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, 2021.

All GLOBAL institutions were able to continue GLOBAL work in some capacity during 2021-Q4, although the end of an academic semester and end of the year holidays reduced productivity for some institutions compared with the prior quarter.

Imaging Equipment & Workflows

Additional progress was reported in setting up and optimizing imaging equipment and workflows during 2021-Q4.

ALA updated their digitization station with LED lights and a better light box. With digitization in full swing again, they installed an easy to use SQL code for keeping track of progress internally. ASU established a standardized image acquisition workflow using BCRWatcher (a barcode renaming and skeletal metadata program). A student worker is currently being trained in this

[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

workflow. Once the workflow has been tested more extensively, it will be shared with participating institutions via Basecamp. COLO explored options to start capturing images of specimens and hope to have a workflow in place soon. Specimen imaging began in earnest at LSU this quarter. NY completed barcoding of the general lichen collection and started progress on lichen exsiccate. OSC consolidated the location of over 750 specimens related to GLOBAL work which were dispersed throughout their collection. They optimized imaging protocols and identified necessary improvements to their imaging platform.

Personnel

COLO began hiring another in-person digitizer and may have one remote digitizer switch to in-person work. This should help speed up progress. Final exams were on the early side this year and they did not have students in the collection for most of December. The university has also announced that they will start the semester remotely which means they will also have limited in-person student help in January. LSU trained a new student and a new volunteer to digitize bryophytes. MSC hired two undergraduates. TENN interviewed and hired four new undergraduate technicians in December 2022 to start work during the January 2022 Winter Mini-Term.

Digitization

Nineteen institutions (ALA, ASU, CINC & MU, COLO, DUKE, F, FLAS, ILL & ILLS, LSU, MICH, MIN, MO, MSC, NY, PH, TENN, UC, WIS, and YU) reported progress on digitization deliverables, with a total of 52,099 specimens barcoded (25,834 bryophytes and 26,265 lichens), 50,055 labels imaged (23,402 bryophytes and 26,653 lichens), 43,766 specimens imaged (17,620 bryophytes and 26,146 lichens), 27,318 specimen records uploaded to the portal (14,509 bryophytes and 12,809 lichens), 38,991 skeletal records created (17,054 bryophytes and 21,937 lichens), 28,696 labels fully transcribed (22,483 bryophytes and 6,213 lichens), and 18,042 specimens georeferenced (8,638 bryophytes and 9,404 lichens).

Table 1: Digitization progress by GLOBAL collaborators in 2021-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	2	823	52	164	54	987								
ASU		526		15		44		15		15		15		
BRY														
CINC & MU	1,380		1,380		1,380		1,380		1,380		3,412	30		
COLO		3,270		3,270				3,270		3,270		1,368		
DUKE	1,770		2,141		906		3,047	8,903	1,770		543		40	
F	3,000	928	3,450	482	3,450	482			1,285	917	2,096	446		446
FLAS	3,600													
ILL & ILLS	1,754		1,754		1,754									
LSU	583	82	1,000	6	383		583	82	583	82	334	87	70	214
MICH	4,504		4,515		400		2,620		3,536		1,335		184	
MIN		6,365		6,365		6,365				6,365	5,052			
MO	3,377		2,260		2,260				2,427		2,428		310	
MSC	2,416	484	2,416	484	2,416	484	2,421		3,310	484	3,242	484		
NY	833	13,244		12,127	183	12,127			721	6,976	113	3,244	3,864	4,136
OSC														
PH	5	393	5	393	5	393		393		393		393		
TENN	646		2,465		2,465		2,494		2,042		2,933	146	654	
UC		150		3,312		3,312				3,400				
WIS				35		1,952		146		35			3,516	4,608
YU	1,964		1,964		1,964		1,964				995			
Totals	**25,834**	**26,265**	**23,402**	**26,653**	**17,620**	**26,146**	**14,509**	**12,809**	**17,054**	**21,937**	**22,483**	**6,213**	**8,638**	**9,404**
B+L Totals		**52,099**		**50,055**		**43,766**		**27,318**		**38,991**		**28,696**		**18,042**

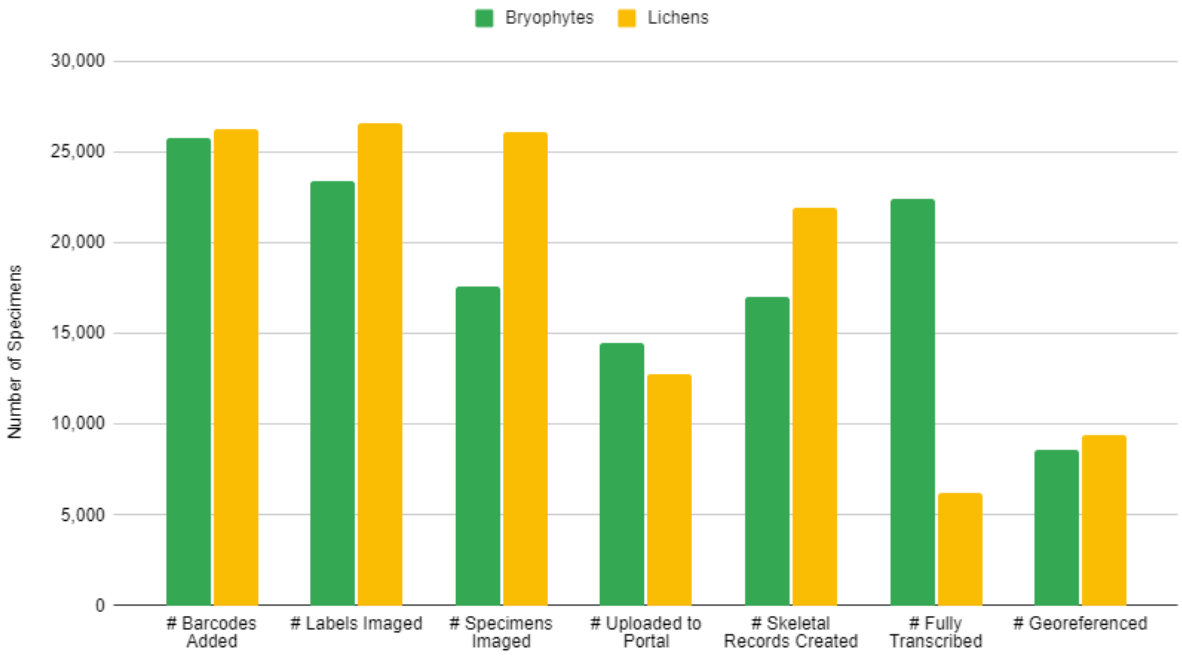

Figure 1: Digitization progress for the GLOBAL collaboration in 2021-Q4, separated by Bryophyte and Lichen specimens.

Share Best Practices, Standards, and Lessons Learned

Flexible Workflows

The GLOBAL teams continued to make use of flexible digitization workflows in 2021-Q4, including some use of virtual transcription work and prioritizing label imaging, while most collaborators were able to begin or continue on-site work.

Based on preliminary work at COLO, the quality of specimen images is hampered by using a fixed imaging system to capture both packet/label data and specimens. Access to the collection improved for the fall semester, but they did not have as many digitizers as they have had in the past. COLO will most likely take the specimen images later in the project when they have a system in place for capturing better specimen images.

NY, while continuing imaging, pivoted to some transcription to accommodate reduced on-site schedules.

OSC discovered that implementing scalable movement of imaging platform to camera lens can increase depth of field and image resolution.

PH found that swim meets, final exams and COVID-19 university closures prevented their work-study student imager from coming into the herbarium.

UC worked to continue creating a positive, supportive, and safe atmosphere for their students, which is especially important during these stressful (COVID) times.

Transcription

LSU found that merging data from a large dataset of duplicate records requires careful review and an understanding of the quality of different herbaria's work. This is good work for experts, as lots of decisions need to be made in order for the task to be most efficient and effective. Whereas, when searching duplicates for single record entry, the task is much more manageable and can be done by any trained individual. Lesson is that it might be easiest to transcribe a full record at once, rather than reviewing the merge of a duplicate record with errors. If duplicate records are blindly added in, errors can easily extrapolate!

MSC found that having spreadsheets submitted with contemporary specimens saves an enormous amount of time transcribing.

Collaboration

Team members continued to make use of Basecamp, Zoom, and email to communicate and collaborate during 2021-Q4. New collaborators and students were given access to Basecamp group resources. A meeting of the Transcription Working Group was held in December to discuss best practices and standards. The Nomenclature & Taxonomy Group also met in December to discuss and demo how taxonomy is maintained in the portals and to brainstorm possible improvements. The Outreach & Education Group met three times in preparation for the October WeDigBio event and a fourth time as a post-event debrief. They also held a higher level meeting in December to discuss Outreach, Education, Diversity and Inclusion goals and plans for the collaboration. The Georeferencing Manager (WIS) held a meeting to update the GLOBAL team on centralized georeferencing progress and to share associated resources. She and her students are continuing to create communities and georeference in the Collaborative Georeferencing Client (CoGe).

A Management Committee Meeting was held in November open to all GLOBAL team members to review quarterly grant progress. The GLOBAL Project Manager (TENN) completed the check-

in meetings that started in 2021-Q3, Zooming with the remaining collaborators in October (FLAS, NY, and OSC) to discuss progress, concerns, and plans.

Data Cleaning

Symbiota's taxon cleaning tool was used to verify all scientific names in the LSU profile of Bryophyte Portal. A back-end duplicate search was conducted to pull in data from other collections to merge into LSU's records. This work requires careful review and is ongoing.

UC Curator Scharnagl was responsible for making sure lichen species names are in the CSpace database, and for updating any missing or duplicate barcodes (most lichen specimens in our collection are already barcoded).

Share Identified Gaps in Digitization Areas and Technology

Image Uploading

ASU IT continued to facilitate the upload of images into the Lichen and Bryophyte portals. While an image uploading workflow has been established, those institutions with alternate hosting may have separate challenges. UC is taking two images per lichen record; one of the label and one of the specimen. However, they seem to be having trouble uploading both images to the Symbiota portal (one simply replaces the other). They will reach out on the GLOBAL platform for troubleshooting ideas.

Barcode Renaming

The development of the BCRWatcher a program at ASU was finalized and subjected to rigid testing. The program reads barcodes from image files, rename the files using these barcodes and allows the user to capture skeletal image metadata as part of the image acquisition workflow.

GLOBAL Interface

A discussion began in 2021-Q4 to determine the best way forward for a combined Lichen and Bryophyte data portal interface. The grant proposal was reviewed and meetings were scheduled for the Executive Committee and IT Team to discuss further in 2022-Q1.

Share Opportunities to Enhance Training Efforts

ALA PI Ickert-Bond demoed a number of outreach tools and resources during the December Outreach & Education Meeting.

The ASU IT team continued to develop tutorial videos, which are posted on the Symbiota YouTube channel: https://www.youtube.com/channel/UC7glMVLRnTA6ES3VTsci7iQ.

The program BCRWatcher will be distributed through https://help.lichenportal.org/index.php/en/cnalh-help-resources/.

COLO Senior Personnel Ryan Allen demoed Zoom tools for some of the team in preparation for WeDigBio, including the use of break-out rooms.

F developed workflows using google sheets to train volunteers to assist with barcoding and sheet-to-packet processing of lichen specimens. Once specimens are barcoded by volunteers, their part time staff will do the photography. After photography, the specimens come back to the volunteers who convert the sheets into packets.

The MSC team learned a lot about volunteer transcription from WeDigBio. In the past, they had volunteers use a guide detailing how to do FULL transcriptions, with no retainment of volunteers. After observing how WeDigBio went, they found that partial transcriptions are so much better for keeping volunteers from getting overwhelmed and discouraged. Their main student transcriber also said that partial transcriptions save her a lot of time.

TENN Collections Manager Oliver took undergraduate interns on a field trip to the local Ijams Nature Center to experience field collecting in October.

The GLOBAL Project Manager (TENN) and Georeferencing Manager (WIS) continued compiling transcription and georeferencing resources during 2021-Q4 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.

The GLOBAL Project Manager (TENN) completed CCH2 Georeferencing Course for CoGe and attended a number of webinars and trainings including: NSF Funding Opportunities for Scientific Collections and the iDigBio Coffee Break and Orientation Series.

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

ALA hosted the October 9th online ARCTOS Webinar, University of Alaska Herbarium (ALA): Documenting Alaska's flora at the crossroads of Beringia https://www.youtube.com/watch?v=1zMgQYwWArI.

ASU jointly organized a October 20-22 online webinar with the Ecuadorian Instituto Nacional de Biodiversidad (INABIO) about "Lichenology in Ecuador." Part of the webinar was a presentation about best practices in data management for the Latin American Lichen Consortium and integrating/exchanging data with the Ecuadorian National Biodiversity Database (https://bndb.sisbioecuador.bio/bndb/).

COLO is also a member of the SoRo TCN and the All-Asia TCN. They continued to share information and technology between projects to help optimize workflows.

Ongoing collaboration between PCC and GLOBAL TCNs continued at MICH, 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.

At NY, there was ongoing collaboration between PCC, All-Asia, SoRo TCNs, as well as a new NSF DEB grant that is funding digitization of Appalachian lichens, which shares the same work flow and equipment.

The GLOBAL Lead PI and Project Manager (TENN) participated in the November iDigBio Quarterly IAC meeting to connect with other active TCN's.

The GLOBAL Project Manager (TENN) shared the GLOBAL Annual Integrated Report with the DigIn TCN and offered feedback on some of their reporting questions.

WIS worked on a resubmission to NSF for a new TCN, using some of the successful practices implemented with GLOBAL.

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. During 2021-Q4, ASU acquired more storage capacity for hosting GLOBAL-generated images.

Back Ups

Images from ALA continue to be stored at TACC. TACC provides both cloud storage as well as tape back-up of their data.

COLO's 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.

UC creates monthly image backups on external hard drives in addition to the in-house server. Records are kept on which specimens have been digitized.

Taxonomy

The taxonomic dropdown for the ImagingWorkflow application used by COLO was missing many of the scientific names they use in their collections. They worked with ASU's Frank Bungartz and Katie Pearson to get an export of the lichen taxonomic thesaurus. COLO's Ryan Allen reformatted this list so it could be added to the application. This helped to speed up the imaging process because they do not need to manually enter as many names while imaging. The new list is in active use at COLO and seems to cover most names in their collection.

DUKE's B. Aguero assisted with cleaning the bryophyte portal thesaurus, removing non-bryophyte names.

MO PI Brinda began work on an API to allow the taxonomic cleaning tool to access the bryonames.org 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 #GlobalTCN Twitter feed was added to the GLOBAL website, in addition to the pre-existing Instagram feed.

ALA PI Ickert-Bond presented to the GLOBAL community on outreach using the Learning Glass and virtual herbarium tour using ThingLink.

On October 28th, ASU held the BioKIC online webinar about using Symbiota software for managing biodiversity data portals throughout Latin America (Guatemala, Mexico, Ecuador, etc.); also see our collaboration with the Ecuadorian Instituto Nacional de Biodiversidad (INABIO) and ASU [detailed above under: Share Collaborations with other TCNs, Institutions, and/or Organizations].

In December 2021, F's application of digitized specimens using community scientists to generate data was launched. This was designed by two high school students and supervised by REPS student Heaven Wade. A description of the event and the Zooniverse launch can be accessed here.

ILLS hosted a "packet-folding party" on December 17 where volunteers folded nearly 3000 bryophyte paper packets that will be used to upgrade our collections to archival-quality packets.

The GLOBAL Project Manager (TENN) discussed natural history collections work and the GLOBAL project with two undergraduate Field Botany Classes during Herbarium tours in October 2021.

The GLOBAL Project Manager (TENN) completed several trainings and workshops on increasing diversity and reducing challenges and harassment including: STRIDE for Staff Training, EEB

seminar on Transformative Justice in STEM, and Safe Zone Tier 2 training. She also communicated with the university's Office of Diversity and Inclusion on resources / links to creating inclusive forms for demographic information.

The annual Wisconsin Science Festival had "Fungi" as its theme this year. Several activities related to mycology (but also lichenology!) were held. A news story mentioned WIS' digitization activities and our large collection of lichenized fungi: https://news.wisc.edu/uw-scientists-decipher-the-mysteries-of-enigmatic-fungi/.

WeDigBio

GLOBAL team members from CINC & MU, COLO, DUKE, F, MSC, and TENN collaborated on a GLOBAL WeDigBio event on October 15-16. The two day event was attended by 80 community science volunteers, including participants from across the United States, as well India, Indonesia, the Philippines, and Sweden. F co-organized the GLOBAL days as part of their routine Field Museum WeDigBio event, and included GLOBAL specimens on October 14 and 17 as well. A total of 205 volunteers participated across all 4 days and 6,363 GLOBAL records were completed. Review of these partial transcriptions (Collector, Number, Date, and Country) was conducted during and after the event. The GLOBAL days included live virtual tours of the herbaria at F, COLO, and DUKE, and a number of presentations by staff and students at F, COLO, and TENN. A full description of the event, including media attention on Fox news and other outlets can be accessed here.

OSC co-organized with Dr. James Mickley an outreach event for specimen label transcription as part of the global WeDigBio week. It was attended by 25 students in person and 10 remote.

Share Information About Your Website and/or Portal Usage

The GLOBAL project website, https://globaltcn.utk.edu, was utilized by 565 users during 2021-Q4, including 88 from Asia, 47 from Europe, 16 from Oceania, and 1 from Africa (see Figure 2). The total number of users more than doubled the previous quarter and a large jump during the WeDigBio event in mid-October can be seen in the data.

The Bryophyte and Lichen Portals, created as part of the original LBCC grant, host new images and data produced by the GLOBAL collaborators. Over 3,200 users visited the Bryophyte Portal and over 16,000 users visited the Lichen Portal during 2021-Q4 (see Figures 3 & 4).

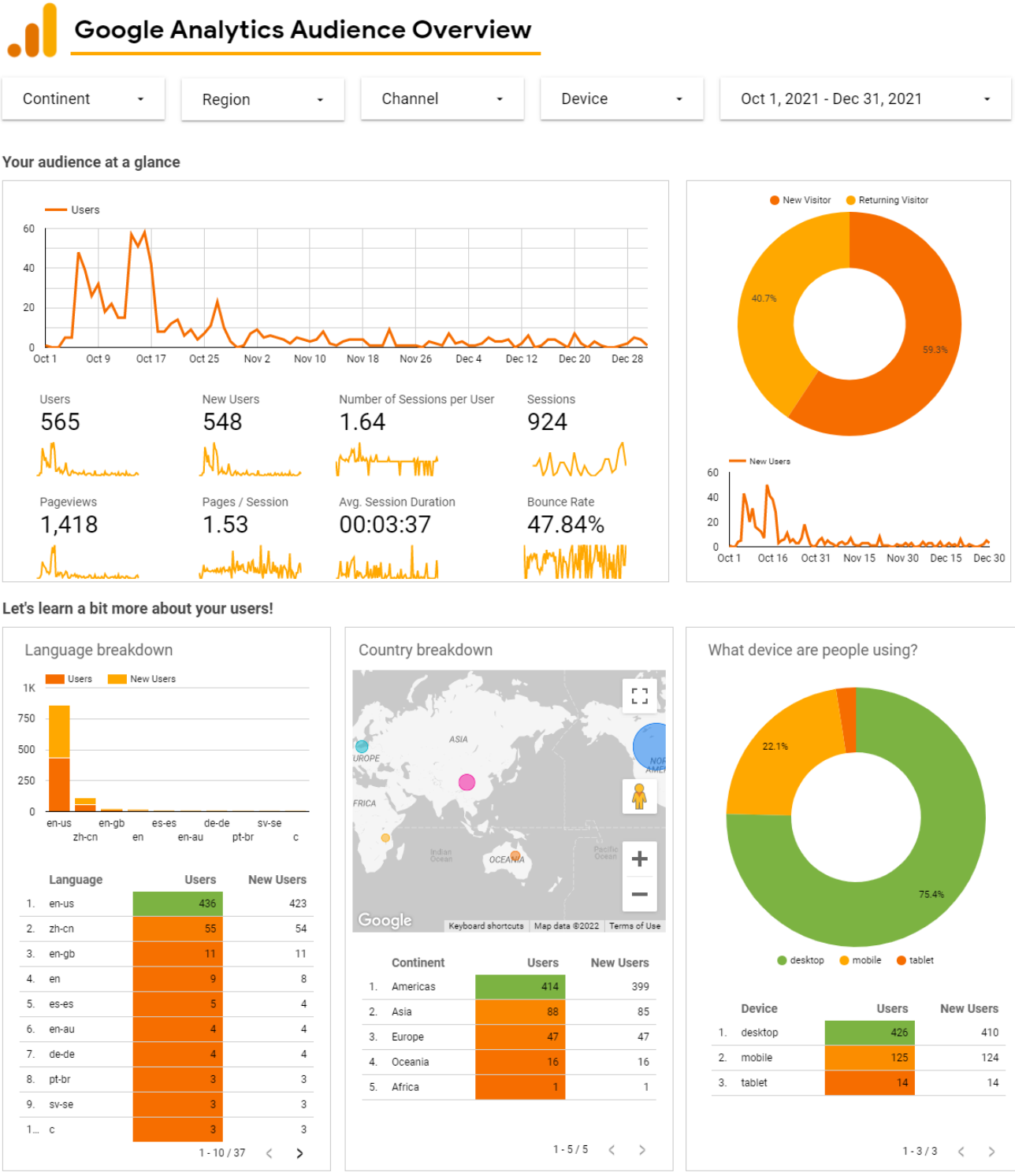

Figure 2: Use metrics for the GLOBAL project website (https://globaltcn.utk.edu) from October1 – December 31, 2021.

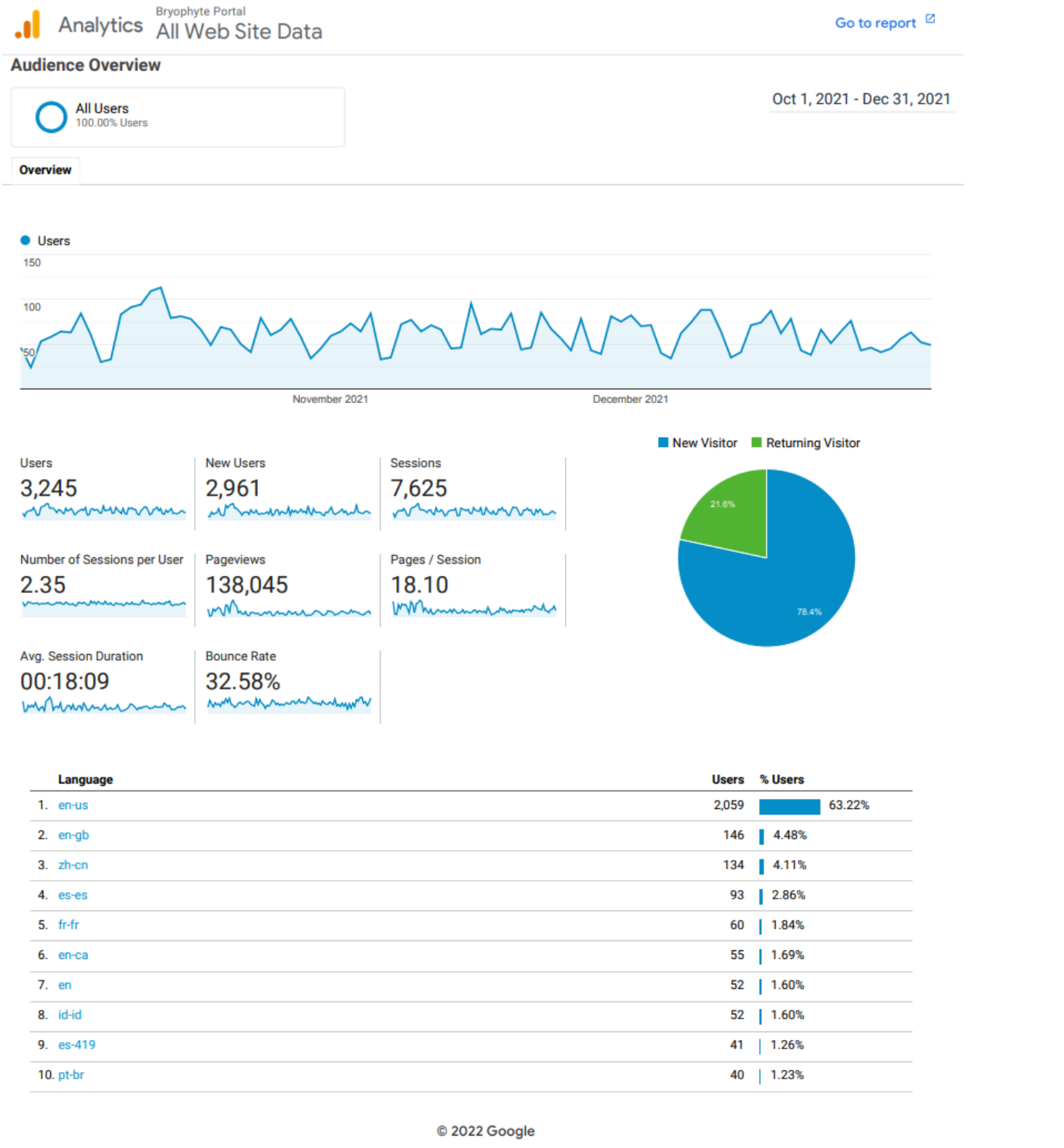

Figure 3: Use metrics for the Bryophyte Portal (https://bryophyteportal.org/portal/) from October 1 – December 31, 2021.

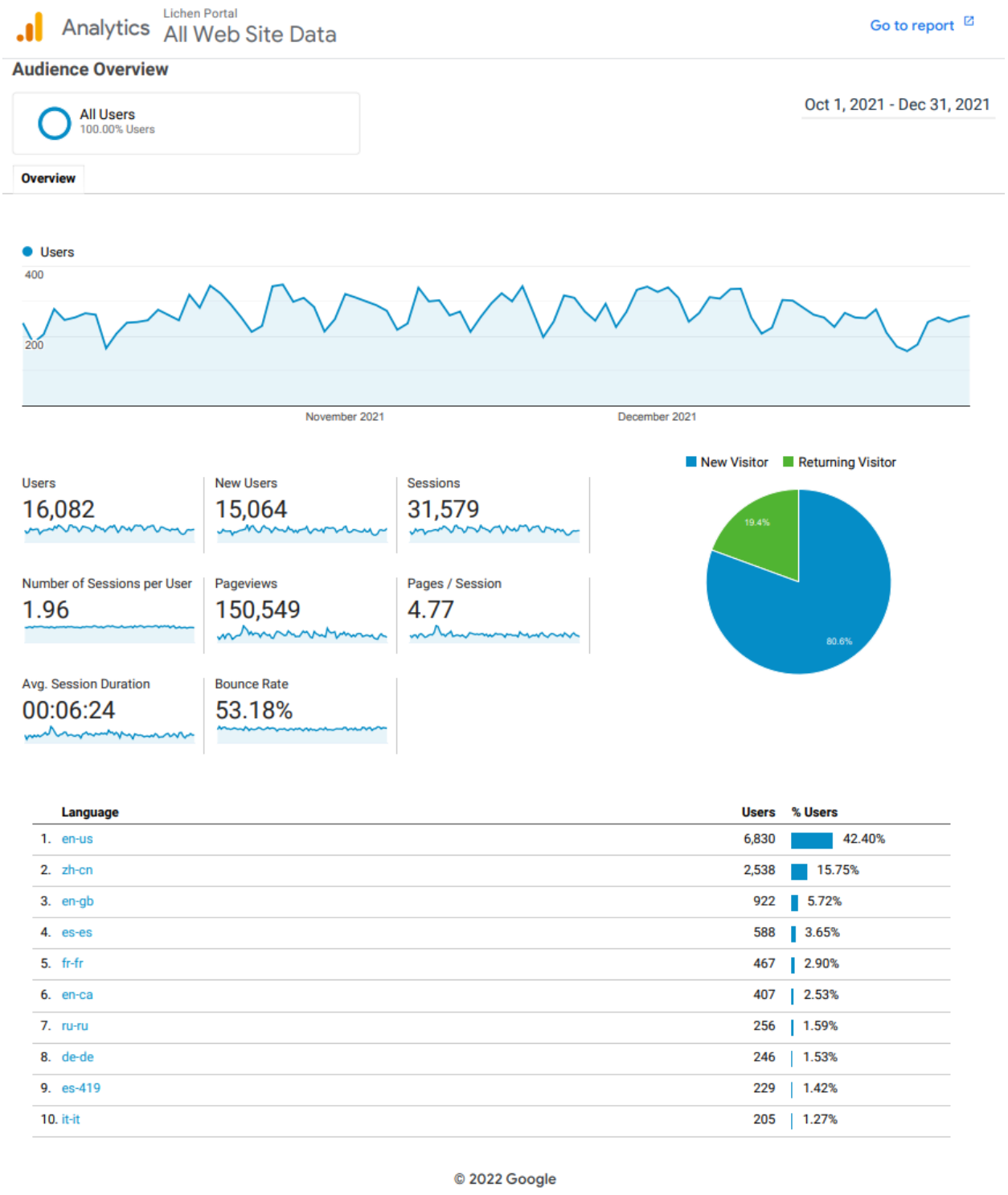

Figure 4: Use metrics for the Lichen Portal (https://lichenportal.org/cnalh/) from October 1 – December 31, 2021.

Share Other Activities and/or Progress

Bryophyte Packet Labels

A new label format was integrated into the Lichen and Bryophyte Portals by the ASU team, where labels can be directly printed onto full paper sheets that can then be folded into lichen/bryophyte packets (the Symbiota YouTube channel has an instructive video how this new label printer works, which was recently shared via Basecamp).

Image Tagging

ASU PI Bungartz made progress on the development of a Controlled Vocabulary of lichen characters for image metadata tagging as part of the ongoing revision of the key character matrix of the Lichen Consortium and the online glossary.