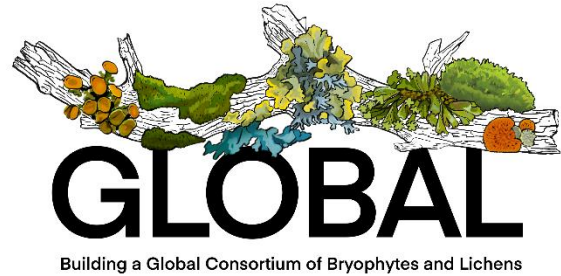




# TCN Quarterly Progress Report

## TCN Name

Building a global consortium of bryophytes and lichens: keystones of cryptobiotic communities (GLOBAL)<sup>1</sup>



## 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, 2023.

### Workflows, Equipment, and Personnel

Most GLOBAL institutions continued steady GLOBAL progress during 2023-Q1.

ALA has nearly completed the lichen reorganization, but the mosses are still being reorganized. They continued to digitize and update metadata in ARCTOS, update locality information and georeferences, and upload specimen records from ARCTOS to the portals.

At ASU, specimen digitization continued, focusing on ASU lichen specimens. A new student worker, Ramisa Zaman, was just hired and is being trained in routine image acquisition by her predecessor Tanishq Jain.

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<sup>1</sup> 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



The herbarium of non-vascular cryptogams at BRY started a major renovation project in January. Digitization efforts have been halted in preparation for the major construction that will start in May 2023.

Imaging and transcription continued on CINC bryophytes. They have nearly completed the Fulford collection of liverworts, and are now working on exsiccatae.

COLO continued work on imaging and transcribing specimens. They are getting a start with the bryophyte collection using the same workflow as the lichens to maximize the number of labels in the system. They want to get as many transcribed records into the system as possible to give WIS specimens to georeference.

DUKE continued barcoding, imaging, transcribing, and georeferencing activities for their bryophyte collection.

At F, additional lichen images were added, most entered directly into Emu. Fully transcribed and georeferenced lichen specimens (mostly from Iceland, New Caledonia, and Tasmania) were added to EMu, and will eventually make their way onto the portal with their next IPT update. Bryophyte specimens were barcoded and imaged and skeletal records were developed. In tandem to the portal, they are also updating and adding images to existing records in EMu.

FLAS is amping up transcribing efforts. All mosses have been carded, almost all hepatics carded, and a quarter of the mosses have been imaged for project.

ILL & ILLS continued transcribing bryophytes.

LSU continued training an undergraduate to complete georeferencing of lichen and bryophyte records, continued to image bryophyte specimens, and re-imaged some lichen labels to resolve issues.

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

MIN continued to image lichen specimens and transcribe label data for bryophyte specimens.

MO continued digitization work on their bryophyte specimens.

NY had two interns dedicated to barcoding and photography, while their lead digitizer focused more directly on transcription.



OSC was able to continue digitization work, barcoding and imaging bryophyte specimens.

At PH one dedicated volunteer transcribed lichen specimens. Continuation of student imaging and transcribing of the remaining moss sheets will start up in the next quarter.

TENN students continued barcoding, imaging, and transcribing bryophyte specimens. They finished the moss collection and have moved on to the liverworts. Three undergrads were hired and trained during a “Herbarium Bootcamp” over the Winter Mini-Term to work on GLOBAL imaging and transcription. The herbarium had 9 undergrad technicians working on the GLOBAL project this quarter. Three undergrad interns were also trained to help on GLOBAL tasks as part of their activities.

With their Herbarium Assistant, Acacia, UC was able to better streamline their digitizing process and to add more skeletal data and images this quarter. Students are currently focusing on skeletal data and imaging before moving on to transcribing and georeferencing.

WIS started imaging and transcribing labels as well as specimens from NEB and WTU. Students continued to image WIS specimens and georeference across the collections.

YU continued digitization work on their bryophyte specimens.

### **Digitization**

Nineteen institutions (ALA, ASU, CINC & MU, COLO, DUKE, F, FLAS, ILL & ILLS, LSU, MICH, MIN, MO, NY, OSC, PH, TENN, UC, WIS, and YU) reported progress on digitization deliverables, with a total of 59,311 specimens barcoded (51,918 bryophytes and 7,393 lichens), 44,348 labels imaged (31,768 bryophytes and 12,580 lichens), 38,655 specimens imaged (24,639 bryophytes and 14,016 lichens), 124,327 specimen records uploaded to the portal (65,484 bryophytes and 58,843 lichens), 66,357 skeletal records created (57,575 bryophytes and 8,782 lichens), 31,261 labels fully transcribed (21,802 bryophytes and 9,459 lichens), and 32,190 specimens georeferenced (24,239 bryophytes and 7,951 lichens) (See Table 1 & Figure 1).



Table 1: Digitization progress by GLOBAL collaborators in 2023-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					80	5,594	156	1,889	18,797						
ASU		335		335	0	335		1,024		1,024		335			
BRY															
CINC & MU	2,763		2,763		2,763		2,665		2,763		3,089		957		
COLO	4,863	3,455	3,863	3,686			3,863	3,686	3,863	3,686	42	4,033			
DUKE	1,539		2,038		304		2,342		1,539		107		64		
F	12,658	526	3,153	347	3,153	347	1,049		1,549			526		526	
FLAS	2,500		1,250		1,250		1,250	50			300				
ILL & ILLS											6,655				
LSU				278	2,584								1,128	903	
MICH	3,934	1,119	3,934	1,119	437	124	1,773	8	3,934	1,119	147		34		
MIN		983		983		983				983	669				
MO	4,733		3,070		3,070				75		76		28		
MSC															
NY	16,509	877	221	5,702	221	5,702	44,709	52,055	16,509	877	5,471	3,827	1,721	1,695	
OSC			1,249		1,249										
PH								1		1		661			
TENN	1,389		6,791		6,791		6,947		2,024		5,146		3,189		
UC	300		2,007		2,007				2,007						
WIS		45	699	77		878		77	699	77	100	77	17,118	4,827	
YU	730	53	730	53	730	53	730	53	3,816	1,015					
<b>Totals</b>	<b>51,918</b>	<b>7,393</b>	<b>31,768</b>	<b>12,580</b>	<b>24,639</b>	<b>14,016</b>	<b>65,484</b>	<b>58,843</b>	<b>57,575</b>	<b>8,782</b>	<b>21,802</b>	<b>9,459</b>	<b>24,239</b>	<b>7,951</b>	
<b>B+L Totals</b>	<b>59,311</b>		<b>44,348</b>		<b>38,655</b>		<b>124,327</b>		<b>66,357</b>		<b>31,261</b>		<b>32,190</b>		

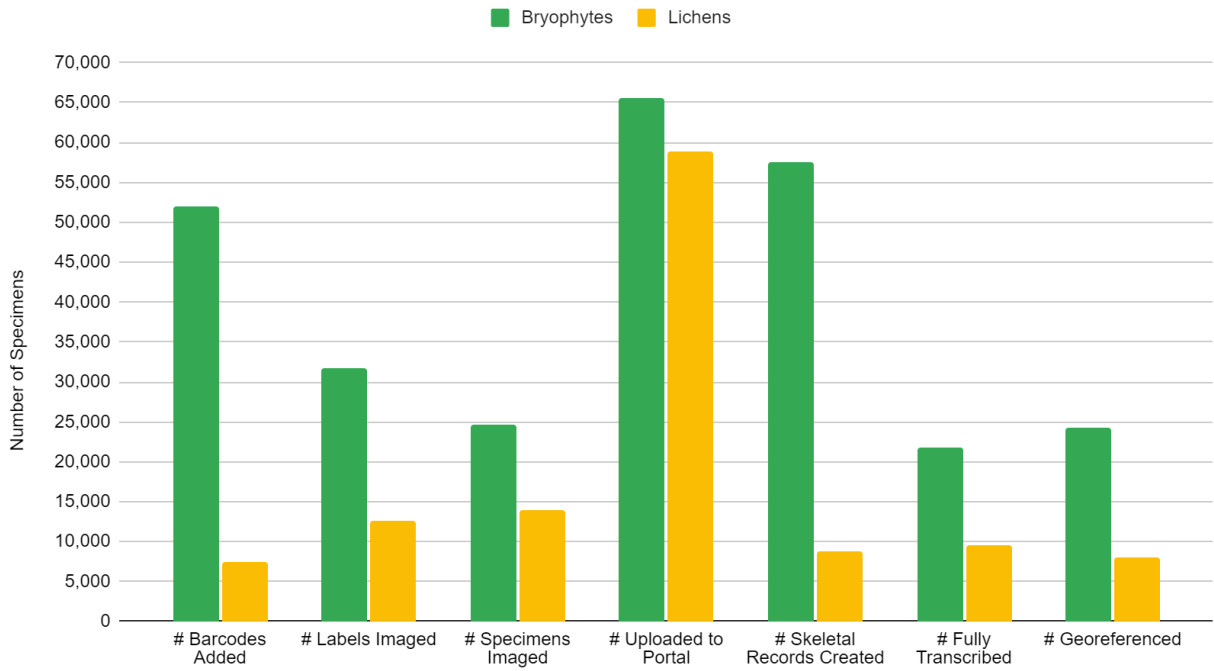


Figure 1: Digitization progress for the GLOBAL collaboration in 2023-Q1, separated by Bryophyte and Lichen specimens.

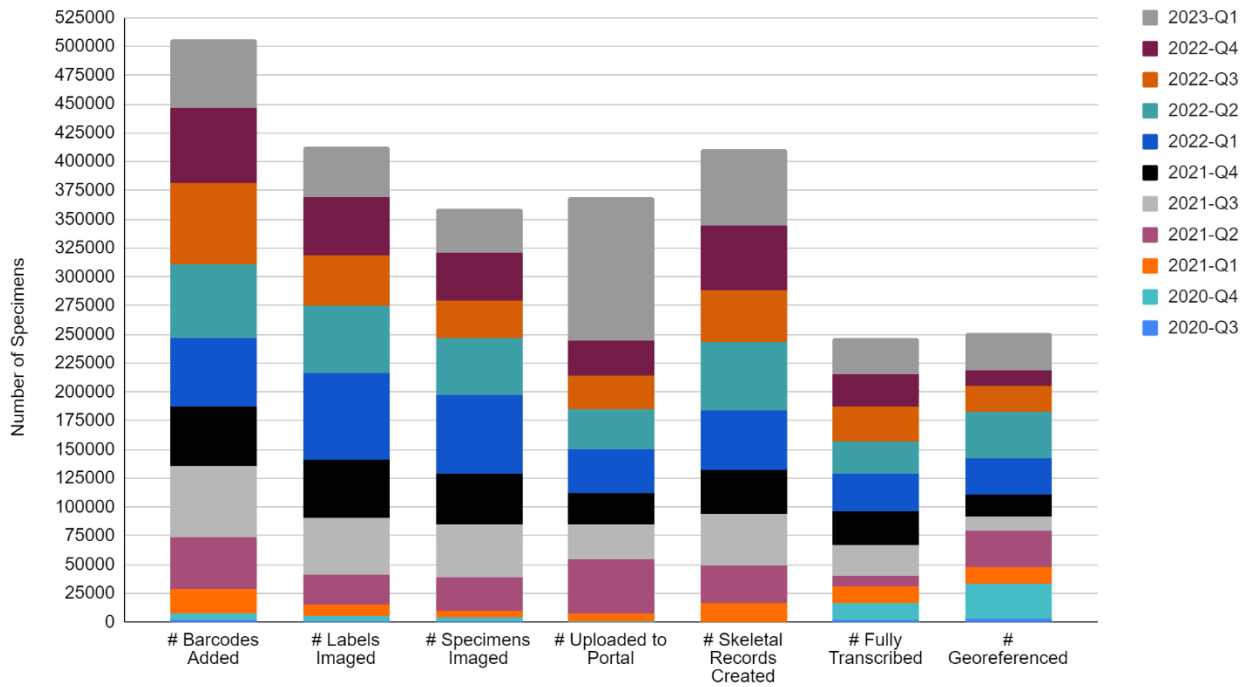


Figure 2: Cumulative digitization progress for the GLOBAL collaboration by quarter.



## Share Best Practices, Standards, and Lessons Learned

### Flexible Workflows

The GLOBAL teams continued to make use of flexible digitization workflows in 2023-Q1, including some use of virtual transcription work and prioritizing label imaging, while most collaborators were able to continue on-site work.

COLO is splitting digitization time between this project, the Southern Rocky Mountain and the All-Asia project. Right now, they have a shared imaging station for the All-Asia project and are trying to maximize time on that station before it is shipped to BRIT. Most of the change was shifting PM Allen's time to All-Asia with the rest of the digitizers continuing to focus on GLOBAL. 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 are prioritizing records from Australia, Chile, Finland, France, Japan, Norway and Sweden for transcription to build sets for georeferencing. One of their digitizers is going to start graduate school in England in the fall and focused on transcribing labels from the UK. With summer approaching they are planning to shift some hours away from imaging to transcription.

### Georeferencing / Duplicate Matching

Georeferencing Manager Smith (WIS) has been verifying completed georeferences and began sending csv files to those with snapshot collections (MO). With Portal Manager K. Pearson's help, they ran the duplicate coordinate matching tool for a few collections to see if they can leverage their georeferencing efforts.

LSU worked with the Symbiota Help Desk to find duplicate records with completed georeferences. After cleaning through a record set of 1136 lichens and 530 bryophytes, they were able to add 164 and 92 corresponding georeferences. They created a criterion for cleaning through the records and would only accept georeferences that included data in remarks and a low uncertainty radius.

MO updated 17,578 Tropicos records with coordinates provided by the centralized georeferencing team. These should be available for duplicate matching when the next snapshot update happens.

TENN reviewed and imported 500+ additional georeferences identified by the R script.



## Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2023-Q1. New collaborators and students were given access to Basecamp group resources. The Georeferencing Working Group and Transcription Working Group met in March to discuss progress, challenges, and plans. The Outreach & Education Group met in March to begin preparation for the April WeDigBio event. A Management Committee Meeting was held in February open to all GLOBAL members to review 2022-Q4 grant progress and provide an open forum to the GLOBAL team.

The TENN Project Manager completed routine check-in's with collaborating teams at ALA, F, MSC, OSC, WIS, UC, and YU to discuss project status, updates, and concerns.

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

### Database Compatibility

MSC started work on transferring coordinates from the Lichen Portal to their institutional Specify database. Updating existing records isn't possible without assistance from programmers. They went to this effort with the idea that they will share what they learned with other Specify users to streamline the workflow. After finishing this exercise, they concluded that it is necessary to georeference within Specify, or only georeference records that don't exist in Specify yet and await import as new records. Many problems were encountered. Symbiota currently doesn't use collection-unique identifiers of localities. Locality identifiers are needed for uploading new coordinates from Symbiota to existing records in Specify.

MICH's uploading to the project Symbiota portals was 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.

UC found some issues in translation between their in-house database manager and Symbiota. They are therefore opting to transcribe within their in-house database prior to uploading data to the Symbiota portals.



## Share Opportunities to Enhance Training Efforts

The GLOBAL Project Manager (TENN) and Georeferencing Manager (WIS) continued compiling resources during 2023-Q1 to share on Basecamp and all resources were posted to the project website (<https://globaltcn.utk.edu>), including additional georeferencing and transcription links and resources.

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/>. Student workers and volunteers continue to be trained in routine image acquisition, specimen curation and data management.

The program Mytabolites (for the analysis of thin-layer chromatography plates) continues to be tested and refined at ASU; a new option to filter results for substance classes has been added.

DUKE trained three biology graduate students one hour per week in herbarium management practices.

MIN trained one volunteer to image lichens and add skeletal records.

NY GLOBAL staff attended the Tuckerman Workshop in Alabama, to learn and teach lichen biology and determination basics.

The TENN Project Manager supervised one of the undergraduate technicians in creating a video about the GLOBAL project for his leadership course. The student was able to develop film and audio-recording, editing, and science communication skills.

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

The Symbiota team at ASU completed the conversion of the Lichen and Bryophyte Portals from being “North American” consortia to being global consortia by remodeling the portals. This included enabling bilingual support on the Bryophyte Portal and merging the Consortium of North American Lichen and Consortium of Latin American Lichen Portals. They also deprecated the *Frullania* and Arctic Lichen Portals in favor of the unified, global portals. Regular updates of





the taxonomic thesaurus continue. Several additional European herbaria have joined the Lichen Portal, e.g., the Senckenberg lichen collections at Frankfurt (FR; 54,794 specimen records) and Görlitz (GLM; 66,049 specimen records), and in Berlin (B; 132,967 specimen records).

Collaboration between GLOBAL teams and other TCN projects occurring concurrently at their sites continued. CINC is also a member of the All-Asia TCN. The students work in the same space and regularly exchange tips and work together to improve workflows. COLO is also a member of the SoRo TCN and the All-Asia TCN and continued to share info and technology between projects to help optimize workflows. F collaborated with the new Africa TCN focusing on flowering plants and continued collaboration with the ongoing Pteridophyte TCN project as well. At MICH, ongoing collaboration continued between the PCC and GLOBAL TCNs, which share many resources including facilities, digitization and management staff, training, some equipment, and workflow. Though the grant objectives and specimens being imaged are separate, much of the institutional infrastructure is shared between the projects. NY shared institutional infrastructure and support with other TCNs (All Asia, Africa). Images generated through GLOBAL TCN used for NEH-funded workshop hosted through NYU. UC is concurrently running multiple digitizing projects at UC, including GLOBAL as well as Ferns, Phenology, and Endless Forms, and students receive the opportunity to gain experience across pipelines.

DUKE collaborated with Symbiota Help Desk and Specify software team on resolving the broken Specify-to-Symbiota updating system (Symbiota Connector). They collaborated with Specify team on figuring out import of coordinates from Symbiota to existing Specify localities. DUKE staff also participated in quarterly NC Lichen Conservation one-day meeting with NC Natural Heritage Program.

TENN Project Manager participated in the quarterly iDigBio Stakeholder Engagement Meeting (Formerly Internal Advisory Committee Meeting) in February with other TCN participants.

## **Share Opportunities and Strategies for Sustainability**

### **Portal Management**

The Symbiota Support Hub at ASU continued to provide portal management and maintenance, including uploading and linking images to GLOBAL collections, updating snapshot data from international partners to facilitate duplicate matching and import, and providing assistance with data cleaning and other issues. The Symbiota Support Hub continued to provide regular training sessions, documentation and tutorials.



The [Global IUCN Red-Lists of Lichens](#) continued to be regularly updated in the Consortium of Lichen Herbaria.

To better integrate different information repositories into a Global Consortium, the previous platforms have now been merged and renamed into the “Consortium of Lichen Herbaria” and the “Consortium of Bryophyte Herbaria”. Both platforms are now bilingual. The option to switch between English/Spanish language locales was newly added to the Bryophyte Consortium. The Spanish language platform “Consortio de Herbarios de Líquenes en América Latina” has been integrated into the general Lichen Consortium. It is therefore now available to the Latin American users by simply switching the language. Merging several different platforms into a single platform, only one for lichens and only one for bryophytes, already reduced maintenance, thus improving functionality and facilitating regular updates. Tools using the API to facilitate access to the data from different Symbiota portals continue to be under development.

### **Back Ups**

All of ALA’s images and metadata have and will be stored on tape and cloud back-up at Texas Advanced Computing Center (TACC), University of Texas at Austin.

During this quarter, CINC established a new collaboration with Research Computing on campus, and their images are now being stored locally and served to the portals from on-campus servers. All images are also backed up on a local, mirrored external hard drive as well as University-sponsored cloud storage.

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.

This quarter, LSU completed their 3rd tier backup in the cloud! They have their images on a local server “Sassafras”, a NAS drive, and in the cloud using Box which is supported by LSU. Using an app in the NAS drive, they are able to create an automated sync for incoming images to the cloud. Previously, they created a script that pushes new images to the NAS drive



and server, as well as creates image derivatives and a mapping of the images to link images with occurrence record data in the Symbiota portals.

TENN continues to back-up project images on external hard drives.

## 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.

Plans progressed for producing the GLOBAL educational videos in conjunction with the team at ALA. Members from ALA, F, WIS, and TENN met bi-weekly to discuss updates on logistics and content. Video filming is planned for May 2023 at the UAF Media Studio in Fairbanks, AK.

ASU's collaboration with the community of Latin American lichenologists continued. A survey on how the Latin American community may be better served was conducted by Jesús Hernandez. A publication discussing best practices for creating Symbiota checklists, using the [Lichenized and Lichenicolous Fungi of Ecuador](#) as an example, has been accepted for publication.

DUKE PI Shaw held a 10-hour on-line course through the Eagle Hill Institute: "Ecology and Evolution of Peatmosses" (Feb 7-21). Duke Herbarium's Blanka Aguero led two public moss walks on "Mosses of Duke Gardens" (Mar 14) and "Mosses of Duke Forest" (Mar 31). DUKE's Scott LaGreca taught an introductory lichen workshop (with both lab and field components, plus an herbarium tour) for 15 adults (non-students) (Mar 25) and introduced six undergraduate students to lichens (lab and field components) (Mar 26).

In January, F hosted a public volunteer event called Collections Club that meets every quarter and barcoded over 10,000 specimens. They continued to work on developing online education tools.

ILL & ILLS led 5 herbarium tours, which highlighted their lichen and bryophyte collections.

LSU led 3 herbarium tours, totaling 40 students, who were exposed to lichen collections.



The NY team published two public interest pieces The Hand Lens, one about Cyanolichens, and another a biographical sketch of Chicita Culberson. Tours of the lichen herbarium were given to visiting researchers.

The TENN Herbarium hosted a “Specimens and Scones” open house for 29 students, staff, and faculty on campus including tours of the herbarium. TENN continued hosting the GLOBAL weekly transcription event on Fridays during 2023-Q1. Six community science volunteers from three countries participated (US, Canada, Sweden) and transcribed skeletal data for over 1,800 specimens. Volunteers were also able to see a number of “Specimen Spotlight” presentations on specimens and collectors compiled by the TENN GLOBAL Project Manager.

UC led 3 herbarium tours, with a particular focus on lichen and bryophyte collections and led a Lichen Walk with a focus on lichens of central California for ca. 20 adults.

### **WeDigBio**

Six GLOBAL collaborators (CINC & MU, DUKE, F, FLAS, PH and TENN) agreed to participate in the April 2023 WeDigBio and were joined by the Cornell Plant Pathology Herbarium. They held two WeDigBio Planning Meetings in March to discuss scheduling, roles, presentations, and advertising. The team from F will again help host and manage the registration for the event, with assistance from the GLOBAL team. It was decided to hold two GLOBAL-specific days on Thursday and Saturday.

## **Share Information About Your Website and/or Portal Usage**

The GLOBAL project website, <https://globaltcn.utk.edu>, was utilized by 263 users during 2023-Q1, including 16 from Asia, 13 from Europe, and 3 from South America (see Figure 3).

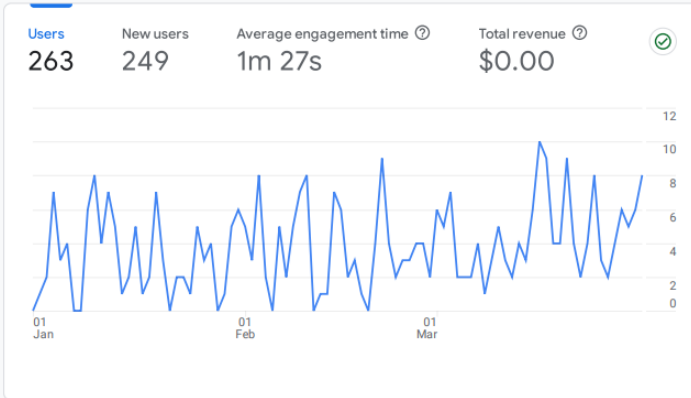
The Bryophyte and Lichen Portals, created as part of the original LBCC grant, host new images and data produced by the GLOBAL collaborators. 254 users visited the Bryophyte Portal and 696 users visited the Lichen Portal during 2023-Q1 (see Figures 4 & 5).



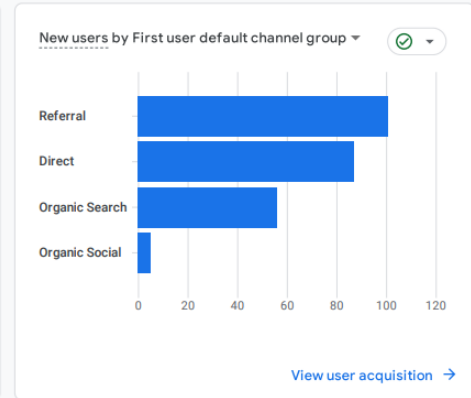
All Users [Add comparison](#)

Custom Jan 1 - Mar 31, 2023

Reports snapshot



WHERE DO YOUR NEW USERS COME FROM?



WHAT ARE YOUR TOP CAMPAIGNS?

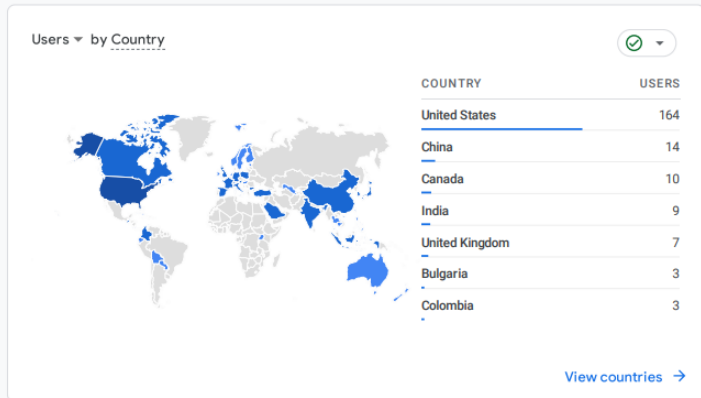
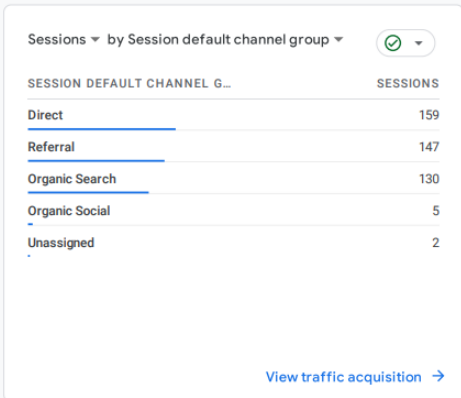


Figure 3: Use metrics for the GLOBAL project website (<https://globaltcn.utk.edu>) from January 1 – March 31, 2023.

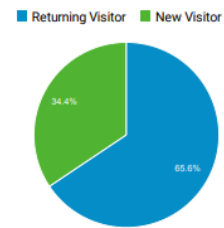
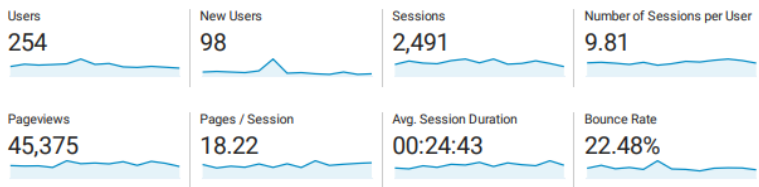
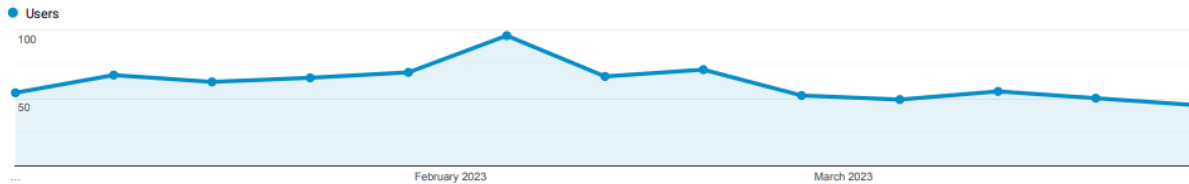


Audience Overview

All Users  
100.00% Users

Jan 1, 2023 - Mar 31, 2023

Overview



Language	Users	% Users
1. en-us	171	66.80%
2. en-gb	13	5.08%
3. es-es	10	3.91%
4. fr	10	3.91%
5. fr-fr	6	2.34%
6. de	5	1.95%
7. pt-br	5	1.95%
8. en	3	1.17%
9. en-ca	3	1.17%
10. en-in	2	0.78%

Figure 4: Use metrics for the Bryophyte Portal (<https://bryophyteportal.org/portal/>) from January 1 – March 31, 2023.

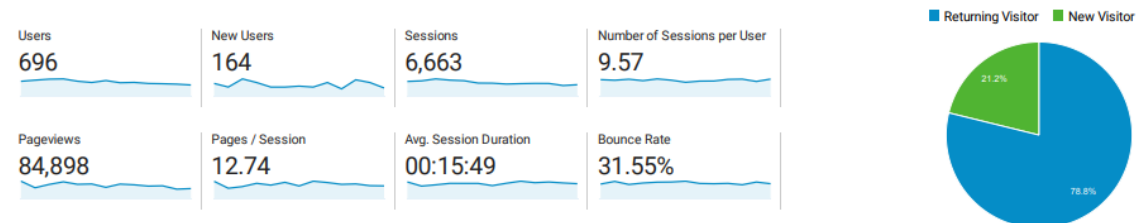
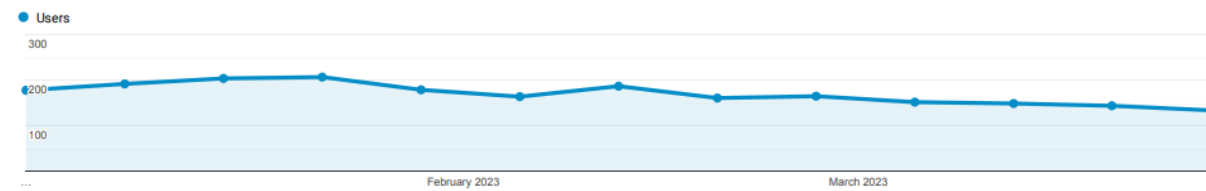


Audience Overview

All Users  
100.00% Users

Jan 1, 2023 - Mar 31, 2023

Overview



Language	Users	% Users
1. en-us	278	39.94%
2. es-es	38	5.46%
3. de	34	4.89%
4. en-gb	34	4.89%
5. ru-ru	25	3.59%
6. fr	21	3.02%
7. zh-cn	19	2.73%
8. sv-se	16	2.30%
9. fr-fr	14	2.01%
10. en-ca	11	1.58%

Figure 5: Use metrics for the Lichen Portal (<https://lichenportal.org/cnalh/>) from January 1-March 31, 2023.



## Share Other Activities and/or Progress

### Image Tagging

Progress continued at ASU on the character revision for tagging and identification keys. The glossary with 2,000+ terms is in the process of being linked to the key characters. Chemical characters have been revised and a program for the analysis of secondary metabolites can access this information directly from the portal.

### GenBank Linking

A new tool developed by ILL & ILLS for downloading GenBank source modifiers is now available on the MyCoPortal: <https://www.mycportal.org/portal/tk/?/genbank>.