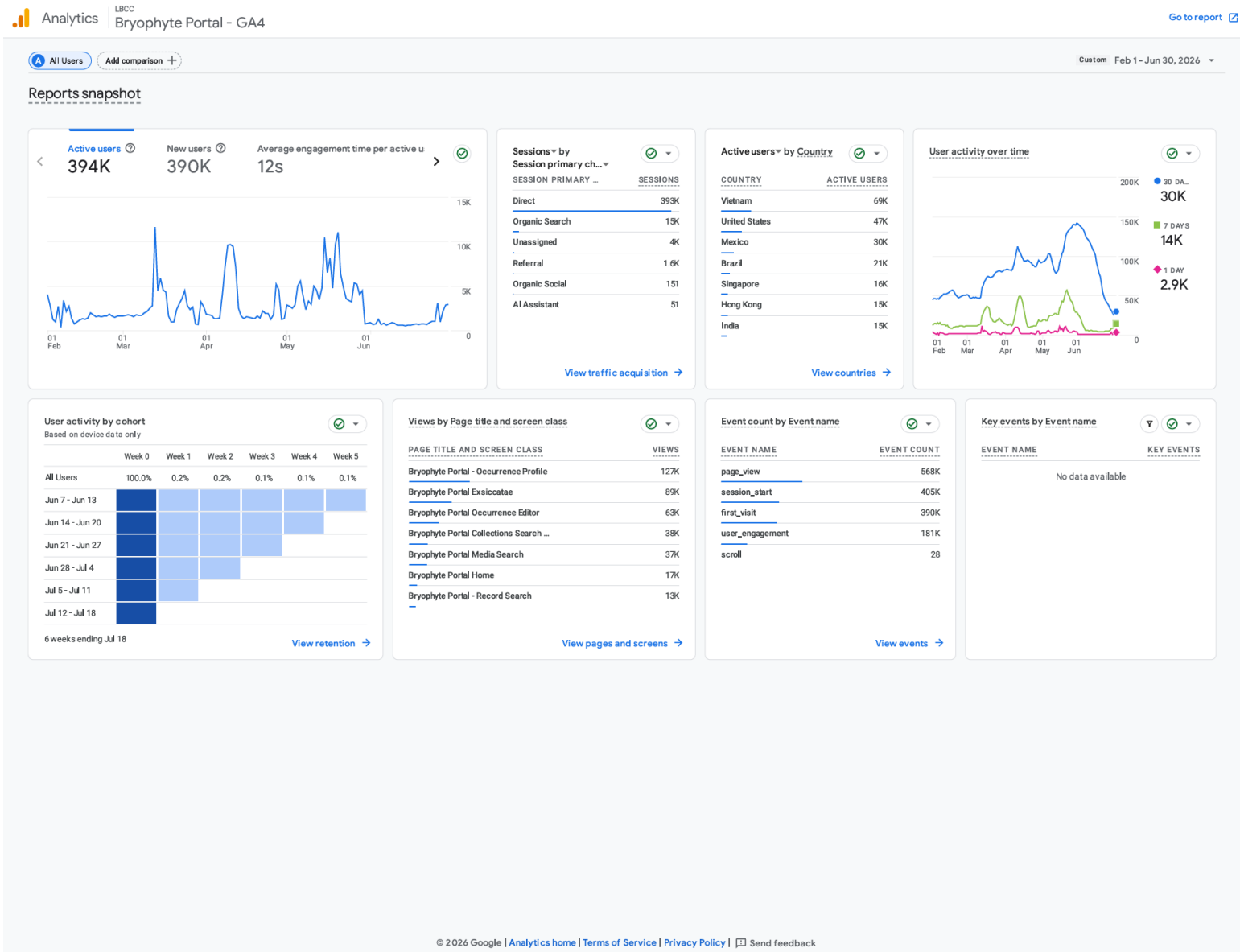


Figure 4: Use metrics for the Bryophyte Portal (<https://bryophyteportal.org/portal/>) from April 1 – June 30, 2026.

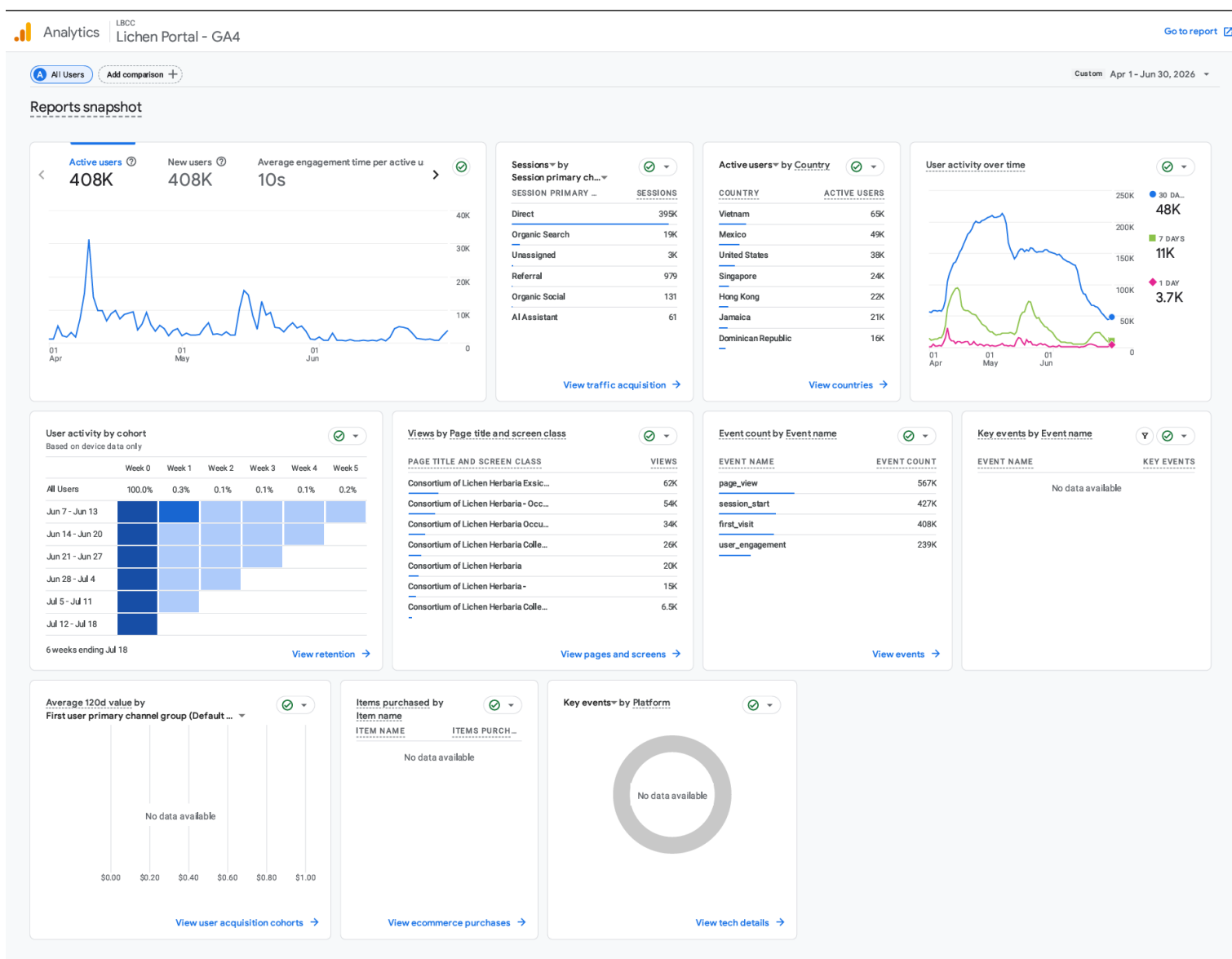


Figure 5: Use metrics for the Lichen Portal (<https://lichenportal.org/cnalh/>) from April 1 – June 30, 2026.



Share Other Activities and/or Progress

Dr. Cliff Smith, Professor Emeritus at the University of Hawai'i, continued his invaluable work identifying the Hawaiian lichen collections housed at BISH. He also continues to contribute his personal lichen collections for accession into the BISH herbarium, further enhancing the breadth and scientific value of the collection.

Emmet Judziewicz and Virginia Feire continued identifying hepatics newly collected in Hawaii by their conservation community and those, too, are then housed in the BISH herbarium collection. They have almost completed their second volume publication on Hawaiian hepatics which includes pictures and species keys.

TENN GLOBAL Project Manager updated broken portal links on the website and updated reporting sheets for collaborators to begin reporting final grant progress.