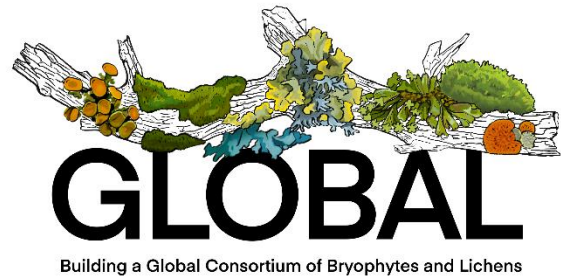




TCN Quarterly Progress Report

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 July 1 – September 30, 2022.

Workflows, Equipment, and Personnel

Most GLOBAL institutions continued steady GLOBAL progress during 2022-Q3.

At ASU, summer digitization progress was slow, but all images taken by the previous student worker have now been uploaded to the Lichen and Bryophyte Consortium. They recently hired a new undergraduate student worker in the fall who just started routine specimen imaging again, making good progress.

CINC & MU were down to one student worker over the summer, but added two new students to GLOBAL in early September. Students are trained on both imaging and label transcription,

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, 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, TENN = University of Tennessee, Knoxville, UC = University of California, Berkeley, WIS = University of Wisconsin, YU = Yale University



but typically feel more comfortable with imaging more quickly than they do with transcription, and this is reflected in their July–September numbers.

At COLO, the first, second, and fifth most productive imaging months occurred during this quarter with 2,693 more specimens imaged than our previous best quarter (138% of the previous best quarter). This was also their most productive transcription quarter with 373 more than the previous high (115% of the previous best quarter). Their hope is that this quarter represents an inflection point for a successful second half of the project. They will also train more students to contribute to transcription work to boost those numbers during the upcoming quarter.

DUKE's three work-study students began transcribing again in September after summer break and three new students were trained.

F barcoded over 3,000 lichen specimens as part of a public engagement activity over a weekend in July. They are currently in a slight transition period with staffing, retaining some summer interns that are continuing as fall/winter interns and two part time collections staff. They continued databasing and imaging, with a focus on imaging lichen specimens and databasing bryophytes.

FLAS added three new hires onto the project, and currently has five student employees barcoding, imaging, and transcribing.

ILL & ILLS continued digitizing bryophytes. Their Collections Manager has been working on databasing bryophytes and one undergraduate student has been working on repackaging bryophytes this quarter.

LSU continued to transcribe bryophyte and lichen records already in the portals. In-house georeferencing included completion of records based on labels containing lat/long data. A volunteer continued to image specimens. A technician/project manager was re-hired in September and is working to assist with imaging and help to clean the bryophyte records. Two undergrads hired over the summer continued to work into the fall semester.

MICH continued digitizing lichens and bryophytes. Two technicians and two undergraduate students have been working in the herbarium on digitizing lichens this quarter.

Progress at MIN was slower over the summer months with only four students working on the project. Two worked remotely on bryophyte transcription and two worked in-person on imaging lichen specimens.



NY hired two interns in this period and has been able to continue imaging their general lichen collection while beginning barcoding both hepatic and moss collections simultaneously.

At PH, the 6-month undergraduate hire (32.5 hrs/week) finished at the end of September, having completed imaging all of the lichen collection and imaging a good portion of the remaining bryophyte specimens. Specimen records were transcribed by staff and volunteers. Transcriptions and image links of type and special collection, housed in their institutional Symbiota, were transferred to the Lichen (3,000 records) and Bryophyte (1,400 records) Portals.

TENN students continued barcoding, imaging, and transcribing bryophyte specimens. They are getting very close to finishing the mosses! Two of their undergraduate curatorial techs graduated and moved on to new adventures at the beginning of August. They have two continuing undergraduate techs and one new intern. The GLOBAL Project Manager began the interview and hiring process to bring on four new undergraduate curatorial techs.

UC continued with a team of three work study students who are digitizing lichens and bryophytes. They hired a recent grad to assist with this process including pulling and filing specimens for digitizing. They finished with our lichen collections and have moved on to bryophytes! No digitalization was completed during the summer break.

WIS continued georeferencing, retaining two students who had graduated in spring. WIS collaborative georeferencing is focused on initial passes over countries well represented on the portals, especially Europe and Scandinavia.

Digitization

Seventeen institutions (ASU, CINC & MU, COLO, DUKE, F, FLAS, ILL & ILLS, LSU, MICH, MIN, MO, NY, PH, TENN, UC, WIS, and YU) reported progress on digitization deliverables, with a total of 71,036 specimens barcoded (32,435 bryophytes and 38,601 lichens), 44,207 labels imaged (22,945 bryophytes and 21,262 lichens), 32,342 specimens imaged (23,497 bryophytes and 8,845 lichens), 29,039 specimen records uploaded to the portal (13,870 bryophytes and 15,169 lichens), 44,982 skeletal records created (28,521 bryophytes and 16,461 lichens), 30,795 labels fully transcribed (20,460 bryophytes and 10,335 lichens), and 23,236 specimens georeferenced (13,287 bryophytes and 9,949 lichens) (See Table 1 & Figure 1). The quarterly total for barcoding was the highest yet. (See Figure 2).



Table 1: Digitization progress by GLOBAL collaborators in 2022-Q3, 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	385	16,319		148		119	344	407		407		407		407
BRY														
CINC & MU	1,680		2,268		2,268		2,268		1,680		1,319			
COLO	500	9,184	264	8,684			264	8,684	264	8,684		2,846		
DUKE	1,560		946		57		1,003		810		1,123		30	
F	3,000	4,800	182	3,176	182	3,176		3,176	4,934	123				
FLAS	3,250		2,840		2,840		2,840							
ILL & ILLS	430										7,630			
LSU					1,977						1,310	6,178	709	2,725
MICH	306	4,167	306	4,167	34	463			306	4,167	14		16	1
MIN		1,762		1,762		1,762			2,465		3,079			
MO	5,004		3,950		3,950				4,010		150		85	
MSC														
NY	5,685	2,179	408	2,424	408	2,424			5,685	2,179	1,487	102	1,249	60
OSC														
PH	4,573	136	4,573	136	4,573	136		136		136	284	802		5
TENN	3,204		4,223		4,223		4,393		3,596		4,064		4,387	
UC	100	54	227	765	227	765			227	765				
WIS								2,766					6,811	6,751
YU	2,758		2,758		2,758		2,758		4,544					
Totals	32,435	38,601	22,945	21,262	23,497	8,845	13,870	15,169	28,521	16,461	20,460	10,335	13,287	9,949
B+L Totals	71,036		44,207		32,342		29,039		44,982		30,795		23,236	

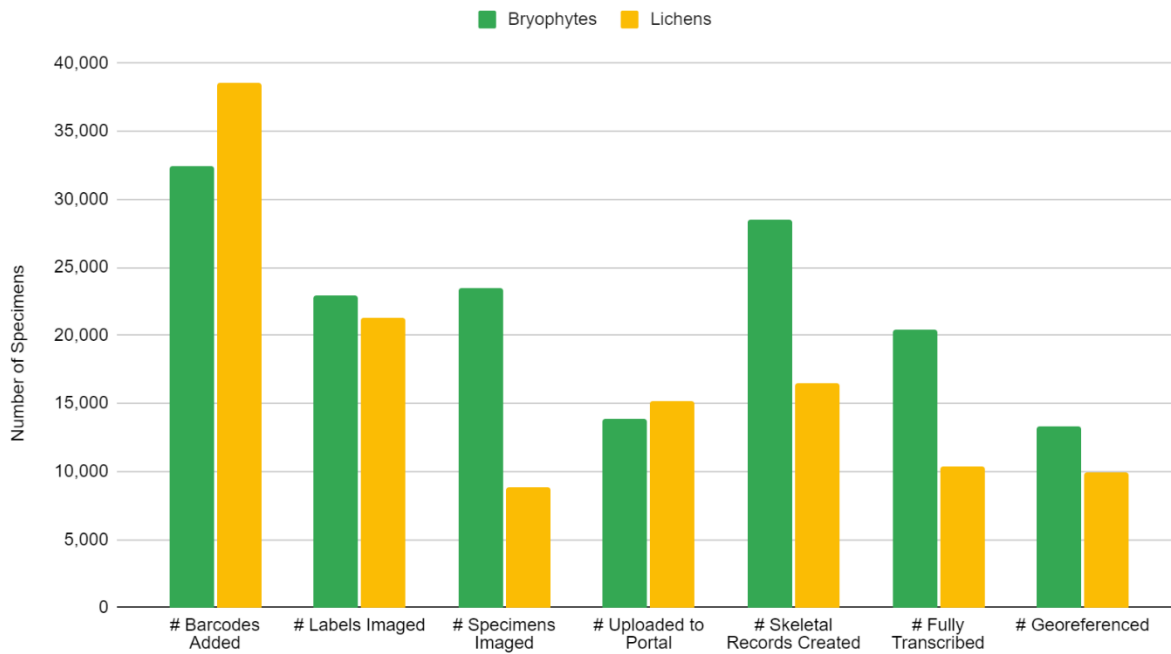


Figure 1: Digitization progress for the GLOBAL collaboration in 2022-Q3, separated by Bryophyte and Lichen specimens.

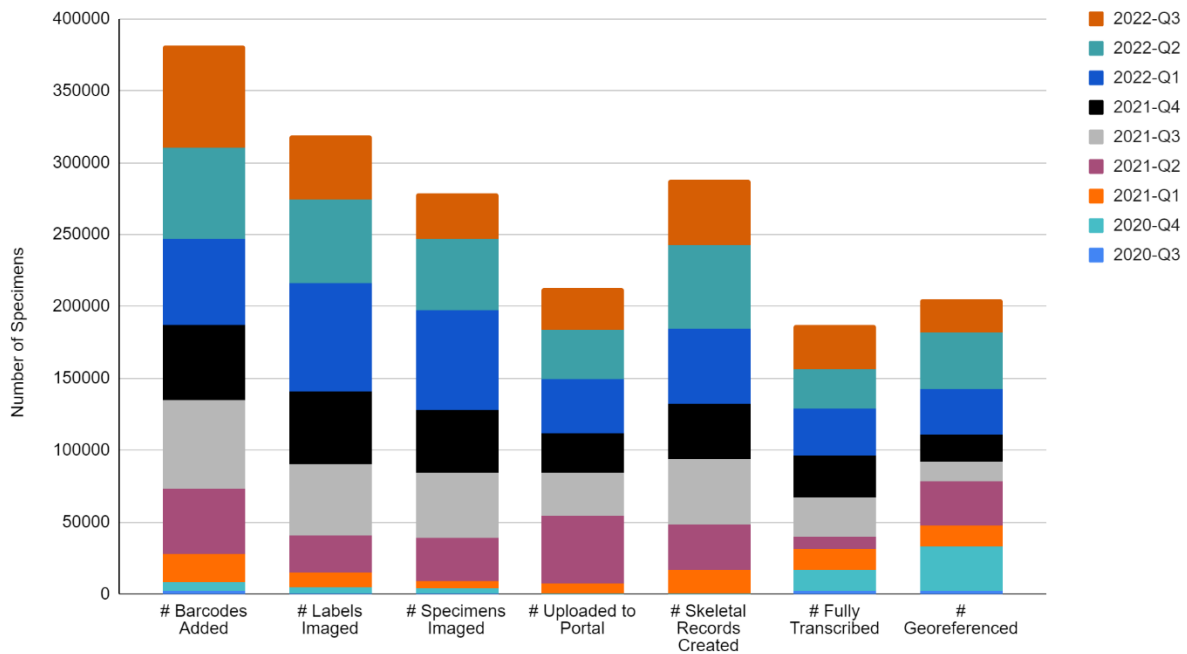


Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.



Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

The GLOBAL teams continued to make use of flexible digitization workflows in 2022-Q3, including some use of virtual transcription work and prioritizing label imaging, while most collaborators were able to continue on-site work.

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 will most likely retake the specimen images later in the project when we have a system in place for capturing better specimen images. They are planning to capture both packets and specimens for the bryophyte collection in the same pass using two separate cameras and will circle back for lichen specimen images. Since no transcription work was completed on their non-North American specimens, they did not have records for the first wave of georeferencing work at WIS. They are prioritizing records from Australia, Finland, France and Sweden for transcription to build sets for georeferencing. They will be adding Chile, Japan and Norway to this priority list starting next quarter.

Duplicate Matching

The Portal Manager (ASU) added two additional publicly available international bryophyte collections for duplicate matching, which included over 49,000 bryophyte specimens with coordinates from the Komi Scientific Centre, Russian Academy of Sciences (SYKO) and 21,000 bryophyte specimens from the Osaka Museum of Natural History (OSA).

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2022-Q3. New collaborators and students were given access to Basecamp group resources. The Outreach & Education Group met in September to discuss ongoing projects and in preparation for the October WeDigBio event. The Executive Committee also met in September and discussed plans for the GLOBAL interface, re-naming / rebranding the portals to be more inclusive of international collaborators / contributors, and how best to engage the Executive Advisory Committee.

A Management Committee Meeting was held in August open to all GLOBAL team members to review 2022-Q2 and Year 2 grant progress and 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

Barcode Renaming

The next version of ASU's BCRWatcher (0.9.0.2.) was released at <https://help.lichenportal.org/index.php/en/bcrwatcher/>. This new version includes several significant improvements and bug fixes (better barcode recognition, additional metadata fields, etc. - for details see the instructions).

Taxonomy

At COLO, the taxonomic dropdown for the ImagingWorkflow application was missing many of the names we use in our collection. Last fall they worked with Portal Manager 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 will be testing the new image upload process starting with their Bryophytes captured in September.

Database Compatibility

MICH's uploading to the project Symbiota portals has been suspended this quarter due to an impediment with their institutional IPT export from Specify. They're optimistic that this issue will be resolved soon.

Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) and Georeferencing Manager (WIS) continued compiling transcription and georeferencing resources during 2022-Q3 to share on Basecamp and all resources were posted to the project website (<https://globaltcn.utk.edu>). Students continued contributing to a shared document of Transcription tips and tricks available to student digitizers across the collaboration.



ASU continued to provide regular user support through the Symbiota Support Hub. [Monthly Monday meetings](#) by the Support Group are open to all members of the Symbiota community and generally well attended. More tutorials have been added to the Symbiota Documentation by the Symbiota Support Hub at <https://biokic.github.io/symbiota-docs/>.

The LSU Collections Manager attended several Symbiota Help sessions for various TCNs. These are often recorded and available from their website, and are very helpful for sharing information about Symbiota and linking with GBIF.

NY presented a short talk at BioDigiCon 2022 on both their open copy stand for photographing packets mounted on sheets and also the photoshop tools they use to auto crop and add digital rulers.

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

As part of ASU's efforts reaching out to the Latin American community, Venezuelan lichenologist Jesús Hernández was hired as free-lancer (on non-Global funding) to do a user survey of the participants of the [Consortio de Herbarios de Líquenes en América Latina](#) and to provide technical support to that community. Undergraduate student Erin Eggenberger is working on uploading Latin American Checklists data as part of her independent student research project.

Ongoing collaboration between GLOBAL teams and other TCN projects (including PCC, All-Asia, and SoRo) occurring concurrently at their sites continued at CINC & MU, COLO, MICH, NY, and WIS, where personnel, resources, and learnings were often shared between projects.

TENN Project Manager participated in the quarterly iDigBio Internal Advisory Committee Meeting in August with other TCN participants.

TENN PI and Project Manager, along with CINC's Eric Tepe and FLAS's Alan Franck, reviewed and gave feedback on a PEN proposal for the Bishop Museum herbarium (BISH) the University of Hawaii (HAW), and the National Tropical Botanical Garden (PTBG).

Rikke Naesborg, Tucker Lichenologist and Curator of the Lichenarium at the Santa Barbara Botanic Garden (SBBG) was given access to our Basecamp resources.



Share Opportunities and Strategies for Sustainability

Portal Management

ASU continued to host and maintain the Bryophyte and Lichen Portals, including nightly backups, regular software updates, adjustments to portal configurations and layout, etc. They have also continued to support image uploading, regularly update snapshot collections from international collections monthly, and troubleshoot any import issues that accompany this procedure.

As an associate of the IUCN Lichen Specialists Red-Listing group, the [Global IUCN Red-Lists of Lichens](#) continue to be regularly updated in the Consortium of Lichen Herbaria. The ASU Symbiota IT team recently added a new GBIF citation applet to both the Bryophyte and Lichen Consortium. The applet tracks specimen citations in scientific data sets that were supplied from the Consortium to GBIF, downloaded and analyzed by researchers in their scientific publications.

Taxonomy

ASU continued regular updates of the taxonomic thesaurus with support of Gary Perlmutter, Jason Hollinger, and Alan Fryday. The newest version #25 of Ted Esslinger's North American Lichen Checklist is now available from the North American Lichen Consortium. In coordination with the GLOBAL Managing Committee, a strategy was devised to better integrate and streamline existing portals. All current bryophyte portals will be integrated into one single Consortium of Bryophyte Herbaria; the different lichen sites will be merged into a single Consortium of Lichen Herbaria. Both sites will provide tools to query data across different Symbiota portals using the newly developed API. New endpoints have been added to the API with API documentation appropriately extended (<https://lichenportal.org/cnalh/api/v2/documentation>, <https://bryophyteportal.org/portal/api/v2>).

ILL & ILLS have developed a taxonomic report which displays a summary of unresolved taxa associations within Symbiota portal collections. This clear, and concise, report provides targeted data to facilitate portal taxonomy updates, from both internal and external resources. Taxa identified in the report can be updated using combinations of existing Symbiota taxonomy tools, and custom functions provided by this plugin. Documentation for installing the taxonomy



plugin, and supporting framework, is being finalized before releasing the code for use by other Symbiota portals.

Back Ups

COLO's raw images and JPGs continue to be 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.

UC is moving their internal collections space platform to a new server.

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 Instagram feed was restored on the website following some connection issues.

In July, ASU PI F. Bungartz taught a workshop about the Lichen Consortium (in Spanish) at an international meeting of the Grupo Latinoamericano de Liquenólogos (GLAL XV), virtually in Argentina.

DUKE led a lichen-collecting field trip for four amateur botanists (non-students) to the North Carolina mountains in August.

F has a number of volunteers doing pre-digitization curation activities preparing specimens for digitization for both lichens and bryophytes. They are also using public events to barcode bryophyte and lichen specimens, and participated in several public outreach programs.

Two LSU CURE Biology Class tours of the herbarium (24 students per class) were led by the Collections Manager. These classes are engaged in research-based work using herbarium specimens.



NY presented a short talk at BioDigiCon 2022 on both their open copy stand for photographing packets mounted on sheets and also the photoshop tools they use to auto crop and add digital rulers.

TENN Lead PI J. Budke presented a talk on the GLOBAL project at BioDigiCon in September.

TENN continued hosting the GLOBAL weekly transcription event on Fridays during 2022-Q3. Ten community science volunteers from three countries participated (US, Canada, India) and transcribed skeletal data for over 500 specimens. Volunteers were also able to see a number of “Specimen Spotlight” presentations on specimens and collectors compiled by the TENN GLOBAL Project Manager.

The GLOBAL Outreach & Education group met in August. F, the lead outreach institution, shared updates on programs and educational materials being created. The team discussed plans and next steps for ALA’s educational videos and began WeDigBio planning. The GLOBAL collaboration was polled to choose topics for the educational videos.

WeDigBio

Six GLOBAL collaborators (DUKE, COLO, CINC & MU, F, FLAS, TENN) agreed to participate in the October 2022 WeDigBio. They held one WeDigBio Planning Meeting in September to discuss initial logistics. The dates and times were chosen and they began creating print, virtual, and social media advertising for the event.

Share Information About Your Website and/or Portal Usage

Google Analytics for the GLOBAL project website, <https://globaltcn.utk.edu>, had some connectivity issues, so usage data was not captured for 2022-Q3. The connection was reestablished and will be reported for most the following quarter in our next report.

The Bryophyte and Lichen Portals, created as part of the original LBCC grant, host new images and data produced by the GLOBAL collaborators. Over 15,000 users visited the Bryophyte Portal (more than double the 7,000 from the prior quarter) and over 23,000 users visited the Lichen Portal during 2022-Q3 (see Figures 3 & 4).

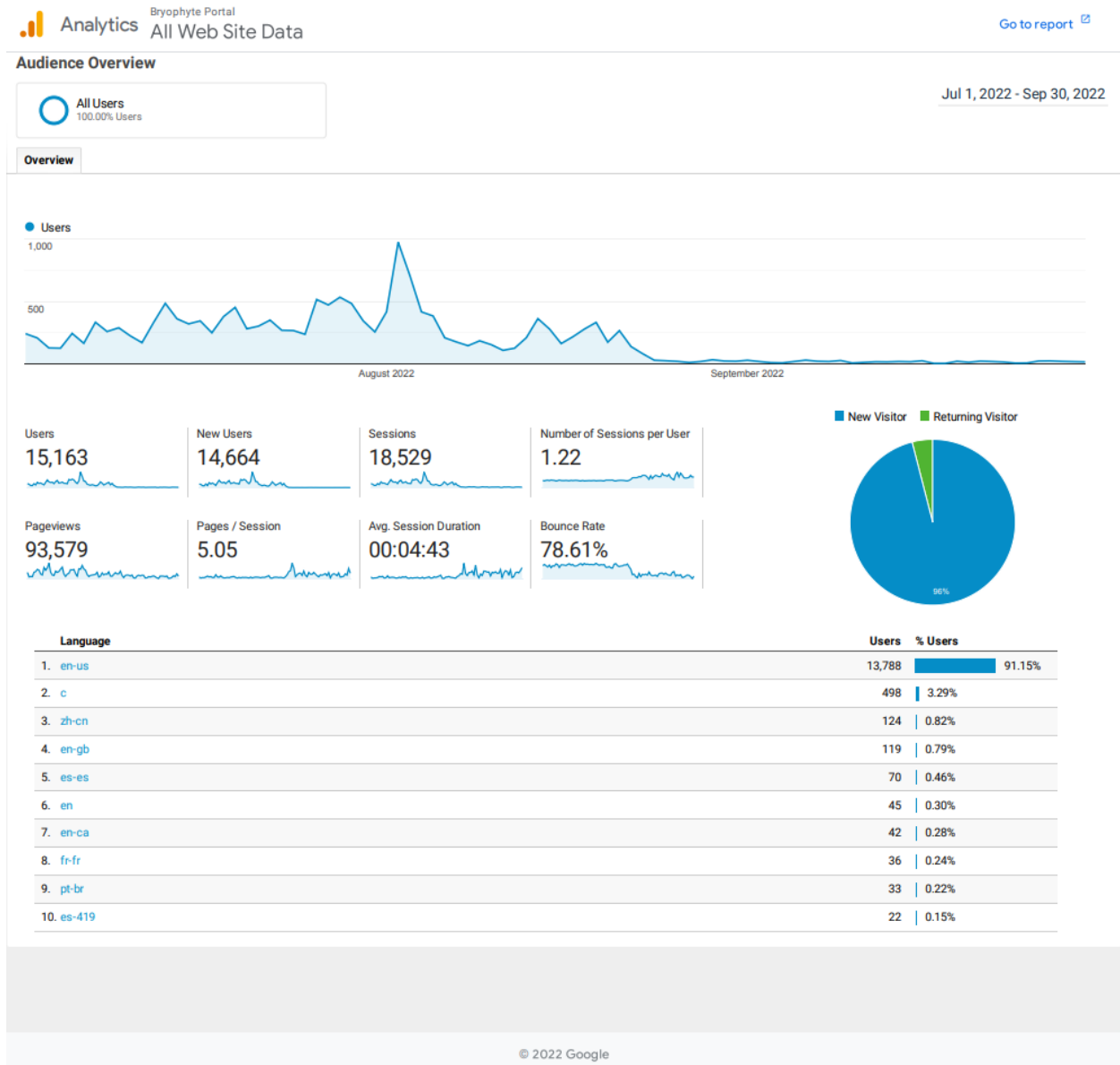


Figure 3: Use metrics for the Bryophyte Portal (<https://bryophyteportal.org/portal/>) from July 1- September 30, 2022.

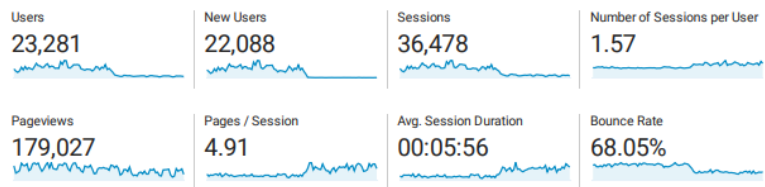
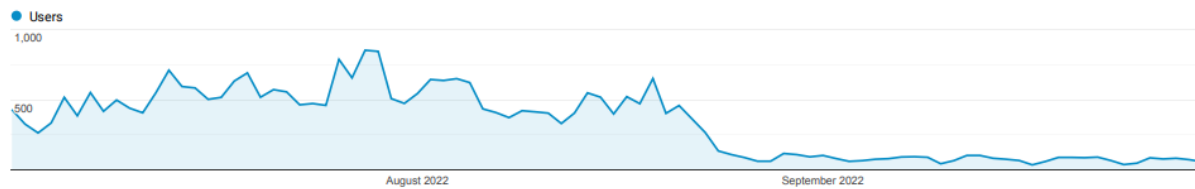


Audience Overview

All Users
100.00% Users

Jul 1, 2022 - Sep 30, 2022

Overview



Language	Users	% Users
1. en-us	16,123	69.56%
2. zh-cn	2,535	10.94%
3. en-gb	605	2.61%
4. c	566	2.44%
5. es-es	335	1.45%
6. en-ca	207	0.89%
7. pt-br	171	0.74%
8. es-419	160	0.69%
9. fr-fr	159	0.69%
10. ru-ru	157	0.68%

Figure 4: Use metrics for the Lichen Portal (<https://lichenportal.org/cnalh/>) from July 1-September 30, 2022.



Share Other Activities and/or Progress

Annual Reporting

GLOBAL Project Manager helped all teams with Annual NSF Reporting and completed the Integrated Annual Report for Year 2.

Image Tagging

As part of revising the lichen identification character matrix, a [Glossary](#) of lichen characteristics authored by F. Bungartz is now available from the Lichen Consortium. Currently this glossary provides text definitions only. Illustrations are currently being added (an example definition with illustrations can be found for the term [lecanorine](#)).

Lichen Images

ASU added 7,939 high resolution lichen macrophoto field images from renowned professional photographers Steven Sharnoff and Sylvia Duran Sharnoff (co-authors of Lichens of North America). These images represent 1429 species, largely from North America. All images are stored as a virtual specimen collection, named the "[Sharnoff Image Collection](#) (hb. Sharnoff-photos)"; all image records are linked to their voucher specimen records in UCR (in transfer to SBBG) and CANL.